

Primary care service use during adolescence and young adulthood

Tertiary care cohort affected by chronic health conditions

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Abstract

Objective To understand use of family physician services and emergency department visits by adolescents and young adults with chronic health conditions.

Design Longitudinal retrospective observational cohort study using administrative health data.

Setting Chronic care clinics at a tertiary care pediatric hospital in Calgary, Alta.

Participants In total, 1326 adolescents who were between 12 and 15 years old in 2008, who were observed until 2016, and who received medical services for chronic conditions were enrolled in the study. Eligible participants had at least 4 visits to the same chronic disease clinic in any 2-year window before age 18.

Main outcomes measures Group-based trajectory modeling was used to identify groups of adolescents with distinct patterns of health care use (for visits to emergency departments and to primary care practices), while χ^2 tests explored trajectory group differences (eg, sex, location of residence).

Results Median age was 14 years (range 12 to 17 years) at study entry, and 22 years (range 14 to 24 years) at study exit. Half were female and most (85.4%) lived in an urban area. Median observation period was 8.7 person-years (range 1.3 to 9.1 years). Group-based trajectory modeling identified 5 distinct trajectory groups of primary care use and 4 groups of emergency services use. Groups differed by sex and location of residence in each trajectory model.

Conclusion Many adolescents increased their use of emergency services between the ages of 12 and 24 years, with distinct patterns of primary care use being observed. Association of additional patient- and system-level factors (eg, disease severity, distance to nearest family physician office) should be explored.

Editor's key points

- ▶ Use of emergency services (ie, emergency department visits) increased after age 16 among a cohort of adolescents, while use of primary care (ie, family physician visits) varied over time.
- ▶ Group-based trajectory modeling identified 5 distinct patterns of primary care use and 4 patterns of emergency department use.
- ▶ The potential barriers to and facilitators of family physician involvement at various times during the transition period need to be explored from the perspectives of youths, providers, and key stakeholders.

Points de repère du rédacteur

- Le recours aux services d'urgence (p. ex. visites à un service d'urgence) a augmenté après l'âge de 16 ans chez une cohorte d'adolescents, tandis que l'utilisation des soins primaires (p. ex. visites chez un médecin de famille) variait avec le temps.
- La modélisation des trajectoires par groupe a identifié 5 modèles distincts d'utilisation des soins primaires et 4 modèles de recours aux services d'urgence.
- Les éventuels facteurs pouvant nuire ou aider à la participation des médecins de famille à divers moments durant la période de transition doivent être explorés selon les points de vue des jeunes, des professionnels et des principaux intervenants.

Recours aux soins primaires par les adolescents et les jeunes adultes

Cohortes de soins tertiaires souffrant de maladies chroniques

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Résumé

Objectif Comprendre le recours aux services d'un médecin de famille et les visites aux services d'urgence par les adolescents et les jeunes adultes souffrant de problèmes de santé chroniques.

Type d'étude Étude de cohortes par observation, longitudinale et rétrospective, au moyen de données administratives sur la santé.

Contexte Des cliniques de soins pour maladies chroniques dans un hôpital pédiatrique de soins tertiaires à Calgary (Alberta)

Participants Dans l'ensemble, 1326 adolescents âgés de 12 à 15 ans en 2008, en observation jusqu'en 2016 et ayant reçu des services médicaux pour des problèmes chroniques ont été inscrits dans l'étude. Les participants admissibles avaient consulté une clinique pour la même maladie chronique au moins 4 fois durant un intervalle de 2 ans, quel qu'il soit, avant l'âge de 18 ans.

Principaux paramètres à l'étude Une modélisation des trajectoires par groupe a été utilisée pour identifier des groupes d'adolescents ayant des habitudes distinctes d'utilisation des soins de santé (pour les visites aux services d'urgence et à des cliniques de soins primaires), tandis que des tests χ^2 exploraient les différences dans les groupes de trajectoires (p. ex. genre, lieu de résidence).

