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Abstract

TITLE: INTER-RATER VARIABILITY OF THE BRISTOL SCALE ON DIAPERED STOOL

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ABSTRACT BODY:

Abstract Body : Background: The Bristol Stool Scale (BSS) is used in pediatric research trials as an outcome metric, and prior work has measured inter-rater reliability and intra-rater reliability across raters with various backgrounds—However, it is unclear whether the level of stool consistency of a given photo is more prone to inter-rater variability (SD).

Methods: 216 diapered stool photos from 9 children ages 2-4 years were collected. Per photo, we collected ratings from the careprovider (the untrained nonclinician), a central rater (a trained nonclinician) and 4 pediatric gastroenterologists. Group A (n=4 clinicians per photo, 215 photos) used the BSS ratings from the untrained nonclinicians as the reference rating, Group B references the trained nonclinician (n=4 clinicians, 212 photos), and Group C (n=3 clinicians, 214 photos) references 1 clinician (clinician “α”, a pediatric gastroenterologist with a focus on motility). Unreadable photos were removed.

Results: Certain BSS scores have higher inter-rater variability (ANOVA F_A=9.867, p_A=1.74E-8, F_B=25.918,

p_B=7.66E-23, F_C=13.6, p_C=5.34E-13, for A, B, and C respectively, which are shown as boxplots in Figure 1a-c, with Tukey HSD post hoc analyses in Table 1). In A, BSS-2 was the lowest score given by the untrained nonclinicians and also had the highest inter-rater variability (std_{A2}=1.068). For both B and C, BSS-1 had the highest inter-rater variability (std_{B1}=1.703, std_{C1}=0.900). For all 3 groups, BSS-7 had the lowest inter-rater variability (std_{A7}=0.421, std_{B7}=0.163, std_{C7}=0.072). Generally, stool ratings from BSS1-2 have the highest inter-rater variability, and BSS-7 has the lowest variability (Table 1, Figure 1a-c).

Conclusion: We provide evidence that inter-rater variability is significantly different across the Bristol stool scale when using a reference BSS rating from a) untrained nonclinicians, b) a trained nonclinician, and c) a pediatric gastroenterologist. This work motivates research into standardized training or automated scoring with a special emphasis on BSS 1-3, where we observe higher disagreement. The typical BSS transitions from constipation, normal and loose stools are 2-3 and 5-6, which had the same variability across A, B, and C (Table 1); although possibly useful in BSS assessments—this work may not hold clinical relevance for stool scales with fewer categories. This variance imbalance would represent a small difference in practice when stool is evaluated on a 3-point or 4-point scale. However, these measures of across-scale variability can provide valuable context when the full BSS1-7 is used.

TABLE:

PostHoc Tukey HSD Results

BSS-BSS comparison	**A) Untrained nonclinician** p-value	**B) Trained Nonclinician** p-value	**C) Clinician** p-value
1-2	NA	0.042	0.900
1-3	NA	0.001	0.662
1-4	NA	0.001	0.081
1-5	NA	0.001	0.327
1-6	NA	0.001	0.001
1-7	NA	0.001	0.001
2-3	0.768	0.632	0.900
2-4	0.900	0.449	0.232
2-5	0.583	0.690	0.670
2-6	0.764	0.188	0.003
2-7	0.004	0.001	0.001
3-4	0.900	0.900	0.744
3-5	0.900	0.900	0.900
3-6	0.900	0.900	0.025

3-7	0.001	0.001	0.001
4-5	0.868	0.900	0.900
4-6	0.900	0.900	0.229
4-7	0.001	0.001	0.001
5-6	0.900	0.865	0.227
5-7	0.091	0.001	0.001
6-7	0.001	0.001	0.131

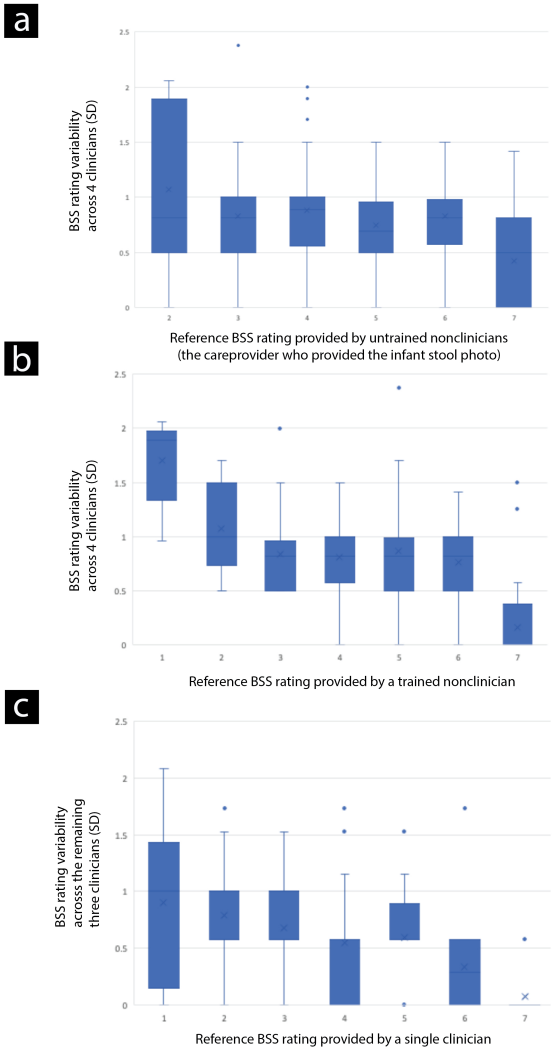

Figure 1. Bristol Stool Scale (BSS) clinician inter-rater variability (SD), with respect to a given reference rating provided by **a)** untrained nonclinicians, **b)** a trained nonclinician, and **c)** clinician α. No untrained nonclinicians reported their child's stool as BSS-1.