Article

Hospitalization following eating disorder diagnosis: The buffering effect of marriage and childbearing events

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A R T I C L E   I N F O

A B S T R A C T

Eating Disorders (ED) are defined as abnormal eating behaviors, stemming from an obsession with food, body weight, or body shape. EDs affect 10 million men and 20 million women in the US, with an estimated 15% lifetime prevalence among women. An ED diagnosis is often accompanied with a host of adverse physical and mental health outcomes, including a heightened risk for suicidality. Given the complex comorbidities associated with EDs, treatment occurs in inpatient and outpatient settings. This study used linked administrative and health records from the Utah Population Database to create a cohort of women $n = 4183$ and men $n = 423$ who had a known diagnosis of ED between 1995 and 2015. Cox proportional hazard regression was used to model ED-related hospitalization trajectories, including subsequent risk for suicidality/self-injurious behavior-related hospitalization. To better estimate the risk profiles associated with different health care utilization patterns, models explored how family-related life course events (childbirth, marriage transitions) and sociodemographic characteristics (race, sex, and median income at census-block) modify hospitalization trajectories following initial diagnosis. Results suggested that increased outpatient treatment was associated with reduced risk of initial ED-related hospitalization, but higher risk for subsequent ED-related hospital readmission. In addition, transition to marriage (i.e., getting married) was associated with reduced risk of ED-related and suicidality/self-injurious behavior-related hospitalizations (initial hospitalization and subsequent readmission). Increased number of children was only associated with reduced risk of initial ED-hospitalization, but not readmission. When assessing individuals' risk for ED-related hospitalizations, social and health services researchers should contextualize treatment trajectories within the individual's life experiences, particularly marital transitions, while simultaneously considering sociodemographic characteristics and utilization of outpatient care. Future research should further examine whether marriage represents an important turning point in the health trajectories of individuals with EDs.

Prevalence and consequences of eating disorders

The current Diagnostic and Statistical Manual (DSM-5) classifies feeding and eating disorders as a range of complex mental health conditions characterized by abnormal or "disturbed" feeding and eating habits stemming from an obsession with food, body weight, or body shape (American Psychiatric Association, 2013). This study focuses on eating disorders (EDs) specifically, which have a variety of symptoms, including severe restriction of food, food binges, and purging behaviors such as vomiting or over-exercising. EDs affect millions of people across the United States (US), and around the globe. In the US alone, it is estimated that 20 million women and 10 million men have or have had

an ED (National Eating Disorder Association, 2020). About 15% of US women meet the criteria for lifetime prevalence, meaning that they had an ED at any point in the life course (Micali et al., 2017). While ED prevalence has remained relatively stable in the US over the last 20 years, global prevalence rates have risen since the early 2000s (Galmiche, Déchelotte, Lambert, & Tavolacci, 2019). EDs can affect anyone at any stage of the life course, but are most likely to emerge during adolescence and early adulthood and decline through midlife (Brown, Forney, Klein, Grillot, & Keel, 2020; Stice, Marti, & Rhode, 2013). Also, EDs are more common among women compared to men (Striegel-Moore et al., 2009).

EDs are associated with a host of adverse physical and mental health

outcomes (Hudson, Hiripi, Pope, & Kessler, 2007; Piran & Robinson, 2011). Overtime, EDs and related-behaviors (called disordered eating behaviors) can have deleterious effects on nearly every organ system in the body (Katzman, 2005), with potentially life-threatening consequences such as heart arrhythmias and renal failure (Giovinazzo et al., 2019; Nicholls, Lynn, & Viner, 2011). While EDs are associated with elevated mortality risk (Franko et al., 2013; Smink, van Hoeken, & Hoek, 2012), underscoring the severity and public health significance of EDs in general, a significant risk posed to young adults with EDs is their heightened risk for suicide attempt or completed suicide (e.g., suicidality) (Arcelus, Mitchell, Wales, & Nielsen, 2011; Goldstein & Gvion, 2019).

Elevated risk of suicidality among those with a history of EDs is unsurprising, given the mental health comorbidities commonly associated with EDs (Santos, Richards, & Bleckley, 2007; Swanson, Crow, Le Grange, Swendsen, & Merikangas, 2011). Individuals with a history of EDs often experience high levels of stress and depression, as well as a myriad of other psychiatric comorbid conditions, such as post-traumatic stress disorder (PTSD) and substance abuse (Norris et al., 2012; Swanson et al., 2011). In addition, the mental health implications of EDs extend beyond their original manifestation most often occurring in adolescence or young adulthood (Hudson et al., 2007; Keel & Brown, 2010); there is evidence that EDs are predictive of, and may perpetuate, poor mental health outcomes that persist later into early adulthood and midlife for both men and women (Berkman, Lohr, & Bulik, 2007; Norris et al., 2012); Easter et al., 2015; Tabler, Geist, Schmitz, & Nagata, 2019).

Treatment of eating disorders

Given the number and complexity of comorbidities associated with disordered eating, the initial diagnosis of ED often co-occurs with a health crisis requiring medical or psychological intervention (Friedman et al., 2016). The treatment and management of EDs occurs in both inpatient and outpatient settings, involving a combination of nutrition counseling, medical care to address the physical health consequences associated with disordered eating, psychiatric monitoring of underlying emotional conditions, and ongoing psychological counseling such as family-based therapies and cognitive behavior therapy to address the social and cultural forces that maintain one's obsessions with food and body (Grilo & Mitchel, 2011; Stice, Marti, & Rohde, 2013). Following initial diagnosis and establishment of a treatment plan, the average duration of an ED episode ranges between a few months to one year (Stice et al., 2013). Generally, treatment is most successful for those whose conditions have not yet become chronic, but even those with longstanding EDs can and often do recover (Wilson, Grilo, & Vitousek, 2007). Longitudinal analyses of ED patients show that full recovery and remission are possible, as are relapse or recurrence (Kordy et al., 2002).

