


# How to use the Bristol Stool Chart in childhood constipation

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## ABSTRACT

Constipation in children is common and is a frequent cause for healthcare attendances in both primary and secondary care. The Bristol Stool Chart has become ubiquitous as an aid in the diagnosis and treatment of constipation, but many clinicians may not be aware of its origins or strengths and weaknesses. In this article, we outline the history and rationale behind the development of the Bristol Stool Chart and how it should be used in childhood constipation.

## CASE HISTORY

A 10-year-old girl is referred to the general paediatric outpatient clinic with constipation. She has been treated with two sachets of macrogol powder each day but continues to experience troubling symptoms. You decide to use the Bristol Stool Chart (BSC) to assess her stool consistency as a marker of how well her constipation is managed. She says her stools are typically type 1 or type 2. You then wonder how accurately the BSC performs in assessing constipation in children.

## INTRODUCTION

Constipation affects up to a third of children in the UK. It is responsible for 3% of general paediatric consultations and 25%–30% of consultations with paediatric gastroenterologists.<sup>1</sup> Despite its high prevalence, the assessment and treatment of constipation remains difficult, with 5% of children experiencing symptoms for more than 6 months.<sup>1</sup>

There are multiple tools and guidelines available to assist in the assessment and treatment of constipation, but the BSC is undoubtedly the most popular. This pictorial chart is often taped to walls and desks, and its simplicity and subject matter has led it to transcend its original purpose appearing on mugs and even cakes.<sup>2</sup> In this article, we discuss the origins and rationale of the BSC and its strengths and

weaknesses in the assessment and management of childhood constipation.

## PHYSIOLOGICAL BACKGROUND

Constipation describes a collection of symptoms rather than a specific disease in childhood. Diagnosis therefore depends on the reported symptoms, accurate description of bowel habits and physical examination. The Rome IV criteria is considered the 'gold standard' criteria to make a diagnosis of functional constipation. Children must have two or more of specific signs or symptoms in the previous one or 2 months (see [box 1](#)).

In the vast majority of children with functional constipation, there is no single cause. There is increasing evidence that a proportion of children may have an underlying genetic tendency to constipation,<sup>3</sup> while children with neurodevelopmental disorders including autism<sup>4</sup> are at higher risk. A delayed colonic transit time<sup>5</sup> and an inability to relax the pelvic floor when attempting to defecate<sup>6</sup> have also been surmised to contribute to the disorder.

However, the reality is that almost any child has the potential to develop constipation. It is commonly thought of as a disorder of the West, but epidemiological data suggest it is present throughout the world.<sup>7</sup> The problem can often be traced to single events such as toilet training, a change in diet, episodes of pain, febrile infections and dehydration.<sup>1</sup> The overriding process is that of increased intestinal transit time. Any delay of stool passage increases colonic time, increasing water reabsorption, hardening stool and increasing faecal loading. This leads to painful defecation and a reluctance to pass stool, further exacerbating the problem.

## TECHNOLOGICAL BACKGROUND

The premise of stool form charts is that stool transit time can be approximated by the appearance of stools. It is non-invasive, does not involve radiation



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### Box 1 Definition of functional constipation according to the Rome IV criteria<sup>25</sup>

Presence of two or more of the following criteria in the previous 1 or 2 months:








1. Two or fewer defecations in the toilet each week.
2. At least one episode of faecal incontinence each week.
3. History of retentive posturing or excessive stool retention.
4. History of painful or hard bowel movements.
5. Presence of a large faecal mass in the rectum.
6. History of large diameter stools that may obstruct the toilet.

and simply relies on either the patient or caregiver inspecting faeces and deciding which description fits best.

The BSC is the most popular stool form chart. It classifies stools into seven different categories, with types 1 and 2 hard stool indicating constipation, types 3 to 5 'normal range' and type 6 and 7 loose stools, in keeping with diarrhoea. Figure 1 demonstrates a typical BSC. The proposed theory for the BSC is that stool form will alter according to gut transit time. For example, a slow transit time such as in constipation will lead to firmer stool forms, while a quicker transit time leads to looser stools.

The BSC was originally formulated and validated by Stephen Lewis and Ken Heaton at Bristol Royal Infirmary in the UK.<sup>8</sup> It was inspired by a previous study examining defecation habits in a large cohort of adults that showed that stool appearance correlated with frequency of defecation.<sup>9</sup> This led to the development of a scale of stool types that was subsequently validated using only 66 adult volunteers.

