Advances in Neurodevelopmental Disorders
https://doi.org/10.1007/s41252-024-00423-z

ORIGINAL PAPER

The Latency-Based Interview-Informed, Synthesized Contingency Analysis (IISCA): A Clinical Validation and Replication of 34 Applications in the USA and Brazil

Joshua Jessel[1,5] · Felipe M. Lemos[2] · Tess Fruchtman[1,6] · Monica Howard[3] · Phoebe MacDowell[1] · Jessica Slaton[4]

Accepted: 23 October 2024

Abstract

Objectives Behavioral treatments for problem behavior are known to be more effective when informed by a functional analysis. However, evaluating problem behavior during a functional analysis requires observation of repeated instances of problem behavior, which could be a safety concern. Using latency as a measure can improve safety by reducing exposure to problem behavior. We conducted this two-part study to determine if latency could be integrated into the recently developed functional analysis format termed the interview-informed, synthesized contingency analysis (IISCA).

Methods Each of the nine participants from Brazil experienced two functional analyses (study 1): latency-based IISCA and rate-based IISCA. We then evaluated the generality of the latency-based IISCA from 16 replications in the USA and Brazil (study 2).

Results The results indicated a high level of correspondence between the two functional analyses, suggesting that latency is likely a valid measure of problem behavior during the IISCA. We found that the latency-based IISCA identified a function in less than 20 min with the observation of only three instances of problem behavior. In addition, clinicians provided high ratings of acceptability, helpfulness, safety, and efficiency.

Conclusions Clinicians may be able to avoid repeated instances of problem behavior during a functional analysis using the latency-based IISCA when safety or time is of concern.

Keywords Efficiency · Functional analysis · Latency · Problem behavior · Rate · Safety

Functional behavior assessment (FBA) is a broad term that refers to an understanding of the environmental determinants of problem behavior to inform the design of function-based treatment packages (Hagopian et al., 2013). When problem behavior presents itself as an issue among those diagnosed with intellectual and developmental disabilities, an FBA is often recommended as best practice (Brodhead et al., 2022) because its use has been found to improve treatment outcomes (Campbell, 2003; Heyvaert et al., 2014). Due to the prevalence of problem behavior among individuals with intellectual and developmental disabilities (e.g., Hemmings et al., 2006; Mayes et al., 2012) and the debilitating impact problem behavior has on quality of life, FBAs remain integral in the training of professionals such as special education teachers, psychologists, and behavior analysts.

The specific FBA process a clinician could use to improve their understanding of a client's problem behavior can vary between indirect questionnaires with caregivers, direct observations, or empirical validation during a functional analysis. For example, Hanley et al. (2014) introduced the practical functional assessment (PFA) model using a single process with a combination of multiple techniques (i.e., combining interview, observation, and functional analysis) that identified individualized contingencies for the problem behavior of three children diagnosed with

✉ Joshua Jessel
JJessel@Brocku.ca

1 Queens College and The Graduate Center, City University of New York, New York, NY, USA

2 Federal University of São Carlos (UFSCar), São Carlos, Brazil

3 The ELIJA School, Levittown, NY, USA

4 Nashoba Learning Group, Bedford, MA, USA

5 Brock University, St. Catharines, ON, Canada

6 Temple University, Philadelphia, PA, USA

Published online: 04 November 2024

autism. The experimenter began the assessment with an open-ended interview to determine possible antecedents and consequences that could be contributing to problem behavior in the home and school environments. The experimenter then briefly observed each child while unsystematically introducing the interview-informed environmental events to finalize the contingency to be evaluated during the functional analysis. The PFA ended with a functional analysis that included a single test condition compared to a matched control targeting an open-contingency class of all topographies of problem behavior (i.e., empirical demonstration validating the outcomes of the interview and observation). The open-contingency class is a core tenet of the functional analysis used during the PFA because it reduces the probability of observing escalation to severe problem behavior by reinforcing non-severe precursors to those behaviors (Warner et al., 2020). The entire PFA model required an average of 2.3 clinical visits to conduct and informed a function-based treatment that eliminated the problem behavior for all three children.

The specific functional analysis format used in the PFA process has been termed the interview-informed, synthesized contingency analysis (IISCA) and has been presented as an efficient alternative to other functional analysis models that may require more time to complete (Ferguson et al., 2020; Herman et al., 2018; Jessel et al., 2016; Rose & Beaulieu, 2019; Santiago et al., 2015; Slaton et al., 2017; Strand & Eldevik, 2018). Efficiency is an important element of functional analysis to consider because a quicker assessment period can (a) reduce exposure to severe problem behavior, (b) allow for more immediate implementation of function-based treatment, and (c) improve practicality and acceptability among clinicians. In fact, lack of time to conduct a functional analysis has been reported by practitioners to be a major barrier to implementation (Oliver et al., 2015; Roscoe et al., 2015). For example, Oliver et al. (2015) collected information from 682 practicing behavior analysts in a survey regarding FBA usage. The authors found that the vast majority of the respondents to the survey received formal training on the functional analysis but less than 50% reported frequent usage with the most common reason for avoiding the use of the functional analysis being a lack of time.

While reviews of the literature have found that functional analyses can take multiple hours to conduct contributing to this concern of lack of time (Jessel et al., 2022; Saini et al., 2020), the entire PFA process (interview, observation, IISCA) has been found to often require a single 1-h outpatient visit, with the IISCA requiring about half the visit time (see Coffey et al., 2020 for review). Although the IISCA does prove to be an efficient functional analysis format, much like most functional analyses, it measures problem behavior as a rate (i.e., instances of problem behavior observed across time). The reliance on the measure of rate of problem behavior requires multiple exposures to the problem behavior, and in certain cases that may not be ideal.

One reason to avoid the use of rate during a functional analysis is that topographies of severe problem behavior can pose safety concerns to the child or therapist. For example, larger individuals whose aggressive behavior towards a therapist could cause lacerations or concussions that need medical attention. In addition, self-injury such as eye gouging could cause irreparable damage. Therefore, the risks of elevated rates of severe problem behavior seem to outweigh the potential benefits of conducting a functional analysis using rate as a measure of response strength in some cases. Latency, on the other hand, refers to the time between the presentation of a discriminative stimulus and the first instance of problem behavior. Thus, only a single instance of problem behavior need occur within a session, which may significantly reduce exposure to unsafe behavior.

Another reason to avoid the use of rate could be that some topographies of problem behavior do not naturally occur repeatedly over time and would necessitate a resetting of the environment to evaluate as a rate (Traub & Vollmer, 2019). These behaviors are often defined as restricted operants. For example, a child who elopes from a room would have to be returned to the original area for elopement to occur again. Therefore, latency tends to be a common measure when assessing and treating elopement (e.g., Boyle et al., 2020; Davis et al., 2013; Neidert et al., 2013). For example, Boyle et al. (2020) conducted a latency-based functional analysis for a child's elopement believed to be maintained by access to stereotypic behavior with a door. Latency served as a better measure of elopement because in order to observe the behavior, the child had to be removed from the door and placed in a separate area. Each session was a maximum of 5 min and test sessions ended following a single occurrence of the targeted elopement. Short latencies were observed during the test condition when the participant could only regain access to play with the door if he eloped and the participant did not elope during the control when he had continuous access to the door. When a clinician is addressing severe behavior or restricted operants, it may be better to forgo the measure of response rate and evaluate the functional relation using latency because it only requires the participant to exhibit one instance of problem behavior per session.

