

Immediate and repeat interrogative suggestibility in a sample of adolescents with Fetal Alcohol Spectrum Disorder (FASD)

Authors names: David J Gilbert¹, Clare S. Allely¹, Gisli Gudjonsson³, Raja AS Mukherjee^{1,2}, Penny A Cook¹

Authors' affiliations: 1. School of Health and Society, University of Salford, Manchester, United Kingdom.
2. FASD Specialist Behaviour Clinic, Surrey, and Borders Partnership NHS Foundation Trust, Redhill, Surrey, UK
3. Department of Psychology, Institute of Psychiatry, Psychology and Neuroscience, Kings College London, De Crespigny Park, Denmark Hill, London SE5 8AF, UK

Corresponding author's details: Dr David J. Gilbert
University of Salford,
School of Health and Society
Manchester, England
M6 6PU

Abstract

Individuals with fetal alcohol spectrum disorders (FASD) are more likely to be involved with the criminal justice system (CJS) than neurotypical individuals. Interrogative suggestibility is theorised to be a weakness in this population. Fifty-two participants (aged 11-16 years) completed the Gudjonsson Suggestibility Scale (GSS 2) immediately and after one week; the Wechsler Intelligence Scale for Children (WISC-V); and the Behavioural Rating of Executive Function (BRIEF-2). Compared to the control group, individuals with FASD were more vulnerable to leading questions, negative feedback and evidenced significantly higher suggestibility, immediately and after one week. A significant correlation was found between immediate and repeat suggestibility at one-week follow-up. Poorer memory recall, lower IQ, and higher impulsivity was also seen in the FASD population. The preliminary results indicate the importance for the CJS to establish whether suspects, witnesses and victims of crimes may have been impacted by prenatal alcohol exposure, since this is a significant source of vulnerability that could lead to false confessions or miscarriage of justice.

Keywords: *Fetal Alcohol Spectrum Disorder; FASD; Suggestibility; Vulnerability; Police interview; Investigative interview; Criminal Justice System*

Introduction

Fetal alcohol spectrum disorder (FASD) is a neurodevelopmental disorder characterised by prenatal alcohol damage in several parts of the brain, including the frontal lobe (Hoyme et al., 2016). The frontal lobe controls goal-oriented behaviour such as decision-making and behavioural/emotional regulation (Fuster, 2015). Individuals with FASD display behaviours that could lead to an increased likelihood of incarceration due to frontal lobe damage and psychological vulnerabilities (Popova et al., 2011; Streissguth et al., 2004).

Psychological vulnerabilities are “psychological characteristics or mental state which render a witness prone, in certain circumstances, to providing information, which is inaccurate, unreliable or misleading” (Gudjonsson, 2006; p. 68). Four categories of psychological vulnerabilities are highlighted by Gudjonsson (2006): mental disorder, abnormal mental state, low intellectual functioning, and personality traits. The current study investigates a personality trait, namely interrogative suggestibility due to time/resource limitation in studying other categories of psychological vulnerabilities.

Gudjonsson and Clark (1986, p.84) define interrogative suggestibility as the “extent to which, within closed social interaction, people come to accept messages communicated during formal questioning, as the result of which their subsequent behavioural response is affected”. The involvement of questioning regarding past events within closed social interactions are the distinguishing features of interrogative suggestibility, as opposed to the other types of suggestibility (Gudjonsson, 1987). The Gudjonsson and Clark (1986) model proposes three antecedents to suggestive responses: interpersonal trust, uncertainty, and expectations. Interrogative suggestibility, as measured by the Gudjonsson Suggestibility Scales (GSS 1 and GSS 2; Gudjonsson, 1997), has been found to be related to susceptibility to false confessions both in real-life and experimental studies (Otgaar et al., 2021).

