**Abstract**

**Introduction**

The COVID-19 pandemic has had wide reaching primary and secondary health implications. The United Kingdom (UK) government implemented a lockdown to slow the rate of infection at the end of March 2020 lasting until early summer 2020. Results from a UK nationwide survey suggest the majority of IBD patients were followed up using technology enabled care services during this time. We therefore sought to explore the impact of the pandemic on nutritional status of children with inflammatorybowel disease, focusing on the effect of national lockdown from March to early summer 2020.

**Methods**

A retrospective study was conducted. All patients with a diagnosis of inflammatory bowel disease , aged <18 years, and under the care of Southampton Children’s Hospital were eligible for inclusion. Those patients who attended an outpatient-appointment in time-period-one (November 2019-February 2020), and following the period of national lockdown, time-period-two (July-November 2020) were included in the analysis.

**Results**

116 patients had paired measures. Using the World-Health-Organisation criteria of nutritional-status, 19% (n=22/116) were mildly-malnourished body mass index z score <-1. In this group the mean BMIZ-1.3±0.9 at time-point-1 vs. -1.9±0.9 at time-point-2 (p=0.03). The mean body mass indexz score of those overweight at time-point-one of 1.2±1.2 vs. 1.6±1.4 in time-point-two (p=0.2) During the period of lockdown 27% of malnourished children(n=6/22) had a technology enable care nutrition review, 2% of normally-nourished ( body mass index Z>-1to<1), (n=1/51) (p=<0.0001) and none of overweight (body mass index Z>1), (n=0/43) children (p=<0.0001).

**Conclusion**

Dietetic reviews were severely restricted during the lockdown. Patients with low body mass index Z prior to lockdown became more malnourished. During the ongoing pandemic it is important to identify those children with nutrition risk, focusing support on this group of children.

**Introduction**

The COVID-19 pandemic has had wide reaching primary and secondary health implications ([1](#_ENREF_1)). The United Kingdom government implemented a strict lockdown to slow the rate of infection at the end of March 2020 lasting until early June 2020. During this period the National Health Service (NHS) experienced unprecedented cessation of many outpatient clinics and all elective surgical procedures from March to June 2020.

Inflammatory bowel disease (IBD), including Crohn’s disease (CD), ulcerative colitis (UC) and IBD unclassified is a chronic, relapsing inflammatory disease involving the gastrointestinal tract. Malnutrition has frequently been associated with Crohn’s disease, leading to a lean mass deficit and growth delay ([2](#_ENREF_2), [3](#_ENREF_3)). Nutritional support and routine growth monitoring remain a vital aspect of management of CD ([4](#_ENREF_4)). In response to the COVID-19 pandemic the British Society of Gastroenterology published rigorous recommendations on medical management of IBD ([5](#_ENREF_5)). A UK nationwide survey of tertiary paediatric services provided during the first national lockdown (March – June 2020) suggested the majority of IBD patients were followed up remotely either via a video or telephone call using technology enabled care services (TECS) ([6](#_ENREF_6)). We therefore, sought to complete a retrospective chart review to explore the impact of the pandemic on growth children with IBD, during the time period of the first national lockdown, in order to better identify those children who would benefit from more frequent contact and support in subsequent periods where routine access to face to face healthcare may be reduced.

**Materials and methods**

*Subjects and setting*

A retrospective study was completed of all paediatric patients with IBD under the care of Southampton Children’s Hospital, all patients were aged <18-years. Patients who attended an outpatient appointment in both time period one, prior to the national lockdown (November 2019 to February 2020), and time period two, following the period of national lockdown (July to November 2020) were included in this study. The first period of national lockdown was from March 23rd 2020 – May 31st 2020.

*Anthropometric measurements*

Anthropometric measurements were performed and recorded in accordance with local Standardised Operating Procedures and World Health Organisation (WHO) guidelines ([7](#_ENREF_7)). Z-scores were calculated using WHO Anthro software (version 3.3.3, 2011)([8](#_ENREF_8)). WHO growth reference interpretation of cut offs for body-mass-index z (BMIZ ) scores defined as mild malnutrition <-1 z score, normal >-1 to <1 and overweight as >1([7](#_ENREF_7)).

At each outpatient appointment anthropometric measurements are entered into the patient’s electronic patient record (EPR). An EPR data specialist extracted the dataset from the patient electronic record and downloaded into Microsoft Excel (Microsoft Corp., Redmond, WA, USA).

*Statistical analyses*

Statistical analyses were performed in Prism Graph Pad (Graph Pad Software, San Diego, CA, USA). Results are expressed as means with standard deviation, median and interquartile range... Non parametric t-tests and Chi squared tests were used. Statistical significance was taken as p<0.05.