Thomason-Sassi et al. (2011) evaluated the correspondence between response rate and latency as a measure of response strength in a three-part study. Experiment 1 served as a translation model whereby four adults diagnosed with developmental disabilities completed acquisition tasks while earning preferred edibles. The rates of responding were then compared to the latency to the first response and the authors found that elevated rates were often associated with brief latencies. Experiment 2 included previously conducted functional analyses for 38 individuals who exhibited problem

behavior using rate as a measure and reanalyzed the latency to the first response of each session to determine if the interpretation of function would be negatively impacted by the change in measure. Thomason-Sassi et al. (2011) found that 87% of the latency-based interpretations corresponded with the rate-based depiction. The high level of correspondence informed the final experiment (experimental 3) where a latency-based functional analysis was conducted for 10 individuals with sessions ending after one instance of problem behavior. The latency-based functional analysis format was then compared to the subsequent traditional, rate-based functional analysis and the authors found 90% correspondence between the outcomes. Although the latency-based functional analysis format reduced the relative exposure to problem behavior compared to the traditional rate-based model, participants still exhibited a mean of 11 responses during the entire analysis period.

Jessel et al. (2018) combined the measure of latency with the IISCA model to improve the efficiency of the PFA process for two children diagnosed with autism. The interviews with the caregivers and direct observations with the participants identified a socially mediated contingency for the elopement of both participants (i.e., contingent access to water play; contingent access to free play with mom), which was then tested during the latency-based IISCA. The latency-based IISCAs required less than 10 min to conduct and only three instances of elopement were exhibited by both participants throughout the entire analysis period. Furthermore, Jessel et al. (2018) used the results of the latency-based IISCA to inform the subsequent function-based treatment and reinforcement thinning procedures. The treatment eliminated problem behavior for both participants and the entire assessment and treatment process was formally reported by the caregivers to be helpful and acceptable.

The latency-based IISCA may be an effective method for identifying the function of elopement; however, the generality of these findings to other forms of problem behavior has yet to be fully explored. Lambert et al. (2017) collected 18 latency-based functional analyses of participants admitted to university hospitals due to their severe problem behavior. The authors mentioned that some elements of the IISCA format were included (i.e., open-ended interviews, open-contingency class, synthesized contingencies); however, only 44% of the outcomes were differentiated and implicated a function. The authors also noted that the functional analyses did not always include IISCA-like modifications. Thus, it is difficult to determine if consistently using all of the IISCA elements instead would improve interpretations of functional control.

To date, the latency-based IISCA has only been successfully applied to elopement and the correspondence between the latency and rate during the IISCA has not yet been evaluated. Therefore, the purpose of this study was to (a) compare the results of the latency-based IISCAs to that of the rate-based IISCAs conducted with the same participants (study 1) and (b) collect multiple replications of the latency-based IISCAs with behaviors ranging in severity including aggression, SIB, and disruptive behavior (study 2). To support the generality of the latency-based IISCA procedures, data were collected across various clinics, homes, and schools within the USA and Brazil.

Study 1: Comparison of 18 Latency-Based and Rate-Based IISCAs

It is unknown if the results of the latency-based IISCA would correspond to the outcomes of the rate-based IISCA (i.e., the more traditional approach). This is important because there are relatively few replications of the latency-based IISCA in which a function-based treatment is included (e.g., Boyle et al., 2020; Jessel et al., 2018). On the other hand, the rate-based IISCA has been found to consistently support effective intervention. Layman et al. (2023) conducted a meta-analysis of 39 articles that included the IISCA. The authors found that, of the 293 applications of the IISCA, 111 treatment evaluations were conducted, all of which produced reductions in problem behavior. Thus, the purpose of study 1 was to evaluate the correspondence between the latency-based IISCA and the rate-based IISCA. Both analyses were conducted with each of the nine participants (creating a total of 18 IISCA applications) and the outcomes were then compared.

Method

Participants and Settings

Participant data included a collection from clinical patients obtained during training for practitioners across Brazil. Practitioners were receiving online training on how to conduct, design, and implement IISCA procedures. The second author provided the free training in Portuguese. The practitioners were asked to conduct the IISCAs and send a recording to the second author as a part of their training to receive feedback on their performance. A subset of practitioners were asked to conduct the latency-based IISCA and rate-based IISCA for the purposes of this research project. The subset of practitioners was based on their level of interest in supporting research and receiving additional training in the latency-based IISCA. Otherwise, the selection process was seemingly random across practitioners who were receiving the training. This resulted in nine participants being included in the current study.

The majority of the participants were male ($n = 6$) and the mean age was 6 years old (range, 3 to 10 years old).

All participants were diagnosed with autism and exhibited a collection of non-severe and severe problem behavior. A summary of the demographic information for all participants can be found in Table 1. The setting in which the IISCA was conducted varied by participant and could include a clinic, home, or school. However, the IISCA was always conducted in a separate room and the latency-based and rate-based IISCAs were always conducted in the same space for each participant.

Response Measurement

The measurement of problem behavior included any severe (e.g., aggression, self-injury, or disruption) or non-severe (e.g., screaming, crying, whining) topographies of behaviors targeted for assessment and intervention. We defined aggression as problem behavior directed towards others (e.g., hitting, pinching, biting, scratching others), self-injury as problem behavior direct towards oneself (e.g., hitting oneself, scratching oneself, head banging), and disruptions as problem behavior directed towards objects (e.g., throwing things, ripping paper, banging toys). Non-severe problem behavior often included measurements of loud vocalizations (e.g., swearing, yelling, screaming, crying, or whining). Some additional topographies included stomping (i.e., forceful steps that make an audible noise), gnashing teeth (i.e., rubbing teeth until making an audible noise), spitting (i.e., saliva leaving plane of lips typically in the direction of other people), and food stealing (i.e., reaching for and grabbing the baited food in front of others).

Interobserver Agreement (IOA)

All responses were measured as a latency during the latency-based IISCA and as a frequency, converted to a rate, during the rate-based IISCA. IOA was calculated during 40% of all sessions. To calculate IOA, we divided the smaller value (latency or frequency) by the larger value (latency or frequency). The mean IOA for the latency-based IISCA was 98% (range, 95–100%) and the mean IOA for the rate-based IISCA was 99% (range, 93–100%). Individual IOA for each participant can be found in the Supplemental Material.

Experimental Design

The latency-based and rate-based IISCAs both used a multielement design to demonstrate functional control over problem behavior. It is important to point out that interpretations of functional control for the latency-based and rate-based IISCAs were inversely related. That is, functional control during the latency-based IISCA was demonstrated when long latencies (or no responding) were observed in the control condition and brief latencies were observed in the test condition. On the other hand, functional control during the rate-based IISCA was demonstrated when low rates (or no responding) were observed in the control condition and elevated rates were observed in the test condition.