A recent systematic review highlighted relatively little empirical investigation of interrogative suggestibility in individuals with FASD (Gilbert et al., 2022). The only peer reviewed experimental study is the pilot study by Brown and colleagues (2011) that involved seven adult males with FASD, where they were found to be more significantly suggestible in comparison to normative scores. This article presents an addition to the sparse empirical

literature. Although reviews exist (Brown et al., 2016; Brown et al., 2020; Mukherjee et al., 2023) and qualitative studies have been undertaken with individuals with FASD and their parents which highlight interrogative suggestibility (Gilbert et al., under peer review; Gilbert et al., 2023), this is the first study to present experimental findings from the assessment of interrogative suggestibility of individuals with FASD upon immediate assessment and after one week of reassessment.

In addition, we investigate the correlation between immediate and repeat suggestibility. A previous study among a normal population (Singh and Gudjonsson, 1984) had found a significant correlation between immediate and repeat suggestibility at one-week follow-up. The correlations were .85, .26, and .75 for Yield 1, Shift and total suggestibility, respectively. Yield 1 is the which is the number of leading questions to which the interviewee gives a false answer before negative feedback is administered. Shift is the number of questions to which the interviewee changes their answer after receiving negative feedback while total suggestibility is a sum of Yield 1 and Shift which indicates the overall susceptibility to suggestions of an interviewee.

Hypotheses

Hypothesis 1: There exists significant differences in suggestibility between the FASD population and controls, immediately and after one week.

Hypothesis 2: Immediate and repeat suggestibility will be significantly correlated.

Hypothesis 3: Memory, impulsivity, Executive Function and IQ predict suggestibility.

Method

Ethical approval was obtained from the University of Salford research ethics panel (09/04/2021; reference no: 1366). The ethics process provided accommodation for the vulnerability of participants, as parents were signposted to support organisations in the event any of their children became distressed as a result of their participation in the research. Also, debriefing was provided at the end of participation to participants.

Design

The present study employed a case control study design.

Participants

Fifty-two participants were conveniently recruited and participated in the study; the participants were divided into – ‘FASD Group’ and ‘Control group’. Power calculation (G*Power 3, version 3.1.9.7) was undertaken (Bartlett, 2019); Alpha level was specified at .05 and the desired power was set at 0.80 as to detect small effect sizes, larger observations will be required. To detect a large effect size ($r = .80$), the power analysis indicated that 54 participants (27 test participants and 27 comparison participants) would be sufficient. Our sample fell short by two participants; due to the diagnosis challenges in this population, the sample number reported in this study was a pragmatic decision.

Individuals with FASD were recruited via advertisement using social media and through the UK FASD charities. The sample comprised 27 adolescents with a diagnosis of FASD/documentated prenatal alcohol exposure; 24 were white and three Black-British; 14 (52%) were females, while 13 (48%) were males. The mean age was 12.7 years (SD = 1.60; Range = 11 – 16 years).

The control group was recruited through social media; parents of the FASD group also assisted in identifying possible controls from their social networks. The control group comprised 25 adolescents without any diagnosis of neurodevelopmental disorders. Parents/caregivers confirmed that the participants in the control group had not been diagnosed with any neurodevelopmental disorders at the time of this research. Twenty-two participants in the control group were of white ethnicity and three were Black-British. The control group had 14 (56%) females and 11 (44%) males with a mean age of 12.80 (SD = 1.63; Range = 11 – 16 years).

Instruments

Gudjonsson Suggestibility Scale 2 (Gudjonsson, 1987, 1997)

The GSS 2 consists of a short story followed by 20 questions, 15 of which are misleading. The test measures immediate and delayed recall of the story by providing a score out of 40 items correctly recalled. The scores obtained from the GSS 2 include: Yield 1, which is the number of leading questions to which the participant gives a false answer, the maximum score for which is 15; Yield 2, which measures the number of leading questions to which the participant

gives a false answer after receiving negative feedback (maximum score 15); Shift, which measures the number of questions to which the participant changes the answer after receiving negative feedback (maximum score 20); and Total Suggestibility, which is the sum of Yield 1 and Shift, giving a maximum possible score of 35. The internal consistency and construct validity of the GSS2 is good with alpha coefficients of 0.87 for Yield 1, 0.90 for Yield 2 and 0.79 for Shift (Gudjonsson, 1992).