Research indicates that the one-year remission rates range from up to 71%–100%, depending on type of ED diagnosis, with longer episodic trajectories associated with ED diagnoses that involve food binging behaviors such as *Bulimia nervosa* (Stice et al., 2013). Patients with ED diagnoses that involve severe food restricting behaviors, such as *Anorexia nervosa,* often exhibit the most adverse physical health complications and higher mortality risk over time (Hoek, 2006). While individuals with histories of EDs often navigate care related to addressing ED-symptoms and behaviors, these individuals also experience high suicidality and self-inflicted injury comorbidities, which elevates their risk for mortality and hospitalization (Preti, Rocchi, Sisti, Camboni, & Miotto, 2011). These results suggest that treatment trajectories often differ by ED-type, and may involve a series of health care encounters, ranging from outpatient services, partial inpatient, and full inpatient hospitalization (Grilo & Mitchel, 2011).

Hospital readmission

Given the significant financial and human costs associated with

hospitalizations (Dobkin, Finkelstein, Klunder, & Notowidigdo, 2018), identifying who is at the greatest risk for hospital readmission is a growing and important concern across health care settings (Kansagara et al., 2011). In general, outpatient treatment following an inpatient hospitalization is considered a cost-effective and accepted prevention strategy for hospital readmission of psychiatric inpatients and those with chronic illnesses (Farrell et al., 2015; Lowe et al., 2003). As stated previously, in the context of EDs, outpatient aftercare has generally been found to help reduce frequency of disordered eating behaviors and reduce ED-related relapse (Jacobi et al., 2017). However, outpatient treatment programs can be resource intensive for patients, and research has found that nearly half of psychiatric inpatients will not connect with an outpatient clinician after being discharged from the hospital (Cuffel, Held, & Goldman, 2002). Intensification of care management or comprehensive discharge services have been found to have mixed effects on outpatient follow-up and readmission rates for psychiatric inpatients (Cuffel et al., 2002; Smith et al., 2020; Vigod et al., 2013). Ironically, for patients discharged with an ED, those with the more favorable outcomes during inpatient treatment often experience the least favorable outcomes post-discharge (Lowe et al., 2003), illustrating the complexity of addressing ED-related aftercare.

In order to identify those who are at greatest risk for hospital readmission and who may benefit most from follow-up interventions in an outpatient setting, many health systems have adopted risk prediction models for hospital readmission. The predictive performance of these models are mixed at best, given the complex interplay of factors that contribute to potential readmission (Kansagara et al., 2011; Vigod et al., 2015). The predictive capacity for ED-related readmission modelling is particularly challenging due mostly to limitations of the small, clinical samples from which they are often estimated, and the inconsistency of ED diagnosis at the time of hospitalization (Uher & Rutter, 2012).

While medical records can provide data from which to understand the diverse treatment paths followed by persons with EDs, they alone do not provide a full picture of one's contextual and social resources that might further determine or influence one's treatment path or success over time. Research has found that sociodemographic characteristics of patients such as race, gender, or income may be better predictors of hospitalization than aspects of the care system (Cuffel et al., 2002). For example, in a study examining factors associated with readmission for psychiatric disorders, authors noted that most readmitted patients were divorced (Bernardo & Forchuk, 2001). This study seeks to bridge prior clinical research with social science studies to engage in more contextually rich hospitalization modelling that simultaneously considers outpatient treatment, sociodemographic characteristics, and social experiences.

Eating disorders, marriage, and childbearing

Much of ED symptomology, treatment, and remission, occurs during emerging adulthood (age 20–29) (Stice et al., 2013), that is, when youth and young adults are entering into serious romantic partnerships, including marriage. A *life course approach* posits that early life social experiences and events shape individuals' experiences and outcomes in mid and later life (Elder, 1985, 1998). It also posits that timing of experiences, and historical context, matter for the unfolding of individual lives (Elder, 1998). For example, the digital media era provided an important context to the rise of EDs globally (Morris & Katzman, 2003), and prior research indicates that experiencing EDs during late adolescence potentially represents a turning point leading to reductions in income and education by early-adulthood (Tabler & Utz, 2015). Turning points are defined as transitional events that redirect paths in the life course (Elder, 1985). Life experiences during early or emerging adulthood, such as marriage and childbearing events, may act as turning points that shape the trajectory of the individual's wellbeing across adulthood (Elder, 1985, 1998).

However, there is a dearth of research regarding how marriage

transitions may shape ED-related hospital admissions of young adults over time. The stability of being in a committed relationship, and the influential social control that is often attributed to a spousal relationship (Umberson, 1987), could potentially be associated with less severe ED symptoms, fewer physical and mental health comorbidities, and lower risk hospitalization among persons with histories of EDs over time. There is preliminary evidence that those with an ED who are married or living with a partner have higher motivation to change, which may translate to better treatment adherence (Bussolotti et al., 2002). Conversely, preliminary evidence from a small clinical sample suggest that marital problems and divorce could potentially trigger an ED event or relapse (Kiriike, Nagata, Matsunaga, Nishiura, & Nishiura, 1998). Therefore, based on a life course perspective, we would anticipate that ED patients who do not have an intimate partner, or who experience discord or dissolution of a marital relationship may be at risk of less successful treatment trajectories (Casad, Salazar, & Macina, 2015; Robustelli, Trytko, Li, & Whisman, 2015). Yet, to our knowledge, marital events have never been included in the modelling of ED-related hospitalization and readmission risk, and this study seeks to assess whether marital events function as an important turning point for ED-related hospitalization trajectories.