Résultats L'âge moyen était de 14 ans (variant de 12 à 17 ans) au début de l'étude et de 22 ans (entre 14 et 24 ans) à la fin. La moitié des sujets étaient de sexe féminin, et la plupart (85,4 %) vivaient en milieu urbain. La période moyenne d'observation était de 8,7 années-personnes (entre 1,3 et 9,1 ans). La modélisation des trajectoires par groupe a cerné 5 groupes distincts de trajectoires d'utilisation des soins primaires et 4 groupes de recours aux services d'urgence. Les groupes variaient selon le sexe et le lieu de résidence dans chacun des modèles de trajectoires.

Conclusion De nombreux adolescents ont augmenté leur utilisation des services d'urgence entre 12 et 24 ans, et des modèles distincts de recours aux soins primaires ont été observés. Il y aurait lieu d'explorer l'association entre d'autres facteurs chez les patients et à l'échelle du système (p. ex. la gravité de la maladie, la distance pour se rendre à la clinique de médecine familiale la plus proche).

Adolescents with chronic health conditions are required to transfer from pediatric to adult care when they turn 18 years old (though this varies across health care jurisdictions in Canada).¹ Transitioning to adult care is a challenging and complex process for adolescents and their families. Numerous barriers to successful transition exist² and include lack of care coordination,^{3,4} inadequate preparation or transfer planning for families,⁵⁻⁷ poor access to ambulatory adult care,⁸ and lack of developmentally appropriate services for young adults in the adult system.^{4,9} These factors can lead to deterioration in health and disengagement from health services, posing substantial risks for these young adults.^{10,11}

Increases in emergency department use and hospitalizations for young adults (ie, 18 to 25 years) are common quality indicators of “poor transition” to adult care.^{9,12} These indicators have been observed in those with various diseases, including type 1 diabetes,^{11,13} congenital heart disease,¹⁴ sickle cell disease,^{15,16} and inflammatory bowel disease.¹⁷ Although use of emergency services and hospitalizations are important indicators, they do not fully capture the continuum of health care for adolescents transitioning to adult care.¹² Routine primary care, as recommended by transition guidelines,² can mitigate adverse outcomes or visits to emergency departments and promote health maintenance.¹⁸ Yet, in the United States, the percentage of young adults with a chronic health condition who have routine primary care varies from 40% to more than 90%.^{19,20} Furthermore, very few pediatric transition interventions involve a primary care component,²¹ and thus little is known about how adolescents use primary care services during that transition period.

In Canada, most people receive primary care from family physicians.²² For example, a national survey of adolescents and young adults (aged 12 to 24 years) showed that approximately 64% reported having at least 1 visit with a family physician and 62% were “high users” (4 or more visits). In adolescents ages 12 to 19, having a chronic condition was associated with greater use, but this association did not hold during young adulthood.²³ Being a female living in an urban area was also associated with use.^{23,24} Limitations included use of self-reported measures and a cross-sectional design. Identifying potential differences in the use of family physician services over time is needed and could inform a more comprehensive understanding of health care use by adolescents.

To address this gap, we conducted a longitudinal study examining health care use (ie, visits to emergency departments or family physicians) in a cohort of adolescents aged 12 to 18 years who received chronic medical services at a tertiary pediatric hospital in Alberta between 2008 and 2016. The objective was to determine whether distinct patterns of health care use existed

within our cohort. A second, exploratory objective was to examine the association of patient-level variables (eg, sex, clinic affiliation) with the identified patterns.

— Methods —

Data for this retrospective observational cohort study were obtained from the Calgary Transition Cohort for which cohort creation methods were published previously.²⁵ The Calgary Transition Cohort represents a cohort of adolescents and young adults aged 12 to 24 years who received care from a chronic disease clinic between 2008 and 2016 at a tertiary pediatric hospital in Calgary, Alta. The province of Alberta, with a population of 4.1 million, is the fourth largest in Canada and, like all Canadian provinces, has a universal publicly funded health care system that covers more than 99% of the population. Physicians are paid for services provided to patients (hospitalized patients as well as outpatients) by the Ministry of Health in Alberta. The hospital is 1 of 3 tertiary care pediatric hospitals in Alberta and provides care to all children and adolescents aged 0 to 18 years old in the Calgary zone, which has a population of 1.5 million residents and, according to 2016 census data, includes about 18% young people (aged 10 to 24 years).²⁶