The retrospective study was registered as a service evaluation within the NHS Trust (reference SEV/0268)

**Results**

*Demographics of IBD cohort*

A total of 116 patients met the study criteria with anthropometry recorded at time point one and two. Of the cohort 54% (n=62/116) were male. The mean age of children at time point 1 was 13.3±2.9 and time point 2 was 14.2±2.8. Considering disease subtype, 54% (n=62/116) of patients had a diagnosis of Crohn’s disease and 46% (n=54/116) had a diagnosis of ulcerative colitis.

*Change in nutrition status during national lockdown*

Of the cohort 19% (n=22/116) had mild malnutrition, with a mean BMIZ-1.3±0.9 in time point one compared to a mean BMIZ of -1.9±0.9 in time point two, and a statistically significant mean delta change in BMIZ of -0.6±1.5 (p=0.03). There was also a significant difference between the delta change of thin children -0.6±1.5 compared to normal BMIZ children 0.1±0.6 (p=0.01) Children who had a normal BMIZ, were 44% (n=51/116) of the cohort. The mean BMIZ for the normally nourished group in time point one was 0.1±0.6 compared to a mean BMIZ of 0.2±0.6 in time point two, with a mean delta change in BMIZ of 0.1±0.6 (p=0.5). Children who were overweight represented 37% (n=43/116) of the cohort, and during national lockdown there was minimal change in BMIZ. The mean BMIZ for the overweight group at time point one of 1.2±1.2 compared to a mean BMIZ of 1.6±1.4 in time point two, with a mean delta change in BMIZ of 0.04±0.2 (p=0.5) (Table 1, Figure 1).

During the first period of lockdown, a total of 6% (n=7/116) of children had a TECS dietetic review, of which 27% (n=6/22) of children with a BMIZ<1 had a TECS dietetic review compared to 2% (n=1/51) of those who were normally nourished (BMIZ >-1 to <1.0) (p=<0.0001), and no patients who were overweight (BMIZ>1) (n=0/43) (p=<0.0001).

**Discussion**

This retrospective review demonstrates children who were overweight at the start of the lockdown period in March 2020 had a stable BMI, however malnourished children, experienced a decline in their nutritional status. There may be a number of factors involved in changes to nutritional status during this time including; i) reduced health care delivery arising from an almost overnight transition of dietetics serviecs to providing remote consultations via TECS, ii) pyschological impact of COVID-19 on families([9](#_ENREF_9)), iii) for children who are of normal may have risk of becoming overweight due to poorer food choices with reduced physical activity([10](#_ENREF_10), [11](#_ENREF_11)) and iii) reduced health care professional availability due to staff absence arising from COVID-19 infection and stress([12](#_ENREF_12)) Although there were significant challenges in providing nutrition reviews during this time a proporption of children with mild malnutrition were reviewed by a dietitian. These data confirm a proportion of those at increased nutritional risk were followed up despite the considerable challenges in providing nutrition reviews during this time.

Perhaps a significant and unexpected challenge for HCPs and parents alike during the national lockdown has been how to adequately monitor growth and assess nutrition risk, via TECS including remote telephone or video-consultation. As children with IBD have lifelong health which may impact on their growth, regular growth monitoring is important, and as such having access to sufficient equipment/expertise to monitor growth virtually will be an important consideration for TECS in the months to come. HCPs became rapidly aware many families do not have access to sufficient equipment to complete growth monitoring remotely e.g. digital scales or tape measures and as such it is likely to be more challenging to discern those children with changing nutritional status. As a community we need to rapidly develop validated tools to guide nutrition assessment including parental measurements of anthropometry via remote consultation ([13](#_ENREF_13)). This is of particular concern as the pandemic is anticipated to increase all forms of impaired nutrition arising from disruption from health services, including those relating to food security and poverty ([14](#_ENREF_14)), negative impact on mental health ([15](#_ENREF_15)) and missed opportunities to adequately address declining nutritional-status ([14](#_ENREF_14)), particularly if measures of weight and height/ length are inaccurate. This includes the potential increase in the number children with overweight/obesity, as well as those with active disease and gastrointestinal symptoms resulting in weight loss ([10](#_ENREF_10)).

In order to better support families and young people during this and subsequent periods of lockdown we need to consider strategies, that better support remote growth monitoring developing validated assessment toolkits that are not reliant on weight and height measures, but something that families are easily able to complete as part of a remote TECS consultation. To future proof services we need to ensure HCPs has sufficient knowledge and skills to run TECS; setting up guidelines and work processes around service delivery. This health care transformation is extraordinary and has the potential to reduce variation of care provided, improve outcomes and reduce inefficiencies of hospital based outpatient appointments e.g. time of work/ school, but we need to pay attention to the details particularly how we identify those with nutrition risk, and keep-going.

**Conclusion**

Dietetic reviews were severely restricted during the lockdown. During the ongoing pandemic it is important to better identify those children with nutrition risk, focusing nutrition support TECS on those groups of children who may be at risk.

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