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## Lack of Follow Up of Pediatric Patients With Celiac Disease

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### Keywords

celiac disease; follow-up; outcome and process assessment (health care); ambulatory care; pediatrics; treatment

### Introduction

Celiac disease (CD) is often diagnosed in childhood and the treatment is a lifelong gluten-free diet (GFD)<sup>1,2</sup>. It may take several years to gain competence in the skills required to follow a GFD successfully. Inadequately treated CD is associated with bone fractures, nutritional deficiencies and lymphoma<sup>3,4</sup>. Healthcare providers are key resources for patients with CD. Consultation with a dietitian with GFD expertise at diagnosis and annual disease-specific follow-up care is recommended<sup>2,5</sup>. The primary objective of this study was to evaluate adherence to guidelines for dietitian consultation and follow-up for children with CD. A secondary objective was to identify factors associated with loss to follow-up.

### Methods

A retrospective cohort of 250 subjects (50/year) were randomly selected from an existing database of children (<18 years) diagnosed with biopsy-confirmed CD at Boston Children's

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Specific Author Contributions

Conceived and designed study: BAB, JAS; collected data: EA, BAB, ZH; Interpreted data: EA, BAB, ZH, AML, JAS, DCW. All authors critically reviewed and approved the final submitted version of the manuscript.

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Potential competing interests:

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Hospital (BCH) between January 1<sup>st</sup>, 2010 and December 31<sup>st</sup>, 2014. Medical records were reviewed from diagnosis through December 31<sup>st</sup>, 2017 to allow a minimum three year observation period. Children who did not have a GI visit for >18 months were considered lost to follow-up. Cox Proportional-Hazards modelling was used for multivariate analysis. The BCH Institutional Review Board approved the study.

## Results

Of 250 patients selected, 9 were excluded because they were seen for a second opinion, yielding 241 eligible subjects (63% female). Median age at diagnosis was 9.7 years (IQR 6.2– 13.3). Abdominal pain (24%) and constipation (14%) were common at diagnosis; only 2% were asymptomatic. Of 237 subjects with primary insurance information, 20 (8%) had Medicaid.

Most subjects (83%) consulted a dietitian with 31% attending both a dietitian-led class and an individual visit. One-quarter of children were lost to follow-up within a year of diagnosis and twenty-two (9%) had no GI visits after their diagnostic biopsy (Table 1). Having a sibling with CD (HR 1.90), using Medicaid (HR 2.19), and rescheduling or not attending >50% of appointments (HR 2.43) were associated with loss to follow-up. Children lost to follow-up within the first year were older at diagnosis than those who adhered to follow-up for longer (median 11.4 vs 8.7 years;  $P=0.01$ ). Similarly, subjects who reached age 18 who continued to follow-up were diagnosed at a younger age than those who did not (median 14.4 vs. 16.2 years,  $P<0.01$ ).

Overall, 73% visited another department at BCH during the observation period with 47% of those who were lost to GI follow-up maintaining a care relationship at BCH >12 months after their last GI visit.

Median time to TTG IgA normalization was 17.0 months (IQR 7.0–32.0;  $N = 155$ ). Of 141 subjects who had recommended serology at last GI follow-up, 25% had an elevated TTG IgA. Eighteen subjects had celiac serology ordered by non-GI providers after loss to GI follow-up. Seven (39%) had abnormal serology a median of 43.6 months (IQR 38.6–72.3) after diagnosis and 13.9 months (IQR 12.5–21.5) after last GI visit.

## Discussion

High rates of loss to specialist follow-up indicate significant shortcomings in the management of children with CD. Although guidelines recommended dietitian education regarding a GFD and annual GI follow-up visits<sup>2,5</sup>, many may not be receiving appropriate treatment as 1 in 6 patients did not receive GFD education and 9% had no GI follow-up after diagnosis. It cannot be assumed that patients lost to GI follow-up are doing well nor that they receive disease specific follow-up in primary care.

Follow-up throughout childhood and adolescence is important both to monitor for complications of CD and a GFD, and to provide developmentally appropriate guidance and education<sup>6</sup>. The association of reliance on Medicaid with loss to follow-up suggests that socioeconomic disparities may further compromise the health outcomes of children with CD

beyond decreased resources to obtain gluten-free foods. Children with CD in low income families constitute a high-risk group, and further attention is needed to determine how to best support these particularly vulnerable children.

Rapid loss to follow-up, often before patients may be considered to have mastered the skills necessary to follow a GFD, is concerning. Children who are inadequately adherent to a GFD are subject to gluten exposure and persistent mucosal damage, which is associated with complications of CD. Establishing a pattern of regular GI follow-up for CD during childhood may establish the habit of continuous, lifelong follow-up and improve long-term outcomes<sup>7</sup>. Further studies are needed to understand why having a sibling with CD is a risk for loss to follow-up and to determine the extent to which loss to follow-up occurs across the lifespan. Educational interventions directed to patients, families and providers regarding the importance of continuity of follow-up care for patients with CD are needed to ensure the best long-term outcome for those with CD.

## Acknowledgments

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## Abbreviations

<b>BCH</b>	Boston Children's Hospital
<b>CD</b>	Celiac disease
<b>GFD</b>	Gluten-free diet

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**Table 1:**

Adherence to gastroenterology follow-up visits and serum TTG IgA levels

Category	N (%)	At Last Gastroenterology Follow-up Visit		
		Median time since diagnosis Months [IQR]	TTG IgA N (%)	TTG elevated N (%)
<b>Entire Cohort</b>	241 (100%)		141 (59%)	(25%)
<b>1) Lost to gastroenterology follow-up after diagnosis</b>	22 (9%)	N/A	N/A	N/A
a) Did not attend GFD education visit with a dietitian	8 (3%)	--	--	--
b) Attended GFD education visit with a dietitian	14 (6%)	--	--	--
<b>2) Lost within the first year, attended at least one follow-up gastroenterology visit</b>	37 (16%)	5.7 [3.2 – 7.6]	23 (62%)	9 (40%)
<b>3) Lost after one year, attended 1 follow-up gastroenterology visit &gt; 12 months after diagnosis</b>	61 (25%)	26.3 [19.6 – 42.4]	44(72%)	16 (36%)
<b>4) Still attending follow-up gastroenterology visits</b>	104 (43%)			
a) Non-adherent to recommended schedule	55 (23%)	57.6 [46.3 – 70.0]	35 (64%)	4 (7%)
b) Adherent to recommended schedule	49 (20%)	45.3 [36.4 – 58.7]	32 (65%)	3(6%)
<b>5) Attended gastroenterology visit after age 18, then lost</b>	17 (7%)	27.8 [19.8 – 45.3]	12 (71%)	3 (25%)

GFD – gluten-free diet; IQR – interquartile range; TTG IgA – serum tissue transglutaminase IgA

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