Calgary Transition Cohort

The Calgary Transition Cohort (N=1326) was created using patient-level hospital records held by the Alberta Health Services (AHS) corporate data repository.²⁵ Patients eligible for the cohort were 12 to 15 years old in 2008; were involved with a chronic care clinic (CCC) at Alberta Children’s Hospital (eg, diabetes, endocrinology, nephrology); and had at least 4 visits to the same CCC within a 2-year period, with at least 3 months between visits, before the age of 18. The age criteria ensured outcomes could be observed for at least 2 years before and after age 18. Not all clinics at the hospital were included; CCCs were selected by the research team and key stakeholders to represent clinics likely to provide ongoing care to adolescents. The 4 qualifying CCC visits had to be at least 3 months apart to align with definitions of chronic health disorders in childhood, although some patients had more frequent visits.²⁵

Patients were excluded if they moved out of province during the study window or if they had an invalid AHS insurance plan number, which provides a unique identifier for each person eligible for health care in the province. The Calgary Transition Cohort was deterministically linked to several administrative health data sets using patients’ unique identifiers to describe demographic information and health care use.

The study was approved by the University of Calgary Conjoint Health Research Ethics Board in Alberta. Written consent from individual patients was not required, as analyses were performed using administrative

data collected by AHS (custodian for all databases used in this study); no identifiable data were released to the research team.

Demographic data. Patients' sexes, birth dates, and postal codes were obtained from the vital statistics data set.²⁵ For the purposes of this study, postal codes from the 2011 census were used. Residence location (ie, urban or rural) was based on postal code upon entry into the cohort and the AHS rural-urban typology.²⁷ Area-level socioeconomic status was determined using the material deprivation component of the Alberta Pampalon deprivation index (PDI).²⁸ This index is a small area-based composite index that uses Canadian census data at the dissemination area level to present socioeconomic disparities among the population. The material deprivation component of the PDI is most relevant and applicable in Alberta.²⁸ This index stratifies the population into 5 quintiles, with the highest quintile (Q5) representing the population living in areas with the most deprivation.

Health care service use data. Health data sets included in this study were from the National Ambulatory Care Reporting System (NACRS)²⁹ and Alberta Health Care practitioner claims. The NACRS contains ambulatory care data and includes emergency department visit details (eg, date, service provided) at the patient level. For each visit to the emergency department, there can be up to 10 ICD-10-CA diagnostic codes. The NACRS falls under mandatory national reporting guidelines, and data quality is monitored regularly by the Canadian Institute for Health Information. Physician claims data from the Ministry of Health report physician remuneration for services provided to patients and contain a unique physician identification code to support submission of claims. A physician's claim for payment must, in addition to a billing code for the service provided, include the patient's unique identifier and up to 3 ICD-9 diagnostic codes for health conditions for which services were provided. Our study obtained claims data on visits to family physicians, as these claims distinguish visits to family physicians from visits to other types of physicians. Only 1 visit per day to a family physician was included in our visit counts; it is possible that youth receiving care from multiple physicians could have had more than 1 visit per day.

Analysis

To identify subgroups within the Calgary Transition Cohort who had similar patterns of health care use over time, longitudinal group-based trajectory modeling³⁰ (GBTM; a type of finite mixture modeling) was performed using R statistical software (CrimCV package, version 0.9.6). Separate GBTM analyses were conducted for use of emergency services and of primary care (ie, visits to family physicians), which were the only variables

entered into models to determine groups. Group-based trajectory modeling uses a clustering approach that identifies groups, within a heterogeneous population, that follow similar (within groups) but distinctive (between groups) patterns of use over time.³¹ The optimal number of trajectory groups is determined by fitting a series of models with various complexity (by adding more groups) and assessing model fit. A zero-inflated Poisson model, offered by R statistical software, was used to fit models with a predetermined number of groups (2 to 5). Event rates during unobserved periods were handled as per R statistical software. Model fit indices included Bayesian information criterion and Akaike information criterion; the preferred model had the lowest values for these indices. Model selection was also guided by visual inspections of graphs. Discussions within our team and with clinical stakeholders ensured the statistically preferred model was also useful and applicable to our research aim.^{32,33}