Like the start and end of marital relationships, the presence of children, and the experience of childbearing, may also serve as a stabilizing (or de-stabilizing) force in one's life course (Elder, 1985). Parenthood is associated with a complex interplay of costs and benefits that can influence one's wellbeing across the life course (Umberson, Pudrovska, & Reczek, 2010). Childbearing may also be an indicator of ED recovery for women, as women with a history of EDs are likely to experience fertility issues associated with ED-related symptomology (Tabler, Utz, Smith, Hanson, & Geist, 2018). The relationship between EDs and the transition to parenthood is arguably complex, with the impact of EDs on fertility extending well beyond explanations focusing on the "physical capacity" for childbearing (Tabler, Schmitz, Geist, Utz, & Smith, 2018). EDs are often experienced during typical childbearing years for men and women, with many persons experiencing transitions to parenthood simultaneously with ED-related symptoms, recovery, and relapse (Tabler, Utz, et al., 2018). However, much like marriage, additional comprehensive modelling is necessary to delineate whether childbearing is associated with ED-related hospitalization trajectories.

Current study

This study utilizes a population-based data source that combines health records with vital events records to examine how childbearing events and marriage transitions influence ED-related hospitalization and readmission risk of young males and females diagnosed with an ED. In addition, we model hospitalization risk for suicidality/self-injurious behavior. Suicidality is the most severe behavioral health issue correlated with any lifetime ED diagnosis (Preti et al., 2011), and would therefore illuminate the extent to which marriage and childbearing events shape the broader mental health trajectories of persons with EDs.

Our goal is to apply a contextually-rich analytic approach derived from a social science perspective that has clinical relevance, with results highlighting whether and which sociodemographic characteristics and social experiences influence or determine one's health outcomes and health care needs over time. We simultaneously consider sociodemographic characteristics (i.e., sex, race, income), and utilization of outpatient care, and contextualize the treatment trajectory within marital and childbearing activities to illustrate how life events commonly occurring during early and emerging adulthood alter ED-related and comorbid psychiatric hospitalization trajectories.

Hypotheses

Hypothesis 1. Childbearing events will have a stabilizing effect on the

recovery trajectories of persons with histories of EDs. They will be associated with lower risk (hazard) of experience ED-related hospitalization and readmission, as well as comorbid suicidality hospitalization and readmission.

Hypothesis 2. Marriage will have a stabilizing effect on the recovery trajectories of persons with histories of EDs. It will be associated with lower risk (hazard) of experiencing eating disorder-related hospitalization and/or readmission, as well as comorbid suicidality hospitalization and readmission.

Materials & method

Data

This retrospective cohort study relies on data from the Utah Population Database (UPDB), a unique data source that links sociodemographic, medical, and vital records (Smith & Fraser, 2018). The UPDB has population-wide coverage (for the state of Utah) and contains information on over 11 million individuals. The UPDB uses a master subject index to link individual vital records to medical records from the University of Utah Hospitals and Clinics (UUHC – the largest medical system in the state of Utah), statewide hospitalization records from the Utah Department of Health (UDOH), and height, weight, and residence information from the Utah Driver's License Division (DLD). Medical, hospitalization, and DLD records are available from 1995 to 2015. Studies using UPDB data have been approved by the University of Utah's Resource for Genetic Epidemiology and Institutional Review Board.

Sample

The sample includes males and females diagnosed previously with an ED in the state of Utah (from UDOH or UUHC medical records) between 1995 and -2015 (data were extracted in the spring of 2016). Primary ED diagnosis was defined as Anorexia nervosa, Bulimia nervosa or ED not otherwise specified (EDNOS), as established from ICD-9 codes recorded on the medical records. A total of 5351 females and 633 males (between 12 and 55 years of age) had a known ED diagnosis in the state of Utah between 1995 and 2015. Persons over the age of 55 were excluded from the sample to avoid conflation with dementia-related ED; feeding disorders and non-specified ED are common health issue affecting older adults with cognitive decline (Chang & Roberts, 2008). Approximately 23% of the original sample had missing values on key covariates, yielding an analytic sample of 4606 persons previously diagnosed with an ED ($n = 4183$ women and $n = 423$ men), after listwise deletion. Median household income (at the census-block level) was the most frequently missing variable. Supplemental analyses indicated that substantive results were largely unchanged when using multiple imputation to handle missing income data.

Measures

Dependent variables

The dependent variables capture the timing and frequency of hospitalization. *Age in months at first hospitalization* is measured as 1) age in months at first ED-related hospitalization (ICD-9 codes 307.1, 307.50, and 307.51), and 2) age in months at first suicide/self-inflicted injury hospitalization (labeled "Suicidality/self-injurious behavior", ICD-9 codes E950–958.9). *Time in months to hospital readmission* was calculated by subtracting prior hospitalization date (Month/Year) from the subsequent hospitalization (Month/Year) for 1) ED-related readmission, and 2) Suicidality-related readmission. All hospitalization data was derived from the UDOH.