Procedure

All participants experienced the latency-based IISCA first to reduce any carryover from the extended experience during the rate-based IISCA (see Thomason-Sassi et al., 2011). The latency-based IISCA included a single test condition compared to a matched control. The synthesized contingency informed by the open-ended interview (appendix of Hanley, 2012) was arranged for the target problem behavior (severe or non-severe) in the test condition. The test session would begin with the removal of any preferred events and the presentation of the evocative events. If problem behavior occurred during the test condition, the evocative events were removed and the preferred events were provided for the remaining 30 s of the session. The next session, alternating between the test and control conditions, began once the 30 s had elapsed (i.e., the test session was discontinued following the first instance of problem behavior and initiated the next session after 30 s of reinforcement). Sessions were conducted consecutively without any breaks in between. During

Table 1 Demographic information for participants in study 1

Participant	Age	Sex	Diagnosis	Problem behavior
Bento	7	M	ASD	Loud vocalizations, aggression, disruption
Beatriz	4	F	ASD	Loud vocalizations
Eduardo	3	M	ASD	Loud vocalizations, stomping, aggression, SIB
Vitor	4	M	ASD	Loud vocalizations, aggression, SIB
Maria	10	F	ASD	Loud vocalizations, stomping, gnashing teeth, SIB
José	4	M	ASD	Loud vocalizations, elopement, aggression
Roberto	8	M	ASD	Spitting, disruption
João	8	M	ASD	Loud vocalizations, aggression, disruption
Gabi	8	F	ASD	Food stealing, SIB, flopping

Note: ASD refers to autism spectrum disorder

the control condition, the preferred events were noncontingently available throughout the entire session and no evocative events were presented. If problem behavior occurred during the control condition, the therapist would ignore and the preferred events would continue to be noncontingently available before the next session was initiated.

Every participant experienced both the latency-based and rate-based IISCAs and the same contingency was evaluated in both analyses. The rate-based IISCA also included a single test condition compared to a matched control and the test session began with the removal of any preferred events and the presentation of the evocative events. If problem behavior occurred, the evocative events were removed (e.g., instructions with books) and the preferred events (e.g., iPad) were re-presented for 30 s. All sessions, test or control condition, were 3 min during the rate-based IISCA regardless of problem behavior. That is, the reinforcers were delivered for 30 s if problem behavior occurred during the test condition and this procedure of reinforcing every instance of problem behavior was repeated until the 3 min had elapsed during the rate-based IISCA. During the control condition, the preferred events were noncontingently available throughout the entire session and no evocative events were presented. The rate-based IISCA was conducted within at least 1 week of the latency-based IISCA. Individual information regarding the analyses can be found in Table 2.

Results and Discussion

The results of the latency-based and rate-based IISCAs are presented in Figs. 1 and 2. There was no problem behavior observed during the control condition of any of the nine latency-based IISCAs and the latency to all problem behavior in the test condition was brief. All latency-based IISCAs demonstrated functional-control over problem behavior. During the rate-based IISCAs, no problem behavior was observed during the control condition and elevated rates of problem behavior were observed during the test condition. The results of all nine latency-based IISCAs corresponded to the nine rate-based IISCAs. This suggests that the latency-based IISCA can be a briefer alternative to the rate-based IISCA without impairing interpretations of functional control.

Study 2: 16 Replications of the Latency-Based IISCA

It is important to know not only that a specific procedure will work, but that the outcomes can be reliably replicated under various and differing conditions (Baer et al., 1986). In addition, collecting clinical applications can provide evidence of patterns among descriptive characteristics (e.g., sex, age, diagnosis) and functional determinants of problem behavior from an epidemiological perspective (Iwata et al., 1994). Jessel et al. (2016) provided evidence of the generality of the rate-based IISCA when they collected 30 replications across a range of different participants in different settings. Overall, the authors found the rate-based IISCA was likely to require only 25 min to conduct and 22 of the 30 rate-based IISCAs were likely to implicate a socially mediated function for problem behavior without the need for further modification. To date, the generality of the latency-based IISCA is relatively unknown. That is, there appear to be but a few replications among a very homogenous population (i.e., young boys diagnosed with autism who exhibit elopement) (Boyle et al., 2020; Jessel et al., 2018). The latency-based IISCA has yet to be conducted with participants who

Table 2 Functional analysis information for participants in study 1

Name	Latency-based IISCA		Rate-based IISCA		Individualized contingency	
	Total (#)	Duration (min)	Total (#)	Duration (min)	Evocative event	Preferred event
Bento	5	3	5	3	Writing activities	Independent play with snacks and phone
Beatriz	5	3	5	3	Denied access and transition to work area	Child-directed play
Eduardo	5	3	5	3	Denied access and transition to work area	Interactive play
Vitor	5	3	5	3	Transition to work area	Interactive play with phone
Maria	5	3	5	3	Transition to work area	Independent play with snacks and phone
José	5	3	5	3	Transition to work area	Interactive play with music
Roberto	5	3	5	3	Match-to-sample tasks	Independent play with tablet and snacks
João	5	3	5	3	Reading and writing activities	Independent play with TV
Gabi	5	3	5	3	Action imitation tasks	Interactive play with music and snacks

Note: Duration of latency-based IISCA is represented as a maximum and the experienced duration depended on the time in which the first instance of problem behavior occurred