Initial models were built using the quadratic degree of the polynomial to specify the shape of each trajectory. Once the model with the optimal number of trajectory groups was selected, the preferred degree of the polynomial was tested with different iterations; the model with the lowest Bayesian information criterion was selected. Given that group membership in GBTM is probabilistic (ie, subjects do not belong to trajectory groups but are assigned a probability of group membership), we also examined the adequacy of our selected model by examining the posterior probabilities estimated from the model parameters. Trajectory groups were described using basic statistics (means, medians, and proportions) for certain characteristics (eg, sex, location of residence, primary clinic affiliation). Associations between demographic (eg, sex, rural residence) and health service use variables (eg, primary clinic affiliation) with group trajectories were analyzed for groups with cell sizes below 5, using χ^2 tests; an α level of .05 was used for all statistical tests, with 95% confidence intervals.

— Results —

Overall, 1326 adolescents met eligibility criteria and had at least 4 visits to the same CCC within a 24-month window before age 18; 7.6% of patients met these visit criteria at more than 1 CCC (ie, had at least 4 visits at various clinics). The median age at study entry (ie, at first qualifying CCC visit) was 14 years (range 12 to 17 years), and at study exit was 22 years (range 14 to 24 years). The median duration of observation was 8.7 person-years (range 1.3 to 9.1 years). Half the sample was female and most (85.4%) resided in an urban location. Moreover, 18.0% of the sample resided in a deprived area (Q5) based on an area-level measure of socioeconomic status. Twenty-eight patients (2.1%) died during the observation period and 9 patients died before reaching 18

years. About one-third of patients were involved with more than 1 CCC at the hospital during the study window. Most patients who met eligibility criteria attended diabetes (21.3%), gastroenterology (12.5%), rheumatology (9.8%), or neurology (8.4%) clinics. Descriptive statistics of sample characteristics for the cohort are summarized in **Table 1**.^{25,27,28}

Health care use during a 9-year period

Visit rates per person-year (total visits per available person-years) are reported below for visits to emergency departments and to family physicians separately. To identify subgroups within our cohort with distinct patterns of emergency department or family physician use, GBTM was used. In **Table 2**, we present the median and interquartile range of the predicted probabilities of membership for each group, among those assigned to that group (eg, predicted probability of being in group 1 among those assigned to group 1), separately for each trajectory model. Group membership was predicted with high probability (close to 1.00, or 100%) across groups in both models. Visit rates per person-year, per trajectory group, are also presented in **Table 2**.

Emergency department use. For the entire cohort, the annual rate of visits to emergency services per person-year was 0.78. Age-specific visit rates ranged from 0.3 at age 14 to 1.7 at age 18. Group-based trajectory modeling revealed that a 4-group model best fit the data (**Figure 1**). Trajectories included group 1 (n=3, <1% of sample), which showed an increased use of emergency services after age 15 and decreased use after age 20; group 2 (n=106, 8.0%) and group 3 (n=415, 31.3%), both of which showed a gradual increase in use of emergency services after age 16, with different “peaks” in visit frequency (<5 visits); and group 4 (n=802, 60.5%), which showed a stable pattern of low use of emergency services over time. Proportions differed in sex and residence across groups ($P<.05$; **Table 3**²⁸); groups 2 and 3 had a higher percentage of female patients and people living in rural areas. Groups attending emergency departments did not differ by area-level socioeconomic status quintiles.

Primary care use. Annual primary care visit rate per person-year was 3.44. Age-specific visit rates varied and ranged from 1.3 at age 13 to 4.3 at age 19. Our modeling analysis revealed a 5-group model (**Figure 2**). Trajectories consisted of group 1 (n=5, <1%), which showed a sharp increase in primary care use after age 15 and a sharp decrease after age 18; group 2 (n=96, 7.2%), which showed increasing use after age 12 and decreasing use after age 15; group 3 (n=157, 11.8%) and group 4 (n=490, 36.9%), both of which showed a gradual increase in use after age 16 and varying peaks in visit frequency; and group 5 (n=578, 43.6%),

which showed a stable trajectory of low primary care use. Annual visit rates per group are presented in **Table 1**.^{25,27,28} Similar to use of emergency services, proportions by sex and residence differed across groups ($P<.05$; see **Table 4**²⁸):