Marriage and childbearing events

Independent variables capture the timing of any life course events

related to marriage and childbirth. *Marriage* is a dichotomous measure with "0" representing not married, and "1" representing married. This variable changes over time in response to marriage, divorce and spousal death events than can move individuals from married "1" to not married "0" and vice versa. We adjust for the individual's *mean proportion married* over the observation period (not shown) to disentangle the effect of change in marital status of an individual from the effect of marriage in general. *Children* is a time-varying measurement, providing an ongoing count of children born to a parent over time. We adjust for the individual's *mean number of children* over the observation period (not shown) to disentangle the effect of additional childbearing events from the influence of having higher total number of children. Marriage and birth data were taken from vital records.

Health covariates

To more fully capture treatment trajectories, all models adjust for any known *Outpatient Treatments* associated with 1) ED-related outpatient events (ongoing count of ED-related outpatient records) and/or 2) global outpatient events (ongoing count of either ED-related or suicide-related outpatient records). We adjust for mean count of outpatient treatments over the observation period (not shown) to isolate the effect of increased outpatient visits from high treatment volume in general. All outpatient treatment information was from UUHC medical records.

Covariates include baseline health characteristics that provide more detail about the ED diagnosis and an individual's body mass. *Eating Disorder* is a three-category measure constructed using inpatient and outpatient medical records. The measure compares those with records indicating previous primary diagnosis of Anorexia nervosa (ICD-9 code 307.1) "1", Bulimia nervosa (ICD-9 Code 307.51) "2", or EDNOS (ICD-9307.50) "3". This measure is restricted to those with first known diagnosis at age 12 or older. Specific diagnostic procedures employed by statewide hospitals are unknown. We also adjust for *age at first known ED diagnosis* using inpatient and outpatient records, measured in age in months.

Body Mass Index (BMI) is time-varying and captures changes across BMI categories over time. BMI is captured from outpatient and inpatient height and weight data (from UDOH or UUHC medical records) or height and weight data from the most proximate driver's license record. Underweight includes those with BMI scores below 18.5, normal weight between 18.5 and 25, overweight between 25 and 30, and obese 30+.

Sociodemographic covariates

Additional covariates capture the sociodemographic resources of the individual. *Birth Year* is a continuous variable taken from vital records. *Sex (assigned at birth)* is a binary measure comparing those assigned sex "male" versus "female" based on vital records. We do not have access to gender identity of study subjects. *Race/Ethnicity* is a categorical variable comparing non-Hispanic whites, Hispanics, non-Hispanic blacks and non-Hispanic other (predominantly Asian/Pacific Islander/Indigenous), taken from vital and DLD records. Although there is additional detail on race and ethnicity within the UPDB, the counts of these categories are too small for meaningful comparison. Finally, *Median Household Income* (at census block) is an ordinal category of eight household income levels ranging from 1 "<$10,000" to 8 "+$75,000." Individuals' census-block and associated median household income (at year 2000) was determined via residential address listed on their driver's license and was pre-constructed by UPDB staff.

Analytic approach

To assess ED-related first hospitalization and readmission risk, we use Cox proportional hazard regression to model age/time (in months) to first hospitalization and readmission (Fisher & Lin, 1999). We first consider the hazard of hospitalization/re-hospitalization determined by baseline health covariates, including ED diagnosis, Age at first known ED diagnosis, BMI category, and ED-related outpatient visits (Model A). We then add sociodemographic covariates and marriage and

childbearing to the baseline model (Model B). To assess the risk of broader psychiatric events among persons with ED, we repeated Cox proportional hazard regressions using suicidality/self-injurious behavior-related first hospitalization and readmission as the outcome. All models are clustered by a unique *person identifier*, and are stratified by *birth year* to adjust for potential cohort effects. Results are presented in hazard rate ratios with robust standard errors. All analyses were conducted in the summer of 2020 using Stata 15.1.

Results

Table 1 presents the longitudinal descriptive statistics of the full ED sample, at the subject ($n = 4606$) and data-point ($N = 32,315$) levels. Longitudinal descriptive statistics indicate that the average number of ED-related hospitalizations by subject was approximately 1 (avg min = 0, avg max = 15), but suicidality hospitalization was much lower, at an average of 0.2 hospitalizations per person (avg min = 0, avg max = 6.7). Approximately 91% of subjects were female, but 94% of data points were derived from female subjects. Among subjects, approximately 26% were diagnosed with Anorexia nervosa, 26% were diagnosed with Bulimia nervosa, and 63% were diagnosed with EDNOS at some point during the study period. The sample was predominantly non-Hispanic white (85%), with an average age at first diagnosis of 26 years (range = 12–55). In addition, subjects spent about 68.10% of their time in the "married" category and 32% of their time in the "unmarried" category, while 90% were unmarried and 39% were married at some point during the study period. The average number of children per subject across the study period is around 1 (avg min = 0, avg max = 6.6).

Table 1
Descriptive statistics.