Each volunteer maintained a diary for 9 days and was then required to ingest radio-opaque pellets of different shapes contained in a capsule on four consecutive mornings. They then had each stool collected from 24 hours after the final capsule ingestion and

Type 1		Separate hard lumps, like nuts (hard to pass)
Type 2		Sausage-shaped but lumpy
Type 3		Like a sausage but with cracks on its surface
Type 4		Like a sausage or snake, smooth and soft
Type 5		Soft blobs with clear-cut edges
Type 6		Fluffy pieces with ragged edges, a mushy stool
Type 7		Watery, no solid pieces, entirely liquid

**Figure 1** A typical version of the Bristol Stool Chart, adapted from Lewis and Heaton.<sup>8</sup>

also underwent serial abdominal radiographs. Intestinal transit time was calculated using a formula that accounted for the pellet shape and the time it took to be excreted. Each volunteer underwent four baseline assessments and then repeated the process with administration of senna and loperamide in separate episodes. The corresponding intestinal transit time was found to significantly correlate with stool form. This correlation has been assessed by other small studies, although only one in children,<sup>10</sup> and there remains controversy about the strength of the relationship.<sup>11 12</sup>

The original paper only verbally described stool types with the stool chart itself being developed several years later. The accepted methodology for using the BSC is for parents, children or both to indicate to a health-care professional the number of stool form that relates most closely to what has been present on defaecation. This is then extrapolated to either aid with the diagnosis of constipation or assess response to laxatives.

### CLINICAL QUESTIONS

In this section, we consider the clinical use of the BSC and its possible strengths and limitations, particularly in the paediatric population.

#### Is the BSC appropriate for use in children?

The BSC was originally developed for use in adults, and concerns exist about its generalisability to the paediatric population. In infants and toddlers, assessment of stool consistency is usually based on parental recall of the stool type, but when children get older, assessment of stool consistency is based on self-reporting.

A number of studies have raised concerns about the reliability of the BSC in children who are not toilet trained and wear nappies. It is generally acknowledged that stool consistency assessment in infants and toddlers is difficult owing to deformation of stools in the nappies or an effect on their appearance by liquid being absorbed. One study examined intrarater agreement between parental report of stool consistency as 'hard', 'normal' or 'soft/mucous/liquid' and the BSC. This showed only fair agreement between the use of the BSC and parental report of stool consistency, although this did not have an impact on the diagnosis of functional constipation.<sup>13</sup> These concerns have led to the development of other stool form scales, specifically designed for the paediatric population such as the Brussels Toddler and Infant Stool Scale or the modified Bristol Stool Chart (m-BSC). Table 1 summarises different stool charts that have been published for the assessment of stools in children.

In general, these charts have fewer categories and are therefore felt to be easier for parents or health-care professionals to use. Several also use actual photographs to aid interpretation. The majority of studies suggest they are more reliable than the BSC as a marker of intestinal transit time and diagnosing constipation in children,<sup>14-17</sup> although there are no studies

**Table 1** Stool charts proposed for use in the paediatric population

Stool form scale	Description
Modified Bristol Stool Scale <sup>14</sup>	A five-point pictorial scale developed as an alternative to the BSC in children. Type 3 and type 5 from the original BSC were omitted to simplify the chart.
Amsterdam Infant Stool Scale <sup>15</sup>	A photographic scale of stool characteristics in nappies. It includes assessment of colour, consistency and amount.
Brussels Infant and Toddler Stool Scale <sup>16</sup>	Another photographic scale of stool in nappies developed as an alternative to the BSC in nappy-wearing children.
3-D Stool Assessment Instrument <sup>26</sup>	Resin-based models designed to be easier for children to interpret. Limited by accessibility.
BSC, Bristol Stool Chart.	

in which all the charts are compared. Clinicians may therefore wish to use these, especially in a child who is not toilet trained. However, lack of awareness of these stool charts and difficulty in accessing them compared with the BSC may limit their usefulness.

There is little literature about whether older children are accurately able to use the original BSC to describe their stools. However, the modified BSC has been evaluated in children aged between 3 and 18 years. It was found that children aged 8 years and older could accurately use this stool scale, which is very similar to the original BSC. Children aged between 6 and 8 years could use the stool chart if the descriptors were read.<sup>14</sup> If clinicians are using the BSC in children younger than 6 years, they should therefore primarily seek the advice of parents about stool type. They should also be aware they may need to read the descriptors of the stool type if the child is less than 8 years.

#### **In children with constipation, is the BSC useful to aid diagnosis?**

The use of the BSC to aid in the diagnosis of constipation in children and to assess response to treatment is recommended by a variety of national and international groups.<sup>18,19</sup> However, there is surprisingly little literature assessing the sensitivity and specificity of using the BSC in this setting.

The majority of studies assessing the BSC use it to define 'hard stools' within the Rome III or IV definition of functional constipation and compare it with another assessment of stool type, usually purported to be more accurate. In these studies, type 1 or type 2 stools on the BSC are classified as hard. Both Koppen *et al*<sup>13</sup> and Vriesman *et al*<sup>20</sup> showed that the prevalence of constipation was the same when the BSC was used to define hard stools compared with other more detailed questionnaire-based approaches.