Table 1. Characteristics of the Calgary Transition Cohort: N=1326.*

CHARACTERISTICS	COHORT, %
Sex	
• Female	50.2
• Male	49.8
• Other	0.0
Deaths during study window [†]	2.1
• Death by suicide	14.2
• Death related to chronic condition or other	85.7
Residence location at study entry [‡]	
• Urban or metro	85.4
• Rural	14.6
Pampalon deprivation index quintile [§]	
• Q1 (least deprived)	18.6
• Q2	20.8
• Q3	20.1
• Q4	17.9
• Q5 (most deprived)	18.0
• Data missing	4.5
CCC involvement during study window	
• 1 clinic only	67.6
• >1 clinic	32.3
Most frequently visited CCC during study window	
• Diabetes	21.2
• Gastroenterology	13.2
• Rheumatology	12.1
• Neurology	8.6
• Endocrinology	7.1
• Nephrology	7.1
• Neuromotor	4.2
• Asthma	3.4
• Oncology	3.3
• Ophthalmology	2.8
• Cardiology	2.2

CCC—chronic care clinic.

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[†]Average age at death was 18.9 years.

[‡]Residence defined by Alberta Health Services.²⁷

[§]Pampalon deprivation index quintiles were determined using 2011 census data.²⁸

^{||}Clinics representing less than 2% (n=28) of sample not reported.

Table 2. Posterior probabilities for GBTM analyses: N=1326.

GBTM ANALYSIS	COHORT, n (%)	MEDIAN ESTIMATED POSTERIOR PROBABILITY (IQR)*	VISIT RATE (TOTAL VISITS/ PERSON-YEARS AVAILABLE)
ED trajectory model			
• Group 1	3 (<1)	1.00 (1.0-1.0)	14.94
• Group 2	106 (8.0)	0.99 (0.88-1.00)	3.21
• Group 3	415 (31.3)	0.93 (0.76-0.97)	1.11
• Group 4	802 (60.5)	0.97 (0.90-0.99)	0.23
Primary care trajectory model			
• Group 1	5 (<1)	1.00 (1.00-1.00)	35.10
• Group 2	96 (7.2)	0.99 (0.96-1.00)	5.87
• Group 3	157 (11.8)	0.99 (0.94-1.00)	8.07
• Group 4	490 (36.9)	0.99 (0.93-1.00)	3.75
• Group 5	578 (43.6)	0.99 (0.96-1.00)	1.26

ED—emergency department, GBTM—group-based trajectory modeling, IQR—interquartile range.
 *Median posterior probability refers to predicted probability of membership for each group, among those assigned to that group (eg, predicted probability of being in group 1 among those assigned to group 1).

there was a higher percentage of female patients in groups 2, 3, and 4, and a higher percentage of people living in rural areas in group 2. The number of chronic disease clinics (1 vs >1) that a patient visited and their area-level socioeconomic status were not associated with trajectory group membership.

— Discussion —

This study described patterns of health care use, specifically use of emergency services and of family physicians, within a cohort of adolescents (N=1326) seen at various chronic disease clinics at a tertiary care pediatric hospital. Visit rates (per person-year) for use of emergency services and for use of primary care over a 9-year window were 0.75 and 3.32, respectively. Using GBTM, we were able to further explore these crude rates and examine potential groups with distinct patterns of health care use over time during this transition age (12 to 24 years old).