	Subjects ($n = 4606$)	Data points ($N = 32315$)
	% or Mean (sd)[min-max]	% or Mean (sd)[min-max]
Number of ED-related[a] hospitalizations	1.02 (0.99) [0–15.00]	1.021 (2.314) [0–32.00]
Number of Suicidality/self-injury[b] hospitalizations	0.20 (0.43)[0–6.67]	0.204 (0.740) [0–11.00]
<u>Health covariates</u>		
ED diagnosis†		
Anorexia nervosa	26.18%	26.26%
Bulimia nervosa	26.27%	22.10%
EDNOS	62.92%	51.64%
BMI category†		
Underweight	23.99%	19.94%
Normal weight	73.62%	60.67%
Overweight	21.58%	11.49%
Obese	13.40%	7.90%
ED outpatient visits†	3.50 (2.99) [0–71.67]	3.50 (10.15) [0–134.00]
Global outpatient visits†	3.53 (3.01) [0–71.67]	3.53 (10.19) [0–134.00]
Age at first known ED diagnosis (presented in yrs)	26.53 (9.50) [12–55.00]	26.53 (9.30) [12–55.00]
<u>Sociodemographic covariates</u>		
Male	9.18%	6.15%
Female	90.82%	93.85%
Race-ethnicity		
Non-Hispanic white	85.45%	85.36%
Hispanic	9.75%	9.81%
Non-Hispanic black	0.91%	0.73%
Non-Hispanic other	3.89%	4.10%
Median household income	6.16 (1.24)[1–8.00]	6.16 (1.23)[1–8.00]
<u>Life course events</u>		
Marriage†		
Not Married	89.99%	68.10%
Married	39.32%	31.90%
Number of Children†	0.87 (0.97)[0–6.60]	0.87 (1.29) [0–11.00]

Data is derived from the Utah Population Database (1995–2015).

Results from the Cox proportional hazard models estimating the hazard of ED-related hospitalization and re-hospitalization (Table 2) suggested that several baseline health covariates are associated with risk for ED-related first hospitalization (Model 1A). Most notably, persons diagnosed with EDNOS experienced lower hazard of first hospitalization relative to those diagnosed with Anorexia nervosa (Hazard Rate Ratio [HRR] = 0.64, $p < 0.001$). In addition, underweight persons experienced higher hazard than those of normal weight (HRR = 1.41, $p < 0.001$). Increased ED-related outpatient visits were associated with reductions in the hazard of first hospitalization by nearly 47% per visit (HRR = 0.63, $p = 0.001$), holding all else constant. After inclusion of sociodemographic covariates and life course events (Model 1B), results suggested that females, relative to males, experienced increased hazard of first hospitalization (HRR = 1.32, $p = 0.004$). Marriage was also associated with reduced hazard of first hospitalization (HRR = 0.68, $p < 0.001$), as was

increased number of children (HRR = 0.89, $p = 0.02$), adjusting for covariates, and the individual's mean proportion of time married and mean number of children over the observation period (Model 1B).

Results differed when modelling time (in months) to ED-related readmission (Table 2, Models 2A-2B). Most notable differences included a change in direction in the effect of ED-related outpatient visits, where each additional outpatient visit corresponded with an increased hazard of first hospitalization of around 5% (HRR = 1.05, $p = 0.006$; Model 2A). Results failed to suggest any differences in readmission hazards between males and females (HRR = 1.19, $p = 0.30$) (Model 2B). Finally, while there were no discernible differences in first-hospitalization hazards based on race-ethnicity, results suggested that Hispanics experienced higher risk of ED-related re-hospitalization relative to non-Hispanic whites (HRR = 1.31, $p = 0.03$), holding all else constant (Model 2B). Finally, while marriage continued to be associated

Table 2

Cox-proportional hazard regression: Time in months to eating disorder-related hospitalization (Model 1) or readmission (Model 2).

	First Hospitalization Model 1A		First Hospitalization Model 1B		Readmission Model 2A		Readmission Model 2B	
	HRR [95% CI](robust SE)	p-value	HRR [95% CI](robust SE)	p-value	HRR [95% CI](robust SE)	p-value	HRR [95% CI](robust SE)	p-value
Baseline health covariates								
ED diagnosis[a]								
Bulimia nervosa	0.964 [0.839–1.072] (0.068)	0.602	0.939 [0.818–1.079] (0.067)	0.376	**0.706 [0.569–0.874] (0.077)**	**0.001**	**0.679 [0.54g-0.843] (0.075)**	**< 0.001**
EDNOS	**0.635 [0.562–0.719] (0.040)**	**< 0.001**	**0.630 [0.558–0.713] (0.039)**	**< 0.001**	**0.564 [0.470–0.677] (0.052)**	**< 0.001**	**0.556 [0.458–0.675] (0.056)**	**< 0.001**
Age at first known ED diagnosis	**0.996 [0.994–0.997] (0.001)**	**< 0.001**	**0.995 [0.994–0.997] (0.001)**	**< 0.001**	**1.002 [1.001–1.004] (0.001)**	**0.002**	**1.002 [1.001–1.004] (0.001)**	**< 0.001**
BMI Category[b]								
underweight	**1.411 [1.252–1.591] (0.086)**	**< 0.001**	**1.397 [1.240–1.575] (0.086)**	**< 0.001**	**1.536 [1.286–1.835] (0.139)**	**< 0.001**	**1.500 [1.253–1.796] (0.138)**	**< 0.001**
overweight	**0.824 [0.712–0.955] (0.062)**	**0.010**	**0.854 [0.736–0.991] (0.065)**	**0.034**	0.942 [0.710–1.249] (0.135)	0.677	0.950 [0.713–1.264] (0.139)	0.723
Obese	0.843 [0.704–1.010] (0.080)	0.064	0.838 [0.701–1.001] (0.076)	0.051	0.948 [0.671–1.339] (0.167)	0.762	0.896 [0.633–1.266] (0.158)	0.532
ED-related outpatient visits[c]	**0.631 [0.482–0.826] (0.087)**	**0.001**	**0.634 [0.484–0.831] (0.088)**	**0.001**	**1.052 [1.014–1.090] (0.019)**	**0.006**	**1.050 [1.013–1.089] (0.019)**	**0.008**
Sociodemographic covariates								
Sex (female)			**1.324 [1.091–1.608] (0.130)**	**0.004**			1.193 [0.853–1.669] (0.204)	0.301
Race-Ethnicity[d]								
Hispanic			1.042 [0.905–1.199] (0.075)	0.569			**1.305 [1.022–1.668] (0.163)**	**0.033**
Non-Hispanic black			0.703 [0.403–1.223] (0.200)	0.215			1.167 [0.466–2.923] (0.547)	0.742
Non-Hispanic other			1.081 [0.878–1.330] (0.114)	0.462			0.801 [0.532–1.205] (0.167)	0.286
Median Household Income			0.976 [0.938–1.016] (0.020)	0.234			1.014 [0.950–1.082] (0.034)	0.674
Marriage & Childbearing								
Married[c]			**0.675 [0.558–0.817] (0.065)**	**< 0.001**			**0.512 [0.364–0.721] (0.089)**	**< 0.001**
Children[c]			**0.890 [0.807–0.980] (0.044)**	**0.018**			1.184 [0.959-0.931] (0.084)	0.116
Number of subjects	3802		3802		2301		2301	
Number experiencing event (e.g., hospitalization)	1751		1751		661		661	
Pseudo R-squared	0.04		0.05		0.02		0.03	