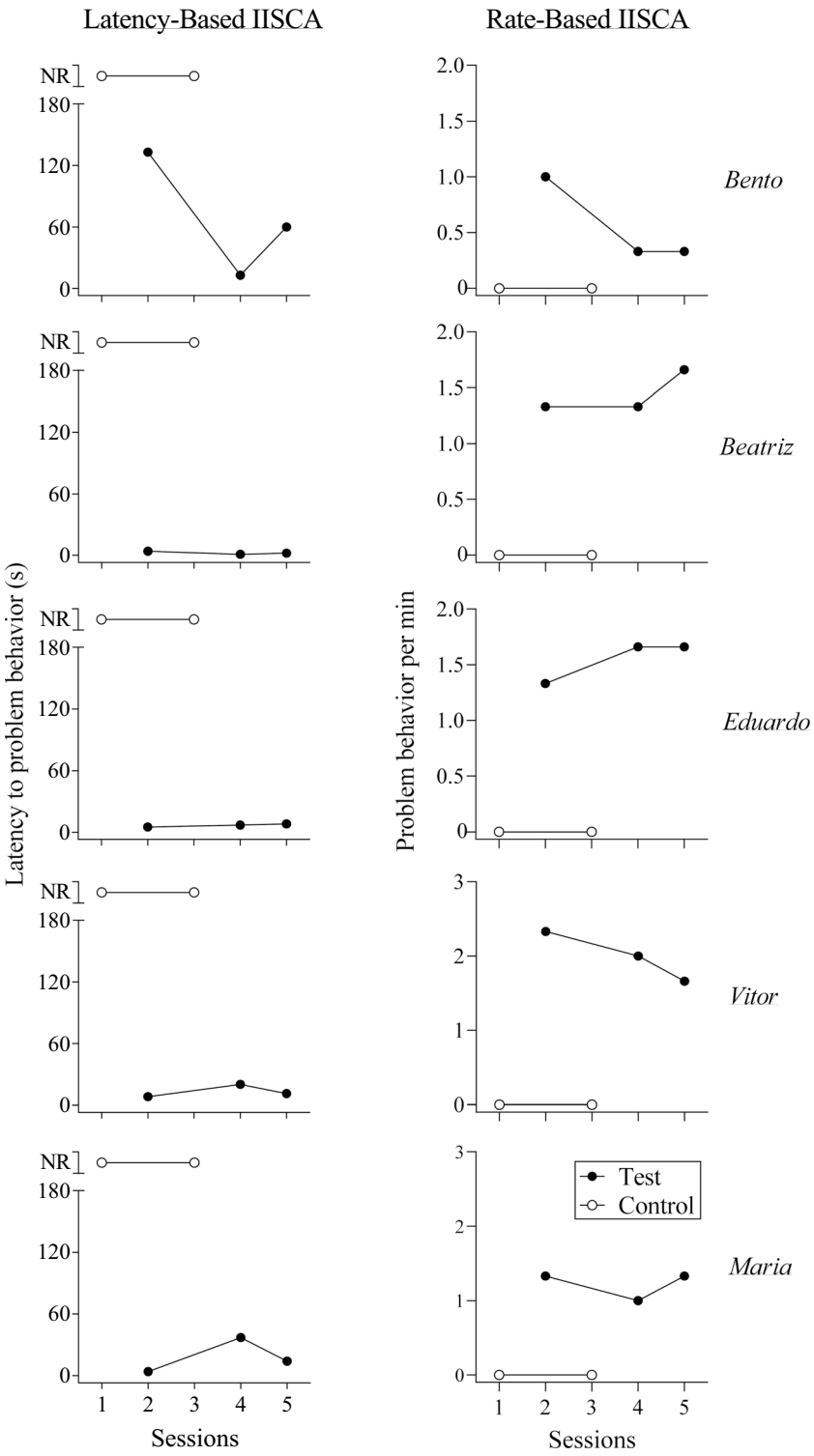

Fig. 1 Results of the latency-based and rate-based IISCAs for the first five participants of study 1. *Note*: NR refers to no response

exhibit severe problem behavior. The purpose of study 2 was to support the generality of the latency-based IISCA by collecting multiple replications among different populations, behaviors, and settings. In addition, participants from two different countries were included (i.e., the USA and Brazil).

Method

Participants and Settings

Participants were included if they exhibited topographies of problem behavior in need of treatment. Fifteen participants

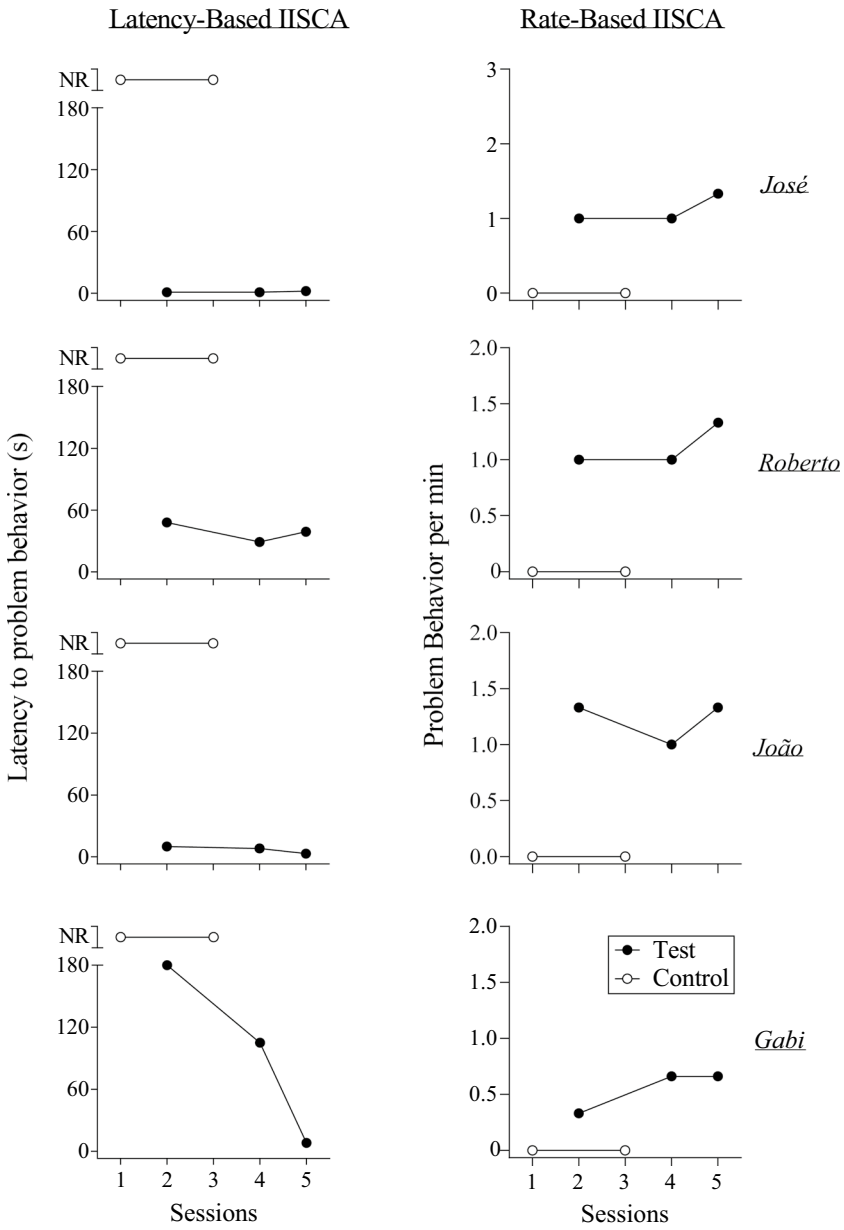

Fig. 2 Results of the latency-based and rate-based IISCAs for the remaining participants of study 1. *Note*: NR refers to no response

were included (Table 3), with one participant experiencing two applications of the latency-based IISCA. Two latency-based IISCAs were conducted with Nelo because his caregivers identified two functionally dissimilar contingencies that could be contributing to problem behavior during the interview. We therefore evaluated each context separately. In other words, contingencies are only synthesized if they are implicated to co-occur. This created a total of 16 applications of the latency-based IISCA. In addition to the specialized school and university-based outpatient clinic from study 1, participants were recruited from two other specialized schools on the northeast for a total of three states. One participant was Brazilian (Fernando) and all sessions were conducted in his home in Brazil. Nine participants were male (six females) and the mean age was 9.2 years old (range, 2 to 16 years old).