In terms of emergency services use, a pattern of increasing use after age 16 was observed in 40% of our cohort. Three different subgroups emerged with varying peaks in maximum frequencies of visits to emergency departments at certain ages. A very small percentage (<1%) showed a sharp increase in visits after age 15 (to a maximum of about 30 at age 20) and had an annual visit rate of 15. Increased use of emergency services after transfer to adult care, as demonstrated by subgroups in our cohort, is similar to other studies.^{14,18,34} Our study suggests use of emergency services might increase at an earlier age (ie, 15 years) for some adolescents compared with previous data reporting increased use immediately after age 18.^{13,14,17}

For family physicians, our cohort showed variability in use over time. A very small percentage showed a sharp increase in use after age 15 (to a maximum of 63 visits at age 18) and a decrease after age 18. Some (7%)

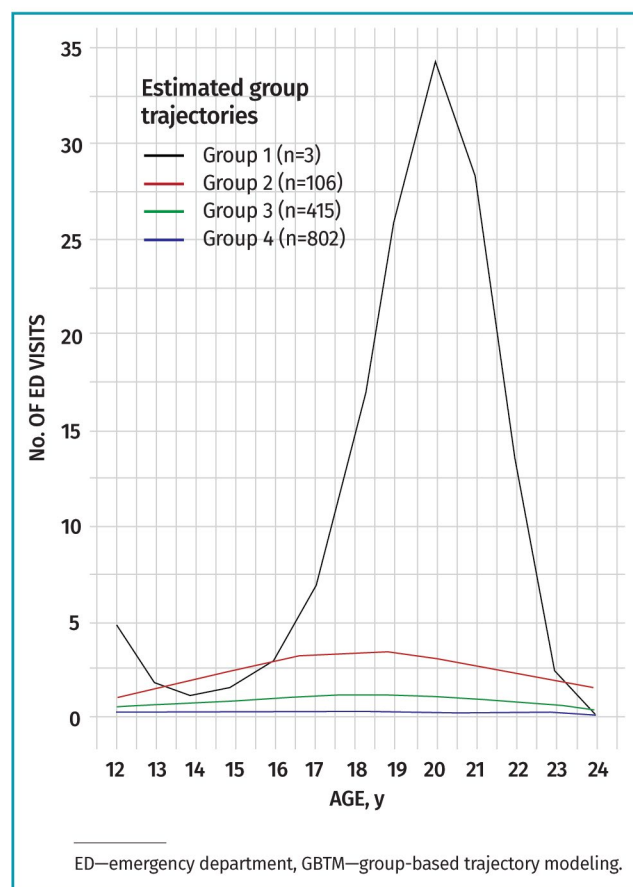
Figure 1. Four-group model showing 4 distinct patterns of ED use over time based on GBTM

Table 3. Comparing cohort characteristics between trajectory groups for ED use

COHORT CHARACTERISTICS	GROUP 2, % (N=106)*	GROUP 3, % (N=415)	GROUP 4, % (N=802)	P VALUE
Demographic variables				
Female	62.3	53.0	47.1	.005
Rural residence location	32.1	18.8	10.1	<.001
Pampalon deprivation index quintile†				
• Q1 (least deprived)	16.0	15.9	20.3	.54
• Q2	21.7	22.2	20.0	
• Q3	20.8	20.0	20.1	
• Q4	20.8	17.3	18.0	
• Q5 (most deprived)	14.2	20.7	17.1	
Health care service use variables				
Seen by >1 CCC in study window	40.6	34.5	30.0	.05
Most frequent clinic				
• Diabetes	19.8	22.9	20.6	
• Gastroenterology	13.2	16.4	11.5	
• Rheumatology	14.2	11.1	12.3	
• Neurology	13.2	11.1	6.7	
• Endocrinology	1.9	4.1	9.2	
• Nephrology	9.4	7.7	6.5	

CCC—chronic care clinic, ED—emergency department.

*Group 1 suppressed owing to cell sizes <5.

†The material deprivation component of the Pampalon deprivation index²⁸ was used, which consists of 3 indicators: proportion of people aged 15 years and older with no high school diploma, population or employment ratio of people aged 15 years and older, and average income of people aged 15 years and older.

adolescents showed decreased use after age 15, while many (48%) showed a gradually increasing use of primary care after age 16; a sizable proportion of our cohort (44%) appeared to have minimal involvement with primary care. Few studies have described primary care use among adolescents or among those with chronic conditions; cross-sectional data suggest young adults might be less likely to use family physicians' services than adolescents.²³ Our investigation into patterns of use over time adds to our understanding of how family physicians are involved in caring for this population.^{35,36}