Data is derived from the Utah Population Database linkages between state-wide hospitalization records (Utah Department of Health [UDOH]), outpatient records from (University of Utah Hospitals and Clinics [UUHC] vital records, and driver's license division (DLD) (1995–2015). Analyses are conducted at month-level intervals; limited to events occurring between ages 12–55 years. Models A adjust for the individual's mean count of outpatient visits, during the observation period; Models B includes additional adjustments for mean count of children, and mean proportion married, during the observation period. More individuals are included in readmission model sets ("subjects" in Model 2) relative to those experiencing first hospitalization event ("failure" in Model 1) due to some individuals entering the study at the time of their first hospitalization.

CI=Confidence interval, SE = standard error, HRR = hazard rate ratio, EDNOS = eating disorder not otherwise specified all analyses stratified by Birth Year.

[a] Reference is Anorexia nervosa.
[b] Reference is normal weight (18.5–25).
[c] Variable represent the effects of a one unit change, holding individual means constant.
[d] Reference is Non-Hispanic white.

with lower hazard of ED-related readmission (HRR = 0.51, *p* < 0.001), childbearing was found to be non-significant (HRR = 1.18, *p* = 0.11), when holding all else constant (Model 2B).

To better assess how marriage and childbearing events might shape the broader psychiatric health trajectories of persons with histories of ED, we also modelled age at first hospitalization (Model 1) and time (in months) to readmission (Model 2) for suicidality/self-injurious behaviors (Table 3). Results suggested that females experienced higher hazard of first suicidality/self-injurious behavior hospitalization relative to males (HRR = 1.67, *p* = 0.03), but not increased hazard of readmission (HRR = 0.89, *p* = 0.74). Finally, while marriage was significantly associated with reduced hazard of suicidality/self-injurious behavior-related first hospitalization (HRR = 0.66, *p* = 0.02) and readmission (HRR = 0.41, *p* = 0.004), childbearing was not associated with suicidality/self-injurious hospitalization or readmission, holding all else constant (Models 1 & 2). Unlike ED-related hospitalization and readmission, residing in neighborhoods with higher median incomes was associated with lower risk of suicidality/self-injurious behavior-related first hospitalization (HRR = 0.90, *p* = 0.03), but not hospital readmission.

Discussion

This study sought to assess the role of marriage and childbearing experiences on the hospitalization trajectories of persons with a history of ED. Results provide empirical evidence that ED-related hospitalization and readmission risk differs based on one's marital experiences, emphasizing the importance of contextualizing treatment trajectories and hospitalization risks within an individual's life course. Our contextually-rich analytic approach makes an important contribution to the broader readmission literature, and our findings emphasize the need to include individual characteristics and life experiences in empirical readmission risk assessment models.

Our findings support Hypothesis 1, as well as prior research indicating that marriage formation and relationship stability can positively shape personal health and wellbeing (Choi & Marks, 2011; Umberson & Montez, 2010). Conversely, remaining unmarried or experiencing marital dissolution may increase risk of ED-related hospital admission and readmission. Our study suggests that experiencing marriage may also buffer the risk of comorbid suicidality among persons with EDs. It is important to note our study identifies the association between *individual* change in marital status (that is, experiencing a marital event over the observation period, controlling for the individual's proportion of time spent married) and reduced risk for hospitalization and hospital readmission. While this does not fully disentangle potential social selection effects, that is, whether healthier individuals are more likely to get married (Hanson, Sobal, & Vermeylen, 2014), this is an important first step in considering the specific influence of marriage events as turning points in the hospitalization trajectories of persons with EDs. While additional research is needed, ED-related treatment plans may benefit from considering existing social science research showing the value of social support broadly for physical and mental health outcomes (Thoits, 2011), and potential value of relationship therapies to the wellbeing of ED patients (Arcelus, Yates, & Whiteley, 2012).

