

Many children with autism spectrum disorder (ASD) have gastrointestinal (GI) abnormalities and associated bowel elimination problems such as fecal incontinence, constipation, and diarrhea (Gubbiotti et al., 2019; Lefter et al., 2020). These problems may be the result of impaired parasympathetic activity, increased endocrine stress response, gut dysbiosis, food allergies, fiber-restrictive diets, and certain medications (Ibrahim et al., 2009; Kang et al., 2014).



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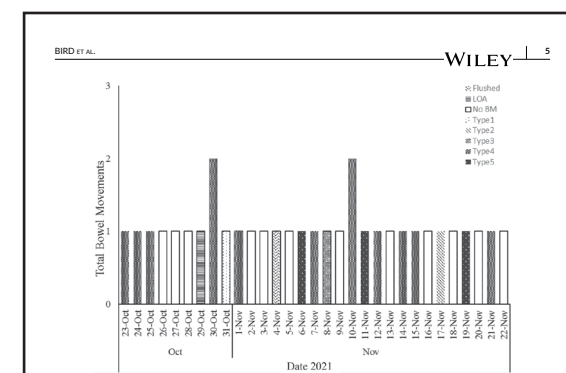
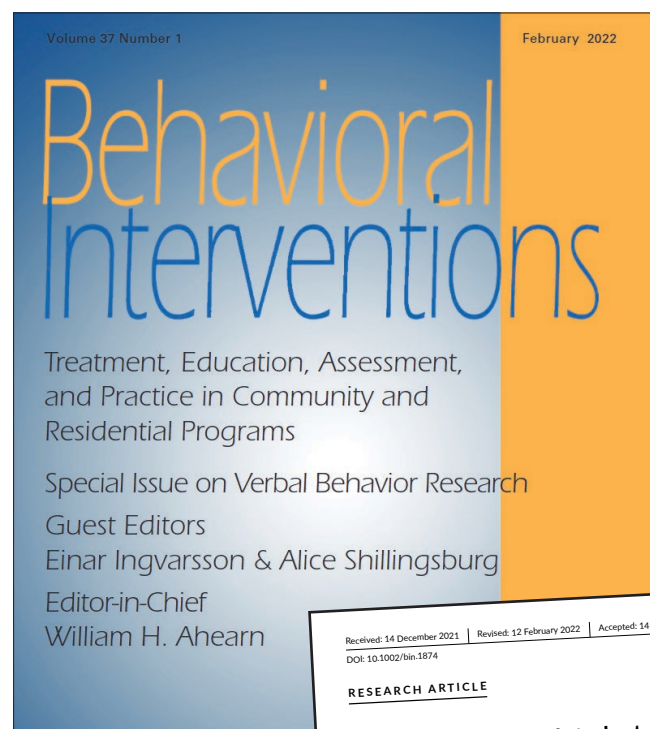


FIGURE 2 Example bowel movement chart

data-entry screen and a reporting module. Figure 2 illustrates the appearance of a student bowel movement chart created within the system.

Supervisors, nurses, and allied health professionals at the residential school reviewed the bowel movement data as described, then selected "all reports" to produce student charts and narrative reports. Reports are reviewed when email alerts are sent to these individuals, during scheduled appointments and at the discretion of school administrators. Copies of reports are also sent either electronically via email or printed and sent to parent-guardians each month and upon request.

TABLE 2 Social validity ratings by parents and gastrointestinal (GI) physicians

Questionnaire statement	Average rating parents	Average rating physicians
The bowel movement tracking system at the residential school accurately monitors bowel movements	5.0	4.7
The bowel movement tracking system at the residential school provides reliable data during physician visits	5.0	4.7
The toilet stool chart clearly classifies types of bowel movements	5.0	4.7
The bowel movement tracking system at the residential school provides useful data for making decisions about over-the-counter medications	5.0	4.7
The bowel movement tracking system at the residential school provides extended evaluation of interventions to treat GI problems	5.0	4.7

Note: 1: strongly disagree, 2: disagree, 3: neither disagree nor agree, 4: agree, 5: strongly agree.

management were directed at highly complexed daily routines, namely bathroom visits that participants conducted with students on a daily basis. These factors plus the sizeable facility of the system may have contributed to implementation integrity, notwithstanding the need for more formal evaluation. For example, the study did not include a formal assessment of training and performance measures. The system's effectiveness in monitoring and managing bowel movement tracking on integrity of course, BST was efficacious with a computer-assisted system.

Social validity is a valuable evaluative measure (Luiselli, 2021b). In this study, we targeted professionals who managed the health monitoring data. For example, the physical activity and hydration status of students from their questionnaires reported that the bowel movement tracking system was useful. Parents also judged the system as being useful.

team to review student health plans, consult with physicians, and consider changes to diet, medication, nutrition, and physical activity. It is advantageous, too, that timely alerts free providers from labor-intensive retrospective analysis of paper and electronic charts to arrive at treatment decisions, possibly reducing hospital visits occasioned by severe constipation, bowel obstruction, and diseases of the GI tract.