Response Measurement

Problem behavior included a combination of multiple topographies of severe and non-severe measures from study 1 for 87% of the participants (13 of 15) with the addition of elopement for four of the participants (27%). Elopement was defined as the participant standing up and leaving a designated area specified by the therapist without the therapist's permission. Different forms of SIB (e.g., heading banging, self-scratching) and loud vocalizations (e.g., yelling, screaming, swearing) were exhibited by 60% (nine of 15) of the

Table 3 Demographic information for participants in study 2

Participant	Age	Sex	Diagnosis	Problem behavior
Matt	12	M	ASD	Elopement
Alex	14	M	ASD	Elopement, aggression, SIB, disruption
Diego	10	M	ASD	Loud vocalizations, aggression
Nelo	10	M	ASD, ADHD	Loud vocalizations, disruption
Liam	4	M	ASD	Loud vocalizations
Kat	12	F	ID	Loud vocalizations, flopping, aggression, SIB, disruption
Tiana	7	F	ASD	Aggression, SIB
Mace	9	M	ASD, ADHD	Elopement
Morgan	12	M	ASD, ID, SNHL	Elopement, disruption, dropping
Tiffany	16	F	ASD, ADHD, OCD	Pushing, grabbing, aggression, SIB, disruption
Stephanie	6	F	None	Loud vocalizations, aggression, SIB, disruption
Fernando	6	M	ASD	Loud vocalizations, aggression, SIB, disruption
Ana	14	F	ASD, ID	Loud vocalizations, SIB
Ryan	4	M	ASD	Loud vocalizations, flopping, thigh taps, aggression, SIB
Jenny	2	F	ASD	Loud vocalizations, flopping, SIB

Note: ASD refers to autism spectrum disorder. ADHD refers to attention deficit/hyperactivity disorder. ID refers to intellectual disability. SNHL refers to sensorineural deafness. OCD refers to obsessive–compulsive disorder

participants. Aggression, including hitting and scratching others, was exhibited by 53% (eight of 15) of the participants. Disruptions, like throwing or banging objects, were exhibited by 47% (seven of 15) of the participants. In addition, some participants exhibited more idiosyncratic topographies of problem behavior as well (i.e., flopping, dropping, pushing, grabbing, and thigh tapping). All target behaviors were measured as the time between the beginning of the session (i.e., removal of preferred events and presentation of evocative events) and the first instance of problem behavior. Only the latency to the first response was recorded and any other instances of problem behavior would have been considered to occur outside of session.

Interobserver Agreement (IOA)

A secondary observer independently recorded the latency to problem behavior in 67% of the sessions of each latency-based IISCA. Latencies were recorded in seconds and rounded to one decimal point (i.e., one-tenth of a second). We calculated IOA by dividing the smaller latency recorded by one observer and the larger latency recorded by the other observer. The mean IOA of the latency to problem behavior across participants was 97% (88 to 100%). Individual IOA is available in the Supplemental Material.

Experimental Design

A multielement design was used to compare the latencies to problem behavior. Functional control was demonstrated when shorter latencies to problem behavior were observed during the test conditions in comparison to longer latencies or no instances of the problem behavior during the control condition.

Procedure

The procedures of the latency-based IISCA were identical to that described in study 1.

The synthesized contingency informed by an open-ended interview was arranged for the target problem behavior in the test condition. Sessions during the latency-based IISCA were programmed to be 3 min; however, the sessions during the test condition were discontinued after the first instance of problem behavior. Sessions remained as 3 min during the control condition regardless of problem behavior. For example, parents reported that when Mace ran from the dinner table, he would go to the living room or bedroom where his toys, including trains and building blocks, were available. Parents had also mentioned that Mace had difficulty eating different kinds of Indian bread (a staple of starch used in their meals), cheese sandwiches (what they wished he would eat for school lunches), and fruit. Therefore, the test condition included Mace being given 30-s presession access to trains and building blocks in the play area. When the session began, he was told that it was time to eat lunch and was prompted to walk to the table in the eating area approximately 1.5 m away. If at any time Mace eloped from the eating area to the play area, the session was terminated and he was given 30-s access to the available leisure items. During the control condition, Mace had free access to the play area and same foods from the test condition were

continuously available in the eating area. Any elopement to the eating area would have resulted in the therapist providing no attention and 30-s independent access to the eating area. Specific preferred and evocative events for each participant are presented in Table 4.

Clinical Validation

Staff members who conducted the latency-based IISCAs were provided with a questionnaire asking them about their specific experience. The questions were presented on a 7-point Likert scale and regarded the acceptability, helpfulness, safety, and efficiency of the procedures. Staff members were not affiliated with this project in anyway and their questionnaire was completed anonymously. Demographic information was not collected on the staff members.

Results and Discussion

The results of the latency-based IISCAs are presented in Fig. 3. No problem behavior was observed during the control condition and brief latencies to problem behavior were often observed during the test condition for all 16 applications. The results of all the latency-based IISCAs implicated a socially mediated function. The analyses required a mean of 10.59 min (range, 6.5 to 20.5 min) to conduct and the participants exhibited only a mean of 3.25 instances (range, 2 to 4 instances) of problem behavior during each analysis period.

Eight clinicians completed the clinical validity questionnaire. Almost all clinicians found the latency-based IISCA to be very acceptable ($M = 6.75$; range 5 to 7) and safe ($M = 6.75$; range 6 to 7). While still highly rated, clinicians rated the helpfulness of the latency-based IISCA to be a little lower ($M = 6.38$; range 5 to 7). The clinicians also provided high ratings when evaluating efficiency ($M = 6.5$; range, 5 to 7). Lastly, the clinicians reported that they were very likely to use the latency-based IISCA format in the future ($M = 6.75$; range, 6 to 7). It is important to point out that all ratings across questions were positive (i.e., above a neutral rating of 4).

All latency-based IISCAs were differentiated and implicated a socially mediated function that could then be used to inform a function-based treatment. The clinicians who conducted the latency-based IISCAs determined the procedures to be safe, acceptable, and helpful. These results supported the generality of the latency-based IISCA because it was conducted with female and male participants, ranging in ages from 2 to 16 years old, among individuals with and without various diagnoses, exhibiting multiple different severe and non-severe problem behavior, in clinics, schools, and homes across the USA and Brazil. It seems latency-based IISCAs are likely to be differentiated, requiring a relatively brief amount of time to conduct, and minimizes exposure to problem behavior.