Our findings partially support Hypothesis 2, indicating that childbearing experiencing may also positively shape ED-related hospitalization trajectories. Having a child (or children) over the observation period was associated with reduced risk of ED-related hospital admission in our sample of females and males, but not ED-related hospital readmission. It is important to acknowledge that childbearing—particularly a female's capacity to conceive and achieve a live birth (fecundity)—may be in-and-of-itself an indication of ED remission and symptom recovery, given the association between EDs and fertility difficulties among women (Cousins, Freizinger, Duffy, Gregas, & Wolfe, 2015; Kimmel, Ferguson, Zerwas, Bulik, & Meltzer-Brody, 2016). Because childbearing was not found to be associated with

Table 3

Cox-proportional hazard regression: Time in months to suicide/self-inflicted injury hospitalization (Model 1) & readmission (Model 2).

	First Hospitalization Model 1		Readmission Model 2	
	HRR [95% CI] (robust SE)	p-value	HRR [95% CI] (robust SE)	p-value
Baseline health covariates				
ED diagnosis[a]				
Bulimia nervosa	1.274 [0.974–1.667] (0.175)	0.077	0.760 [0.491–1.176] (0.169)	0.218
EDNOS	0.955 [0.747–1.221] (0.120)	0.714	0.806 [0.537–1.210] (0.167)	0.298
Age at first known ED diagnosis	0.999 [0.997–1.000] (0.001)	0.118	1.003 [1.000–1.007] (0.001)	0.058
BMI Category[b]				
underweight	1.014 [0.782–1.316] (0.135)	0.914	0.955 [0.631–1.441] (0.202)	0.826
overweight	1.172 [0.881–1.560] (0.171)	0.275	1.183 [0.784–1.785] (0.248)	0.423
Obese	0.983 [0.688–1.404] (0.171)	0.924	0.960 [0.515–1.791] (0.305)	0.899
Global outpatient visits[c,d]	0.892 [0.756–1.053] (0.075)	0.176	**1.116 [1.000–1.245] (0.062)**	**0.049**
Sociodemographic covariates				
Sex (female)	**1.666 [1.064–2.609] (0.381)**	**0.026**	0.893 [0.458–1.739] (0.303)	0.739
Race-Ethnicity[e]				
Hispanic	1.113 [0.848–1.510] (0.167)	0.399	1.080 [0.662–1.762] (0.270)	0.759
Non-Hispanic black	1.033 [0.363–2.938] (0.550)	0.951	1.692 [0.649–4.412] (0.827)	0.282
Non-Hispanic other	**1.528 [1.012–2.307] (0.321)**	**0.044**	1.110 [0.589–2.089] (0.358)	0.747
Median Household Income	**0.900 [0.836–0.969] (0.034)**	**0.005**	1.061 [0.931–1.209] (0.071)	0.377
Marriage and Childbearing				
Married[d]	**0.661 [0.461–0.947] (0.121)**	**0.024**	**0.413 [0.225–0.759] (0.128)**	**0.004**
Children[d]	0.873 [0.727–1.048] (0.081)	0.145	1.090 [0.755–1.575] (0.204)	0.644
Number of subjects	4341		549	
Number experiencing event(e.g., hospitalization)	450		189	
Pseudo R-squared	0.02		0.02	

Data is derived from the Utah Population Database linkages between state-wide hospitalization records (Utah Department of Health[UDOH]), outpatient records from (University of Utah Hospitals and Clinics [UUHC] vital records, and driver's license division (DLD) (1995–2015). Analyses are conducted at the month-level, limited to events occurring between ages 12–55 years. More individuals are included in readmission model sets ("subjects" in Model 2) relative to those experiencing first hospitalization event ("failure" in Model 1) due to some individuals entering the study at the time of their first hospitalization. Models adjust for the individual's mean count of outpatient visits, mean count of children, and mean proportion married, during the observation period.
CI=Confidence interval, SE = standard error, HRR = hazard rate ratio, EDNOS = eating disorder not otherwise specified, all analyses stratified by Birth Year.
[a] Reference is Anorexia nervosa.

[b] Reference is normal weight (18.5–25).
[c] Cumulative outpatient visits for either ED or Suicidality.
[d] Variable represent the effects of a one unit change, holding individual means constant.
[e] Reference is Non-Hispanic white.

hospitalization for suicidality/self-inflicted injury among our sample, it is unclear whether childbearing has far-reaching positive benefits to the overall wellbeing of persons with histories of EDs. That is, childbearing may not represent a clear turning point like marriage for hospitalization trajectories of persons with histories of EDs.

The retrospective cohort design afforded by the Utah Population Database provided up to 20-years of medical records for each subject, allowing us to model both inpatient and outpatient treatments over time. According to our results, receiving outpatient ED-related treatment may protect against initial ED-related hospitalization. However, there appears to be a threshold effect, where follow-up outpatient treatments became predictive of a secondary hospital readmission. These findings suggest that a greater frequency of outpatient services will not uniformly reduce risk for subsequent hospitalizations. In other words, more severe cases, where symptomology is severe enough to trigger an initial inpatient hospital admission, will likely have more complex recovery requiring a combination of both inpatient and outpatient treatments over time. These results support current clinical recommendations regarding the use of targeted inpatient and outpatient treatments (Friedman et al., 2016; Grilo & Mitchell, 2011).