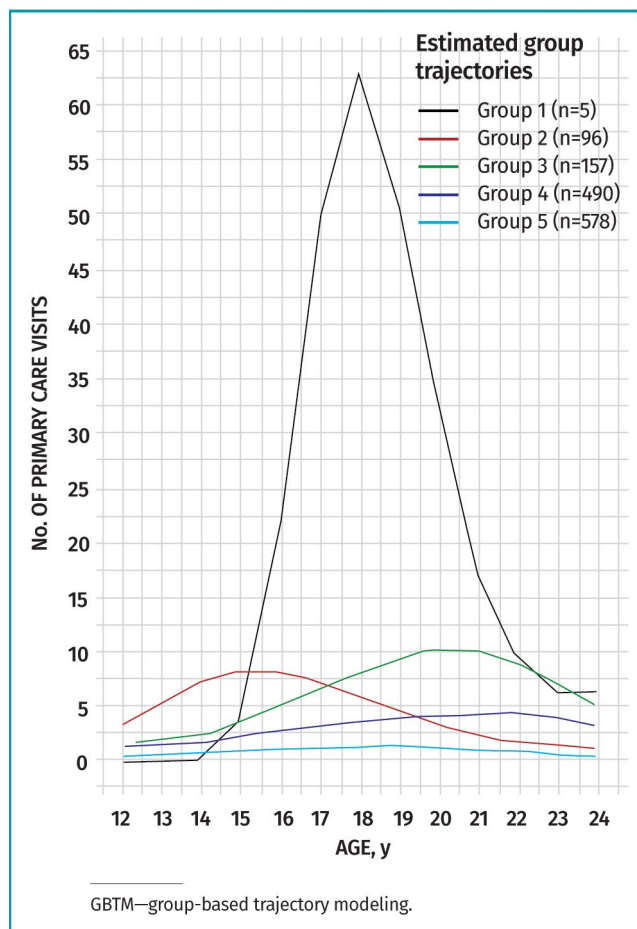
Our findings highlight heterogeneity in patterns of health care use during adolescence and young adulthood for those with chronic conditions, specifically use of emergency services and family physician services, suggesting that patients' needs vary. How patients access health care over time, especially during transition years, also varies. Frequency of contact with the primary care system changes for most adolescents. Guidelines on best practices state family physicians should be involved during transition, a process recommended to start at age 12.^{7,37} Yet, the optimal timing of family physicians' involvement in care of pediatric patients with chronic health conditions remains unclear. Many adolescents and young adults with chronic physical health

conditions report they do not have ongoing contact with their family physician and do not understand the role of their family physician.³⁵ Perceived barriers to access and possible consequences resulting from disruptions in primary care should be explored.

Use of family physician services could differ by patient characteristics (eg, by sex and location of residence). For example, we found a higher percentage of female adolescents were more likely to fall into trajectory groups with higher use, which is consistent with previous literature. Those living in rural areas were more likely to have higher rates of use for emergency services. Research is needed to understand how patient- and system-level factors can lead to different patterns of use (eg, type of chronic condition, distance to nearest family practice). We were unable to examine the relationship between frequency of visits to family physicians and emergency departments owing to insufficient sample size across trajectory groups. We will examine potential for an "offset effect" of primary care use on emergency services use for this population in future work.

Strengths and limitations

Our trajectory analysis of health care use is novel. Group-based modeling methods, which originated in the

Figure 2. Five-group model showing 5 distinct patterns of primary care use over time based on GBTM analyses

field of developmental psychopathology,^{30,31,38} can easily summarize complex longitudinal data and explore patterns within data, especially when no empirical or theoretical basis exists for estimating patterns in a population (one trajectory likely does not “fit all”).³⁰ Our ability to predict trajectory group membership (or who was most likely to belong to a group) was limited to demographic variables available in our data set. Clinically relevant information (eg, level of function, disease severity) was unavailable in our data set. Our cohort represents a unique subset of adolescents who have accessed specialty health care services at a tertiary care pediatric hospital in Alberta. A similar study using province-wide health data, for example, is needed to verify and confirm the patterns of health care use we observed in this single-centre cohort.