General Discussion

The latency-based IISCA is a functional analysis format that requires minimal time to conduct and reduces exposure to problem behavior by discontinuing sessions after a single

Table 4 Functional analysis information for participants in study 2

Name	Session information		Individualized contingency	
	Total (#)	Duration (min)	Evocative event	Preferred event
Matt	5	3	Cookies unavailable in restricted area	Cookies
Alex	5	3	Transitions to classroom	Gross motor activities
Diego	5	3	Transitions away from table	Interactive play at table
Nelo (1)	6	3	Transitions to work area	Independent play
Nelo (2)	5	3	Difficult work	Easy work
Liam	5	3	Mother-directed play	Child-directed play with mother
Kat	7	5	Blocked access to child-directed activities	Child-directed activities
Tiana	6	5	Blocked access to preferred items	Independent play
Mace	5	5	Instructions to eat meal	Free play
Morgan	5	3	Presentation of academic work	Interactive play
Tiffany	6	3	Interruption of rituals	Independent access to rituals
Stephanie	6	3	Adult-directed activities	Child-directed activities
Fernando	5	3	Transition to work area	Independent access to activities
Ana	5	3	Transition to activities of daily living	Interactive play
Ryan	5	3	Transition to work area	Free play with snacks
Jenny	5	3	Presentation of academic work	Free play with bubbles

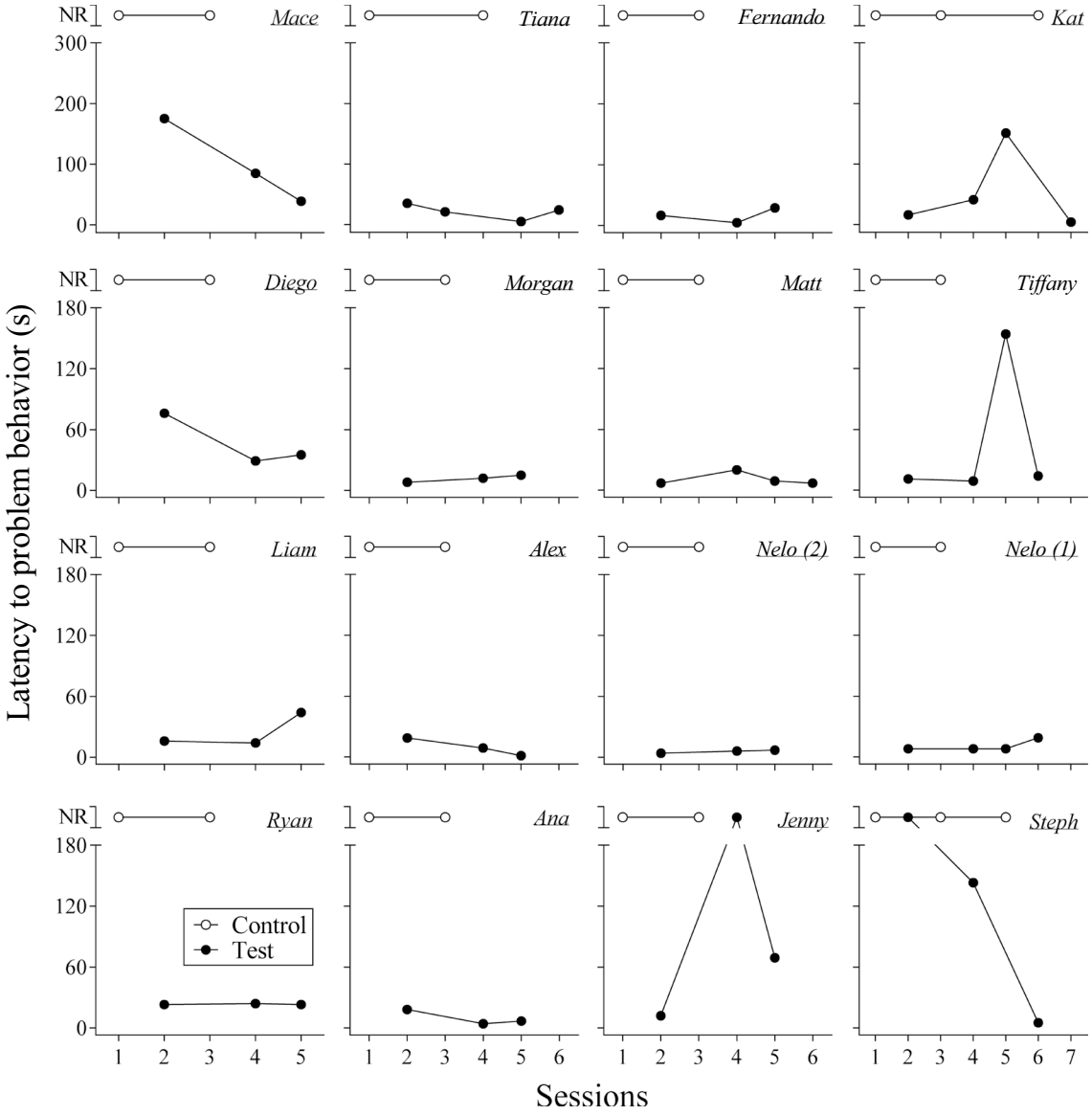

Fig. 3 Latency-based IISCAs from study 2. *Note*: NR refers to no response

instance is observed. Previous applications of the latency-based IISCA have been limited to elopement (Boyle et al., 2020; Jessel et al., 2018) or with severe problem behavior using some elements of the IISCA format (Lambert et al., 2017). In study 1, we conducted the latency-based and rate-based IISCAs with nine other participants in Brazil and found that the results were highly likely to correspond. We replicated the generality of these positive outcomes by collecting 16 additional applications using the latency-based IISCA format with different populations, behaviors, and settings (study 2). Clinicians reported they were likely to use this functional analysis format in the future. The measure of latency in the IISCA model does appear to provide some benefit in terms of reducing exposure to problem behavior and improving the brevity of the assessment period.

An important aspect of this study is the inclusion of participants from two different countries (the USA and Brazil). From a perspective of generality, it is essential to show that the procedures work regardless of where they are implemented and can be conducted in different cultures. In fact, most Applied Behavior Analysis (ABA) research does not report race/ethnicity and, when it does, participants are likely to be Caucasian from the USA (Jones et al., 2020). The results seem to support the viability of conducting either the rate-based or latency-based IISCAs while obtaining differentiated outcomes in two countries.

Although using latency as a measure of response strength during a functional analysis seems to be one of only a few available techniques for improving the assessment of restricted topographies of problem behavior such as elopement, other techniques have been evaluated for improving efficiency and safety. For example, Iovino et al. (2022) introduced a new variation of the IISCA, termed the performance-based IISCA, which incorporates a trauma-informed framework into the functional analysis procedures. The five participants in Italy were all diagnosed with autism and exhibited problem behavior. During the performance-based IISCA, the authors ensured that the participants were calm and engaged with preferred items during the majority of the time. In addition, the entire analysis was dependent on the child's behavior and took an average of 17.6 min to complete. Further evaluations of the performance-based IISCA suggest it aligns with the core commitments of trauma informed care (e.g., acknowledging trauma, ensuring safety and trust, promoting choice and shared governance) because the individual can opt in or out of the assessment at any time and it only requires three to five instances of problem behavior to be observed (Jessel et al., 2023). This is very similar to the current procedures of the latency-based IISCA and suggests that a trauma-informed approach is amenable to measures such as latency.