The Wechsler Intelligence Scale for Children – WISC-V (Wechsler, 2014).

The WISC-V is used to measure the intelligence of children between the ages of 6 and 16 years old, providing a comprehensive understanding of a child's cognitive abilities. The test provides assessors with a Full-Scale IQ score, as well as primary index scores and subtest scores. The primary index scores, which are calculated from 10 primary subtests, are intended to measure a child's verbal comprehension, visual-spatial abilities, fluid reasoning, working memory, and processing speed. Average test-retest reliability coefficients of the WISC-V subtests range from 0.72 to 0.91 while for internal consistency, the average split-half reliability coefficients range from 0.80 to 0.96 (Wechsler, 2014).

Behaviour Rating of Executive Function – 2 (BRIEF – 2); (Gioia et al., 2015)

The BRIEF-2 is a tool used to evaluate executive function in children as reported by parents, teachers and self-report (Gioia et al., 2015). The Inhibit subscale of the BRIEF-2 was used to assesses participants' ability to control their impulses. Test-retest reliability of the BRIEF-2 has been evidenced to be approximately 0.79, 0.87, and 0.80 for the parent, teacher, and self-report forms respectively (Gioia et al., 2015). Internal consistency refers to the extent to which items on a scale measure the same underlying construct or parameter. The internal consistency of the BRIEF-2 is considered very good with scores of 0.89, 0.91 and 0.87 for the parent, teacher, and self-report forms respectively (Gioia et al., 2015).

Procedure

All instruments were administered remotely due to the COVID-19 related restrictions on in-person meetings. Remote administration of psychological tools has been shown to be valid (Hamner et al., 2022; Wachi et al., 2019). After consent/assent was obtained from parents of participants and the adolescents, three sessions were held with the participants: immediate

suggestibility test session (first session), one-week repeat suggestibility session (second session), and a WISC assessment session (third session). Participants completed the BRIEF-2 independently via the online HOGREFE platform.

GSS

The GSS was administered using video conferencing technology (Microsoft Teams) as a meeting platform which also provided an opportunity to record and transcribe participants responses. Participants were sent a meeting link prior the assessment date and the GSS was administered. The GSS 2 story was narrated to participants, after which immediate recall was assessed. A break of 50 minutes was offered to participants before delayed recall was assessed and administration of the 20 questions from the GSS. After one week, participants were invited for a repeat administration of the GSS, which commenced by assessing their recall after 1 week and then administration of the 20 GSS questions. The GSS 2 story was not repeated during the one-week follow-up assessment.

BRIEF-2

The BRIEF-2 assessment was administered via the HOGREFE online testing system which provided separate links to the parent, teachers, and self-report forms.

WISC-V

For the WISC-V assessments, Microsoft teams was employed alongside a mirroring software – Reflector 3 – to administer the assessment. All remote administration adhered to the guidelines provided by the test publishers as well as the guidance on remote administration published by the British Psychological Society (British Psychological Society [BPS], 2020).

Analytical strategy

Memory recall on the GSS was coded by the first author (DG), after which an independent researcher (CL) blindly recoded the memory recall. DG proofread the transcripts (from Microsoft Teams) and corrected all transcription errors; coding was then undertaken using the proofread transcripts. Data were first screened, checked for normality using the Shapiro-Wilk test, and then descriptive statistics was employed to establish the mean difference between the FASD group and the control group, as well as effect sizes. Interrater reliability