Adolescents with chronic health conditions managed by providers outside hospitals (eg, by a community pediatrician or family physician) were not included, and thus our cohort might underestimate certain conditions (eg, asthma, found in only 3.4% of our sample) commonly managed in community primary care. Similarly, our cohort did not include patients with neurodevelopmental

conditions (eg, attention deficit hyperactivity disorder) or common adolescent mental health conditions (eg, depression). A recent population-based cohort study in Ontario found that among adolescents aged 12 to 16 years old with severe mental illness (ie, schizophrenia, eating disorders, mood disorders), 65% had “continuous” primary care (seen by the same physician) during the transition period (aged 17 to 18 years) and had a lower rate of mental health-related hospitalizations in young adulthood than those who had discontinuous or no primary care.³⁹ Further research is needed to investigate how patterns in health care use change for adolescents with specific chronic illnesses, including mental health conditions.

Conclusion

This is the first study to our knowledge to demonstrate variability in use of family physicians during the transition to adulthood among adolescents affected by chronic physical health conditions. Further research with a larger sample size is needed to explore potential differences in trajectory group membership based on diagnoses or other factors (eg, location of residence). Also, potential barriers to or facilitators of family physicians’ involvement at various times during the transition period need to be explored from the perspectives of patients, physicians, and other key stakeholders.

Dr Kyleigh Schraeder is a registered clinical psychologist in Alberta; at the time this manuscript was submitted, Dr Schraeder was a postdoctoral scholar in the Department of Pediatrics at the University of Calgary. **Dr Alberto Nettel-Aguirre** was a statistician in the Cumming School of Medicine at the University of Calgary at the time this manuscript was submitted. **Dr Andrew S. Mackie** is Associate Professor in the Department of Pediatrics at the University of Alberta in Edmonton. **Dr Kerry McBrien** is Associate Professor in Community Health Sciences at the University of Calgary. **Dr Olesya Barrett** is Senior Analyst in Clinical Analytics at Alberta Health Services in Calgary. **Dr Gina Dimitropoulos** is Associate Professor in the Faculty of Social Work at the University of Calgary. **Dr Susan Samuel** is Associate Professor in the Departments of Pediatrics and Community Health Sciences at the University of Calgary.

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Contributors

All authors contributed to the concept and design of the study; data gathering, analysis, and interpretation; and preparing the manuscript for submission.

Competing interests

None declared

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Table 4. Comparing cohort characteristics between trajectory groups for primary care use

COHORT CHARACTERISTICS	GROUP 2, % (N=96)*	GROUP 3, % (N=157)	GROUP 4, % (N=490)	GROUP 5, % (N=578)	P VALUE
Demographic variables					
Female	57.3	77.1	59.8	33.2	<.001
Rural residence location	19.8	14.0	11.0	16.8	.03
Pampalon deprivation index[†]					
• Q1 (least deprived)	29.2	12.1	16.1	20.9	.08
• Q2	16.7	21.7	20.8	21.1	
• Q3	14.6	21.0	22.9	18.2	
• Q4	13.5	19.7	18.2	18.0	
• Q5 (most deprived)	22.9	20.4	16.7	17.8	
Health care service use variables					
Seen by >1 CCC in study window	39.6	36.3	32.2	30.3	.21
Most frequent clinic					
• Diabetes	12.5	22.3	22.0	21.8	
• Gastroenterology	17.7	19.1	11.6	11.9	
• Rheumatology	9.4	12.1	12.7	12.1	
• Neurology	12.5	7.0	10.4	6.6	
• Endocrinology	3.1	8.3	7.6	7.1	
• Nephrology	6.3	7.6	8.8	5.7	
• Neuromotor	1.0	1.3	4.1	5.7	
• Asthma	8.3	2.5	3.9	2.4	
• Cardiology	3.1	5.1	1.4	1.9	

CCC—chronic care clinic.

*Group 1 suppressed owing to cell sizes <5.

[†]The material deprivation component of the Pampalon deprivation index²⁸ was used, which consists of 3 indicators: proportion of people aged 15 years and older with no high school diploma, population or employment ratio of people aged 15 years and older, and average income of people aged 15 years and older.

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