Limitations and Future Research

It is important to note that brief functional analysis formats, such as the latency-based IISCA, rely heavily on the ability of the evocative events to readily "turn on" problem behavior because of the reduced exposure to the repeated delivery of the preferred events as putative reinforcing consequences. Not only does this exclude the possible assessment of low-rate problem behavior (e.g., Tarbox et al., 2004), but using latency may further reduce a clinician's understanding of how to effectively "turn off" problem behavior. That is because in a latency-based functional analysis, sessions are terminated after the delivery of a single reinforcer and how problem behavior responds to this change in environment is not measured. In other words, a broader understanding of reinforcers from a functional analysis could include two elements: (a) the absence of the reinforcer serves as an establishing operation that evokes the problem behavior and (b) the presence of the reinforcer serves as the abolishing operation that eliminates the problem behavior (Hanley et al., 2003). From a clinical perspective, it is important to understand that providing the reinforcers is likely to eliminate problem behavior and reduce the probability of severe bursts.

A limitation of the current study is the lack of treatment data informed by the results of the latency-based IISCAs. Most of the participants went on to receive function-based treatment; however, the treatment was not completed in a systematic fashion in an experimental design. Without a treatment evaluation, it is difficult to determine the validity of using an FBA because, regardless of how efficient or safe the assessment process is, its value is dependent on the ability to inform affective action on the part of the clinician (Hayes et al., 1987; Kratochwill & Shapiro, 2000). In fact, there is a dearth of research including treatment validation with latency as a measure of problem behavior in general, and this study is of no exception. Falcomata et al. (2016) present one of the few examples where the authors conducted a latency-based brief functional analysis for the problem behavior of three children diagnosed with autism. The treatments of differential reinforcement for alternative behavior (two participants) and noncontingent reinforcement (one participant) were all found to effectively reduce problem behavior after being informed by the results of the functional analysis.

Although treatment data were not included, we were able to compare the results of the latency-based IISCA to that of a more established functional analysis format (i.e., rate-based IISCA) in the current study. In addition, the entire assessment and treatment process beginning with the latency-based IISCA has been evaluated by two research groups (Boyle et al., 2020; Jessel et al., 2018). Future researchers may want to consider replicating these positive findings to improve our understanding of the effectiveness of the latency-based IISCA across different locations and individuals. Furthermore, problem behavior was measured as an aggregate including severe and non-severe problem behavior that was reported by caregivers to co-occur, which made it difficult to interpret functional control of each topography. While there is evidence to support the functional similarities between these behaviors when informed by an open-ended interview (Warner et al., 2020), the treatment evaluation would help to further validate the use of an open-contingency class reinforcing all, severe and non-severe, problem behavior if a corresponding reduction in all problem behavior was obtained during the implementation of the function-based treatment.

Author Contribution The first author designed and implemented portions of the procedures of the study, assisted with data analysis, and wrote the paper. The second author implemented portions of the procedures of the study and assisted with data analysis. The third author implemented portions of the procedures of the study. The fourth author assisted with data analysis. The fifth and sixth authors implemented limited portions of the procedures of the study.

Data Availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Competing Interests The authors declare no competing interests.

References

Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis, 1*(1), 91–97. https://doi.org/10.1901/jaba.1968.1-91

Boyle, M. A., Bacon, M. T., Brewer, E. M., Carton, S. M., & Gaskill, L. A. (2020). Evaluating a treatment without extinction for elopement maintained by access to stereotypy. *Journal of Applied Behavior Analysis.* Advanced Online Publication. https://doi.org/10.1002/jaba.682

Brodhead, M. T., Cox, D. J., & Quigley, S. P. (2022). *Practical ethics for effective treatment of autism spectrum disorder*. Academic Press.

Campbell, J. M. (2003). Efficacy of behavioral interventions for reducing problem behavior in persons with autism: A quantitative synthesis of single-subject research. *Research in Developmental Disabilities, 24*(2), 120–138. https://doi.org/10.1016/S0891-4222(03)00014-3

Coffey, A. L., Shawler, L. A., Jessel, J., Nye, M. L., Bain, T. A., & Dorsey, M. F. (2020). Interview-informed synthesized contingency analysis (IISCA): Novel interpretations and future directions. *Behavior Analysis in Practice, 13*(1), 217–225. https://doi.org/10.1007/s40617-019-00348-3

Davis, T. N., Durand, S., Bankhead, J., Strickland, E., Blenden, K., Dacus, S., Pond Hannig, A., Haupert, M., Fuentes, L., & Machalicek, W. (2013). Brief report: Latency functional analysis of elopement. *Behavioral Interventions, 28*(3), 251–259. https://doi.org/10.1002/bin.1363

Falcomata, T. S., Muething, C. S., Roberts, G. J., Hamrick, J., & Shpall, C. (2016). Further evaluation of latency-based brief functional analysis methods: An evaluation of treatment utility. *Developmental Neurorehabilitation, 19*(2), 88–94. https://doi.org/10.3109/17518423.2014.910281

Hagopian L. P., Dozier C. L., Rooker G. W., & Jones B. A. (2013). Assessing and treating severe problem behavior. In G. J. Madden (Ed.), *APA handbook of behavior analysis.* American Psychological Association

Hanley, G. P., Iwata, B. A., & McCord, B. E. (2003). Functional analysis of problem behavior: A review. *Journal of Applied Behavior Analysis, 36*(2), 147–185. https://doi.org/10.1901/jaba.2003.36-147

Hanley, G. P., Jin, C. S., Vanselow, N. R., & Hanratty, L. A. (2014). Producing meaningful improvements in problem behavior of children with autism via synthesized analyses and treatments. *Journal of Applied Behavior Analysis, 47*(1), 16–36. https://doi.org/10.1002/jaba.106

Hanley, G. P. (2012). Functional assessment of problem behavior. Dispelling myths, overcoming implementation obstacles, and developing new lore. *Behavior Analysis in Practice, 5*(1), 54–72. https://doi.org/10.1007/BF03391818

Hayes, S. C., Nelson, R. O., & Jarrett, R. B. (1987). The treatment utility of assessment. A functional approach to evaluating assessment quality. *The American Psychologist, 42*(11), 963–974. https://doi.org/10.1037/0003-066X.42.11.963

Hemmings, C. P., Gravestock, S., Pickard, M., & Bouras, N. (2006). Psychiatric symptoms and problem behaviours in people with intellectual disabilities. *Journal of Intellectual Disability Research, 50*(4), 269–276. https://doi.org/10.1111/j.1365-2788.2006.00827.x

Herman, C., Healy, O., & Lydon, S. (2018). An interview-informed synthesized contingency analysis to inform the treatment of challenging behavior in a young child with autism. *Developmental Neurorehabilitation, 21*(3), 202–207. https://doi.org/10.1080/17518423.2018.1437839

Heyvaert, M., Saenen, L., Campbell, J. M., Maes, B., & Onghena, P. (2014). Efficacy of behavioral interventions for reducing problem behavior in persons with autism: An updated quantitative synthesis of single-subject research. *Research in Developmental Disabilities, 35*(10), 2463–2476. https://doi.org/10.1016/j.ridd.2014.06.017