Interestingly, the receipt of outpatient services was not associated with higher or lower risk for comorbid psychiatric complications following initial ED diagnosis, as measured by hospitalization for suicidality/self-injurious behaviors. The addition of this second outcome variable provides a novel contribution to our understanding of ED-related symptomology and ED-related treatment trajectories, especially in whether these results can help us identify patients who are at the greatest risk for sustained psychiatric comorbidities following an ED diagnosis. As discussed earlier, experiencing a marriage provided a protective risk factor for suicidality-related hospitalization and readmission among ED patients in this sample. In addition, among our sample of individuals with histories of EDs, females and those residing in areas with lower median household incomes had a greatest risk for hospitalization associated with suicidality/self-inflicted injury. While these results are not too surprising—prior research has illustrated that females have higher rates of suicide-attempts relative to males (although males are more likely to complete suicide) (Mościcki, 1994), and that U. S. counties with higher rates of unemployment, poverty, and lower income experience higher rates of suicide (Recker & Moore, 2016)—they reconfirm that sociodemographic characteristics and social context should be considered alongside health characteristics when modelling hospitalization risk.

Finally, our study provides preliminary insight regarding the use and potential effectiveness of treatment options for different types of ED patients. For example, those with histories of Anorexia nervosa, relative to Bulimia nervosa or EDNOS, and those with an underweight BMI, relative to those with a normal or overweight BMI, exhibited higher relative risk for ED-related inpatient hospitalization and subsequent readmission. This potentially suggests more severe physical health complications or medical crises warranting acute inpatient care associated with low weight profiles commonly associated with Anorexia nervosa. Females had higher risk of first hospitalization, but similar readmission risk, relative to males, while Hispanics had higher hospitalization readmission risk, but similar initial hospitalization risk, relative to non-Hispanic and white peers. These differences by ED-type and sociodemographic characteristics suggest potential disparities in ED-related symptomology across demographic subgroups, which may require different treatment plans to address relapses or continued physical health complications associated with the ED. These differences may also indicate possible implicit biases in how ED-related treatments

are prescribed by clinicians or elected by individual patients, as a result of greater cultural recognition of EDs among some demographic sub-types. Future research using qualitative interviews and observation of both patients and clinicians could further explore the cause of these differences in treatment trajectories across diverse patient groups.

Limitations

This study relied on linked vital and medical records to model treatment trajectories. Medical records captured basic diagnostic and treatment information, but did not provide extensive information on specific treatment delivered (other than whether it was delivered in an inpatient or outpatient setting) or duration of treatment, particularly length of stay at hospitals, which is a known predictor of readmission risk for persons with a history of EDs (Kagabo, Hashibe, Kim, Kleinschmit, & Clark, 2017). A limitation of population data resources that rely on medical records for health information in general is that our sample likely speaks to those with greater access to care or whose conditions are most severe. We also did not have information on other co-morbid conditions, such as depression, which likely shape ED-related and suicidality-related hospitalizations.

Relatedly, this study relies on limited covariates, and may suffer from omitted variable bias. For example, we were not able to include important predictors of utilization, such as health insurance status, individual-level income or completed education, which also likely shape hospitalization and outpatient treatment trajectories. These limitations highlight the need to bolster support for population and data linkage centers, such as the Utah Population Database, where highly detailed medical records can be coupled with vital statistics and other institutional data resources to provide additional data on the health, health care use, and sociodemographic features of populations.

This study—as well as prior studies on EDs, interpersonal relationships, and childbearing—reflects a focus on heteronormative relationships and family structures. A growing body of evidence illustrates that sexual and gender minority youth and young adults may be equally, or in some instances, at greater risk, of EDs and comorbid psychiatric symptoms, such as depression (Tabler et al., 2019). Future research should explore how and whether life course processes such as marriage and childbearing differentially influence sexual or gender minority couples and parents. Furthermore, with the current data, we were not able to assess the value of other romantic partnerships, and did not have access to detailed information on the individual's access to other sources of social support, such as extended family, friends, and community.

With richer and more complete variables describing the unique sociodemographic profiles of individual patients, future research should further explore how additional life course dynamics mold the inpatient and outpatient treatment needs and trajectories of individual patients. This study largely speaks to processes occurring in early adulthood, but ED-related hospitalizations often extend well into midlife (Brown et al., 2020). Future studies assessing the risk for inpatient treatment could more fully explore how the timing and sequence of life course events could identify which individual ED patients are at greatest risk for readmission and which are likely to experience comorbid suicidality following initial diagnosis and treatment. These types of contextually-rich analyses, likely completed by social scientists and guided by principles of the life course theory (Elder, 1985), have the potential to create clinical treatment guidelines that move away from a one-size-fits-all treatment approach based solely on diagnosis and symptom severity to a more individualized treatment approach that reflects the unique needs, social resources, and characteristics of an individual patient.

Conclusion

ED-related symptoms and psychiatric events that trigger a need for inpatient treatment are happening within the context of a persons'

broader social life—including marital and childbearing experiences. If we are to better model risk for hospital admission or readmission, we need to consider other life course events and social experiences, such as marriage, divorce, spousal or parental death, and childbearing. This study highlights the value of contextualizing psychiatric hospitalization and readmission within an individual's marital and childbearing experiences, while simultaneously considering sociodemographic characteristics and outpatient treatment.

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Data availability

Data is not publicly available. Information on gaining access to the Utah Population Database can be ascertained through the Resource for Genetic and Epidemiological Research (RGE) (see https://uofuhealth.utah.edu/huntsman/utah-population-database/data/access.php).

Ethical statement

Authors report no financial conflicts of interest.

This study was approved and reviewed by the University of Utah Institutional Review Board, and The Utah Resource for Genetic and Epidemiologic Research.

Declaration of competing interest

Authors report no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2020.100672.

Author statement

J Tabler: Conceptualization, Funding acquisition, Methodology, Formal analysis, and Writing - original draft. B. Utz: Conceptualization, Funding acquisition, Methodology, and Writing - review & editing.

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