There are more data on other types of stool form charts and their usefulness in diagnosing constipation in children. In a survey of 209 children, the modified BSC could be used to diagnose functional constipation according to the Rome criteria with a sensitivity of 79.2% and specificity of 66%. Type 1 and type 2 stools on this scale defined constipation.<sup>21</sup> The authors suggest that this stool chart, which is very similar to the original BSC, can be used as a simple, quick and

easy-to-use tool to objectively evaluate stool form in children and could be used as a screening tool for constipation.

In summary, while the BSC is recommended for the assessment of constipation in children and to monitor response to treatment, there is little evidence to support its use in isolation. Rather it could be used to assess 'stool hardness' as one element of diagnosing and monitoring the treatment of constipation in children. There are some data to suggest a modified version could be useful to screen for constipation in children, but this should then be followed by a more rigorous history and examination.

#### **What is the interobserver reliability of the BSC?**

Scale reproducibility, which includes both reliability and agreement, is an important measure of any scale. In general, the BSC has been found to have good interobserver reliability, especially among gastroenterologists. In one study, 34 gastroenterology providers were asked to rate 35 stool photographs with 20 rating the photographs. More than 95% of ratings were within one category type with the highest agreement occurring at the extreme end of the scale (type 1 and type 7 stools). However, when categorising the stool types into clinically meaningful categories of constipation, normal, or diarrhoea using the Rome III standard, reliability and agreement decreased even for these expert ratings. This was because of a lack of agreement between type 2 versus type 3 and type 5 versus type 6 stools.<sup>22</sup>

The BSC has also been shown to have good validity and reliability in adult patients although again types 2, 3, 5 and 6 stools were less likely to be classified correctly.<sup>23</sup> In paediatric patients reliability using the m-BSC has been shown to increase with age and again was better at the extreme ends of the scale.<sup>14</sup>

In summary, the BSC generally has good reliability and accuracy when used by both patients and health-care professionals. However, clinicians should be aware that assessment of stools at the extreme ends of the scale is most reliable, and the accuracy is less for differentiating the other types of stools.

#### **TOPICS FOR FURTHER RESEARCH**

There remains a paucity of literature assessing the use of the original BSC in diagnosing and managing functional

## Interpretations

constipation in children. Given the popularity of the chart, further studies assessing its use as a screening tool for constipation in children would be helpful. There are also no published studies examining whether the BSC can be used to monitor treatment response in children treated for constipation. Given the increasing number of consultations that are performed remotely,<sup>24</sup> it would be informative to determine if the BSC can be used to assess if children need their laxatives increasing or decreasing without face-to-face assessment.

Finally, there are a number of different stool assessment charts published for children, and it is unclear which, if any, is the best. A study in which the different stool assessment charts are compared in children with constipation would be a useful addition to the literature.

### Multiple choice questions

- Which of the following statements is one of the Rome IV criteria for diagnosing constipation in children?
  - One or fewer defecations in the toilet each week.
  - At least two episodes of faecal incontinence each week.
  - History of loose bowel movements.
  - Presence of a large faecal mass in the rectum.
  - History of rabbit pellet stools.
- Which of the following types of stool is most likely to be identified correctly by patients and healthcare staff on the Bristol Stool Chart?
  - Type 1.
  - Type 2.
  - Type 3.
  - Type 4.
  - Type 6.
- Which of the following stool assessment charts relies on photographs of actual stools?
  - Bristol Stool Chart.
  - Modified Bristol Stool Scale.
  - 3-D Stool Assessment Instrument.
  - Amsterdam Infant Stool Scale.
  - Astellas Stool Form Scale.
- Which of the following stool types on the Bristol Stool Chart, are commonly taken to be 'hard stools'?
  - Type 1.
  - Type 2.
  - Types 1 and 2.
  - Types 1, 2 and 3.
  - Type 7.
- What age would you expect a child to be able to use the Bristol Stool Chart to report their own stools?
  - 3 years old.
  - 5 years old.
  - 8 years old.
  - 9 years old.
  - 12 years old.

Answers to the quiz are at the end of the references.

### Clinical bottom line

- ▶ The BSC is a ubiquitous tool used by many clinicians in the diagnosis and treatment of constipation in children.
- ▶ A variety of other stool form charts exist, and these may be more appropriate, particularly if children are young.
- ▶ The BSC should not be used in isolation to diagnose or monitor treatment response in constipation.
- ▶ The BSC is most reliable when classifying stools at the extreme ends of the scale.

### SEARCH STRATEGY

PubMed database was searched in May and June 2022 with the search terms 'Bristol Stool Chart OR Bristol Stool Form Scale', 'Constipation', 'Rome IV OR Rome criteria' and 'paed\*OR child\* OR pediatric'. The resulting articles were screened for relevance. In addition, we screened UK and European guidelines for paediatric constipation.

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#### Answers to the multiple choice questions

1. Presence of a large faecal mass in the rectum (D)
2. Type 1 (A)
3. Amsterdam Infant Stool Scale (D)
4. Types 1 and 2 (C)
5. 8 years old (C).