Iovino, L., Canniello, F., Simeoli, R., Gallucci, M., Benincasa, R., D'Elia, D., Hanley, G. P., & Cammilieri, A. P. (2022). A new adaptation of the interview-informed synthesized contingency analysis (IISCA): The performance-based IISCA. *European Journal of Behavior Analysis, 23*(2), 144–155. https://doi.org/10.1080/15021149.2022.2093596

Iwata B. A., Pace G. M., Dorsey M. F., Zarcone J. R., Vollmer T. R., Smith R. G., Rodgers T. A.,…Willis K. D. (1994). The functions of self-injurious behavior: An experimental-epidemiological analysis. *Journal of Applied Behavior Analysis. 27*(2). 215-240. https://doi.org/10.1901/jaba.1994.27-215

Jessel, J., Hanley, G. P., & Ghaemmaghami, M. (2016). Interview-informed synthesized contingency analysis: Thirty replications and reanalysis. *Journal of Applied Behavior Analysis, 49*(3), 576–595. https://doi.org/10.1002/jaba.316

Jessel, J., Ingvarsson, E. T., Metras, R., Whipple, R., Kirk, H., & Solsbery, L. (2018). Treatment of elopement following a latency-based interview-informed, synthesized contingency analysis. *Behavioral Interventions, 33*(3), 271–283. https://doi.org/10.1002/bin.1525

Jessel, J., Fruchtman, T., Raghunauth-Zaman, N., Leyman, A., Lemos, F. M., Costa Val, H., Howard, M., & Hanley, G. P. (2023). A two step validation of the performance-based IISCA: A trauma-informed functional analysis model. *Behavior Analysis in Practice.* Advanced Online Publication. https://doi.org/10.1007/s40617-023-00792-2

Jessel. J., Hanley G. P., Ghaemmaghami M., & Carbone M. J. (2022). On the efficiency and control of different functional analysis formats. *Education and Treatment of Children. 45* 69-84.https://doi.org/10.1007/s43494-021-00059-x

Jones, S. H., Peter, C. C., & Ruckle, M. M. (2020). Reporting of demographic variables in the. *Journal of Applied Behavior Analysis, 53*(3), 1304–1315. https://doi.org/10.1002/jaba.722

Kratochwill, T. R., & Shapiro, E. S. (2000). Conceptual foundations of behavioral assessment in schools. In E. S. Shapiro & T. R. Kratochwill (Eds.), *Behavioral assessment in schools* (pp. 3–15). The Guilford Press.

Lambert J. M., Staubitz J. E., Torelli R. J., Houchins-Juarez N. J., Juarez A. P., Sanders K. B., & Waren Z. E. (2017). Outcome summaries of latency-based functional analyses conducted in hospital inpatient units. *Journal of Applied Behavior Analysis, 50*(3), 487-494. https://doi.org/10.1002/jaba.399

Layman, L. N., Dufrene, B. A., Ackley, M. M., Weaver, C. M., Schneider, D. E., LaBrot, Z. C., Taylor, C. N., Rahaman, J. A., Tawney, K., N., Hart, T., & Olmi, D. J. (2023). Interview-informed synthesized contingency analyses on challenging problem behavior: A single-case meta-analysis. *Review Journal of Autism and Developmental Disabilities.* Advanced Online Publication. https://doi.org/10.1007/s40489-023-00357-7

Mayes, S. D., Calhoun, S. L., Aggarwal, R., Baker, C., Mathapati, S., Anderson, R., & Peterson, C. (2012). Explosive, oppositional, and aggressive behavior in children with autism compared to other clinical disorders and typical children. *Research in Autism Spectrum Disorder, 6*(1), 1–10. https://doi.org/10.1016/j.rasd.2011.08.001

Neidert, P. L., Iwata, B. A., Dempsey, C. M., & Thomason-Sassi, J. L. (2013). Latency of response during the functional analysis of elopement. *Journal of Applied Behavior Analysis, 46*(1), 312–316. https://doi.org/10.1002/jaba.11

Oliver, A. C., Pratt, L. A., & Normand, M. P. (2015). A survey of functional behavior assessment methods used by behavior analysts in practice. *Journal of Applied Behavior Analysis, 48*(4), 817–829. https://doi.org/10.1002/jaba.256

Roscoe, E. M., Phillips, K. M., Kelley, M. A., Farber, R., & Dube, W. V. (2015). A statewide survey assessing practitioners' use and perceived utility of functional assessment. *Journal of Applied Behavior Analysis, 48*(4), 830–844. https://doi.org/10.1002/jaba.259

Rose, J. C., & Beaulieu, L. (2019). Assessing the generality and durability of interview-informed functional analyses and treatment. *Journal of Applied Behavior Analysis, 52*(1), 271–285. https://doi.org/10.1002/jaba.504

Saini, V., Fisher, W. W., Retzlaff, B. J., & Keevy, M. (2020). Efficiency in functional analysis of problem behavior: A quantitative and qualitative review. *Journal of Applied Behavior Analysis, 53*(1), 44–66. https://doi.org/10.1002/jaba.583

Santiago, J. L., Hanley, G. P., Moore, K., & Jin, C. S. (2015). The generality of interview-informed functional analyses: Systematic replication in school and home. *Journal of Autism and Developmental Disorders, 46*(3), 797–811. https://doi.org/10.1007/s10803-015-2617-0

Slaton, J. D., Hanley, G. P., & Raftery, K. J. (2017). Interview-informed functional analyses: A comparison of synthesized and isolated components. *Journal of Applied Behavior Analysis, 50*(2), 252–277. https://doi.org/10.1002/jaba.384

Strand, R. C. W., & Eldevik, S. (2018). Improvements in problem behavior in a child with autism spectrum diagnosis through synthesized analysis and treatment: A replication in an EIBI home program. *Behavioral Interventions, 33*(1), 102–111. https://doi.org/10.1002/bin.1505

Tarbox, J., Wallace, M. D., Tarbox, R. S. F., Landaburu, H. J., & Williams, W. L. (2004). Functional analysis and treatment of low-rate problem behavior in individuals with developmental disabilities. *Behavioral Interventions, 19*(2), 73–90. https://doi.org/10.1002/bin.156

Thomason-Sassi, J. L., Iwata, B. A., Neidert, P. L., & Roscoe, E. M. (2011). Response latency as an index of response strength during functional analyses of problem behavior. *Journal of Applied Behavior Analysis, 44*(1), 51–67. https://doi.org/10.1901/jaba.2011.44-51

Traub, M. R., & Vollmer, T. R. (2019). Response latency as a measure of behavior in the assessment of elopement. *Journal of Applied Behavior Analysis, 52*(2), 422–438. https://doi.org/10.1002/jaba.541

Warner, C. A., Hanley, G. P., Landa, R. K., Ruppel, K. W., Rajaraman, A., Ghaemmaghami, M., Slaton, J. D., & Gover, H. C. (2020). Toward accurate inferences of response class membership. *Journal of Applied Behavior Analysis, 53*(1), 331–354. https://doi.org/10.1002/jaba.598