was calculated to establish the extent of agreement between the first author's coding of memory recall and the independent researcher (LC). Results from the test for normality confirmed that several measures violated assumptions of normality with $p < .05$. For instance, the memory recall measure (part of the immediate suggestibility test) before the 50 minutes delay ($W(23) = .85, p < .001$) and memory recall after the 50 minutes delay ($W(23) = .897, p < .001$) showed a non-normal distribution in the FASD group. Following the test of normality, non-parametric tests were employed to analyse the data. Mann Whitney U tests were used to examine differences between the two groups, and Spearman's Rho correlation coefficients were computed to measure the association between the measured variables. Effect sizes were calculated using the formula $r = Z/\sqrt{N}$. Hierarchical regression analysis was employed to predict interrogative suggestibility (as dependent variable), with group (FASD vs control), age, IQ, impulsivity, and memory recall were entered as independent variables. Independent variables for Yield 1 and Shift were added in three stages: Stage 1 (age, sex, group), Stage 2 (Delayed recall during first session; IQ), and Stage 3 (Executive function and Impulsivity). This allowed to predict the incremental effects of memory, IQ, executive function and impulsivity since memory and IQ are known to impact suggestibility. Analyses were computed by the Statistical Package for Social Sciences (SPSS) version 27.1.

Results

Interrogative suggestibility

Table 1 displays the Mean (SD) of the FASD group and the control group alongside effect sizes and Mann Whitney U tests of differences between groups. Memory recall was significantly poorer in the FASD population when compared to controls; interrater reliability for memory recall coding between the two coders reveal a high agreement rate (98%). No significant difference was found between males and females in the FASD group and control group, aside shift score in the FASD group ($Z = -2.18; p = .03$) during immediate GSS assessment and Total suggestibility at one-week follow-up ($Z = 1.47; p = .03$).

Impulsivity and general executive function

Results from the BRIEF-2 assessment indicate that the FASD group were significantly more impulsive with lower executive function across the parents, teachers, and self-report forms

with high effect sizes ($p < .05$; $r > .70$). The BRIEF-2 provides measures in form of T-scores. T-scores less than 60 are considered in the normal range; T-scores from 60 to 64 are noted as mildly elevated; T-scores from 65 to 69 are rated as potentially clinically elevated, while T-scores at or greater than 70 are considered clinically elevated.

Intelligence Quotient (IQ)

The FASD group had significantly lower IQ scores (Mean (SD) = 78.65; $p < .05$; range = 70 - 105) in comparison to the control group (Mean (SD) = 111.86; $Z = -5.09$; $p < .05$; range = 97 - 134) with high effect size ($r = .77$).

Table 1: Mean suggestibility scores for individuals with FASD compared to the control group

	FASD Group Mean (SD)	Control Group Mean (SD)	Z-Scores	Effect Sizes $r = Z/\sqrt{N}$
Immediate recall	5.10 (4.00)	16.07 (7.12)	-4.90***	0.69
Delayed Recall	5.00 (4.32)	15.88 (6.33)	-5.25***	0.73
Yield 1	7.44 (3.00)	3.88 (3.18)	3.65***	0.51
Yield 2	8.22 (3.11)	5.28 (3.74)	2.78**	0.39
Shift	6.04 (3.61)	3.72 (3.21)	2.40**	0.33
Total suggestibility	13.48 (5.52)	7.60 (4.89)	3.48***	0.48
BRIEF-2 Executive Function (Self-report)	72.24(8.56)	53.47(10.34)	-4.10***	0.70
BRIEF-2 Executive Function (Parent report)	73.00 (6.97)	44.29(6.95)	-5.36***	0.92
BRIEF-2 Executive Function (Teachers report)	70.17 (7.78)	44.00 (3.47)	-4.33***	0.74
BRIEF-2 Impulsivity (Self-report)	72.76(9.63)	53.47(7.17)	-4.32***	0.74
BRIEF-2 Impulsivity (Parent report)	80.52(7.96)	46.29(7.22)	-5.31***	0.91
BRIEF-2 Impulsivity (Teacher's report)	68.58(9.74)	44.57(3.55)	-4.32***	0.74
Intelligence Quotient	78.65 (19.33)	111.86 (27.08)	-5.10***	0.77
Suggestibility at one-week follow-up:				
Memory recall	4.56 (3.83)	13.44 (5.63)	-4.72***	0.70
Yield 1	8.83 (3.85)	4.28 (3.66)	-3.69***	0.54
Yield 2	8.34 (3.85)	4.80 (3.64)	3.06**	0.45
Shift	4.13 (3.62)	2.48 (2.68)	1.52	0.22
Total Suggestibility	12.44 (6.57)	6.76 (5.40)	2.97**	0.43