The study was limited to a single human services setting notwithstanding a relatively large participant sample. Also, we conducted a descriptive evaluation without experimental control such as introducing bowel movement tracking training with participants sequentially in a multiple baseline design across group homes (Kasdan, 2011). Despite the aforementioned advantages of computer-assisted data recording and instrumentation technology (Whiting & Dixon, 2016; Yanagita et al., 2016), some service settings may not be able to support or pay for large-scale adoption. Finally, many system variations are possible and should be studied in future research. For example, how do paper-and-pencil and digital methods of data recording compare relative to accuracy and implementation integrity? Second, different approaches to training data recording competency with care providers should be evaluated. And as presented in this study, research assessment of the opinions and recommendations from care providers and other stakeholders can inform system changes that facilitate health monitoring among children with ASD.

ACKNOWLEDGMENT

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CONFLICT OF INTERESTS

The authors declare that they have no conflicts of interest.

ETHICS APPROVAL

All procedures were reviewed and approved by senior administrators at the residential school and were in accordance with U.S. Federal Policy for the Protection of Human Subjects.

DATA AVAILABILITY STATEMENT

Research data are not shared.

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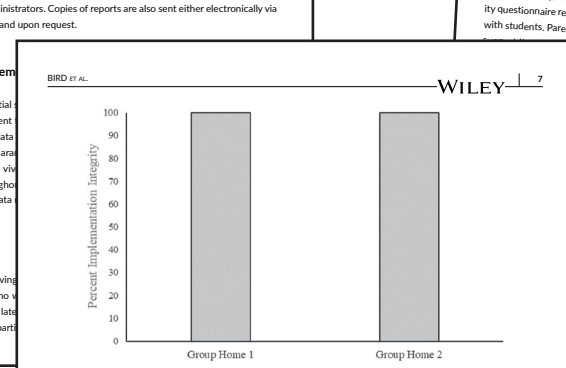
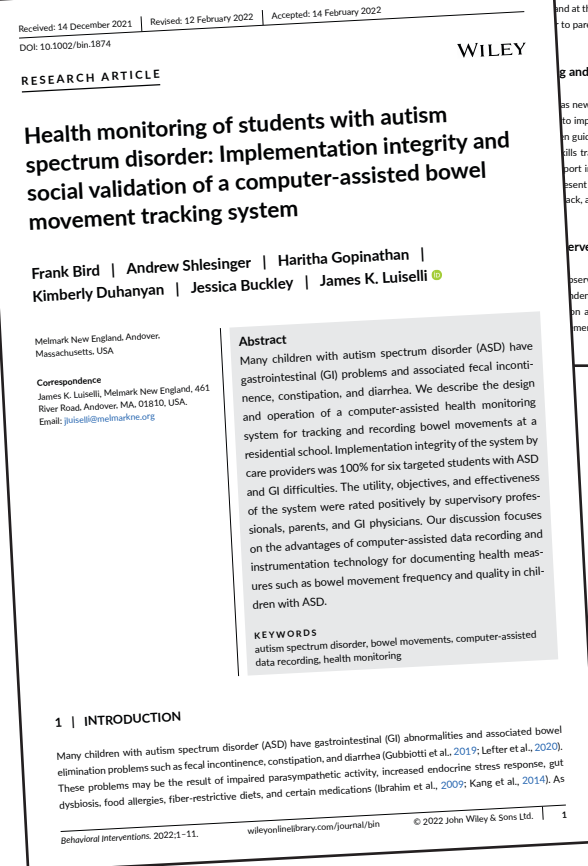


FIGURE 3 Percent implementation integrity across two group homes

TABLE 1 Social validity ratings by clinicians, supervisors, and nurses

Questionnaire statement	Average rating
The toilet stool chart clearly classifies types of bowel movements	4.7
Through training and supervision, care providers are capable of recording bowel movement data reliably	4.3
The bowel movement tracking system provides useful data when parents meet with their GI physician	4.3
The bowel movement tracking system provides useful data for nurses making decisions about over-the-counter medications	4.3
The bowel movement tracking system provides extended evaluation of interventions to treat GI problems	4.3
The bowel movement tracking system is useful for health monitoring of students with GI concerns	4.2

Note: 1: strongly disagree, 2: disagree, 3: neither disagree nor agree, 4: agree, 5: strongly agree.

agree" for each statement. Four of the six GI physicians completed the questionnaire (return rate = 66.6%) with an average rating of 4.7 per statement (Figure).

4 | DISCUSSION

We described a computer-assisted system of bowel movement tracking for health monitoring of students with ASD including evaluation of implementation integrity and assessment of social validity. The system was associated with maximum measurement reliability and implementation integrity was exemplary among a large group of residential care providers. Persons responsible for system administration, parents of students, and GI physicians were uniformly positive about the objectives, methods, and effectiveness of bowel movement tracking.

Participants were taught to use the bowel movement tracking system during their orientation training as new care providers at the residential school followed by in vivo supervision "on the job." This combination of simulated training and post-training performance management is recognized as an evidence-based approach with human services employees (Digennaro Reed et al., 2013; Lerman et al., 2015; Reid, 2017). Further, training and performance

Social validity is a valuable evaluative measure but underreported in human services research (Ferguson et al., 2018; Gravina et al., 2019; Luiselli, 2021b). Wolf (1978) emphasized that direct and indirect consumers of programs should provide feedback about service provision that reflects acceptance and approval. In the present study, we targeted professionals who managed the bowel movement tracking system and made decisions from reviewing the health monitoring data.