SD: Standard Deviation ** = $p < .01$; *** = $p < .001$

Correlation results

i) Immediate suggestibility results

In the FASD group, a significant positive correlation ($r_s = .48, p < .05$) was seen between memory recall before 50minutes delay and age. Impulsivity and executive function were also significantly correlated ($r_s = .69, p < .001$). See table 3 for immediate suggestibility correlation scores in the FASD and control groups.

ii) Correlation between immediate and repeat suggestibility

All the suggestibility scores between immediate and repeat suggestibility, at one-week follow-up, were significant for the FASD Group: Yield 1 ($r_s = .55, p < .001$), Yield 2 ($r_s = .59, p < .05$), Shift ($r_s = .72, p < .001$), and Total Suggestibility ($r_s = .75; p < .001$). The respective correlations for the Control Group were as follows: Yield 1 ($r_s = .55, p < .001$), Yield 2 ($r_s = .68, p < .05$), Shift ($r_s = .29, ns$), and Total Suggestibility ($r_s = .52; p < .001$).

Table 2: Spearman's correlations (r_s) of the GSS measures, age, impulsivity, IQ and executive function in FASD and Control group

FASD Group	1	2	3	4	5	6	7	8	9	10
1. Age	-									
2. Immediate memory recall	.48*									
3. Delayed memory recall	.26	-								
4. Yield 1	.15	.08	-.07							
5. Yield 2	.06	.07	-.16	-						
6. Shift	.09	-.20	-.39	.37	-					
7. Total Suggestibility	.19	-.05	-.27	-	-	-				
8. Intelligence Quotient	.29	.35	.37	-.04	-.10	.15	.07			
9. Impulsivity	-.08	-.15	-.04	-.19	-.23	.04	-.07	.11		
10. Executive Function	-.20	-.17	-.07	-.16	-.17	-.11	-.13	-.17	.69**	-
Control Group	1	2	3	4	5	6	7	8	9	10
1. Age										
2. Immediate memory recall	-.22									
3. Delayed memory recall	-.13	-								
4. Yield 1	-.21	-.42	-.45*							
5. Yield 2	-.12	-.51*	-.46*	-						
6. Shift	.19	-.34	-.23	.26	-					
7. Total Suggestibility	-.11	-.41	-.34	-	-	-				
8. Intelligence Quotient	-.21	.34	.23	.04	-.06	-.10	.05			
9. Impulsivity	.06	-.04	-.04	-.30	-.23	.08	-.04	-.34		
10. Executive Function	.05	-.29	-.31	-.15	-.04	.01	-.07	-.43	.71**	

* $p < .05$; ** $p < .001$

Table 3: Correlation (r_s) between immediate and one week suggestibility in the FASD and Control groups

FASD Group	Immediate Yield 1	Immediate Yield 2	Immediate Shift	Immediate Total Suggestibility
One-week Yield 1	.55**	.74**	.55**	.60**
One-week Yield 2	.27	.49*	.27	.28
One-week Shift	.44*	.27	.72**	.70**
One-week Total Suggestibility	.49*	.55**	.81**	.75**
Control Group	Immediate Yield 1	Immediate Yield 2	Immediate Shift	Immediate Total Suggestibility
One-week Yield 1	.55**	.56**	.33	.55**
One-week Yield 2	.50*	.68**	.52**	.59**
One-week Shift	.42*	.57**	.29	.44*
One-week total suggestibility	.52**	.61**	.33	.52**

* $p < .05$; ** $p < .001$

Hierarchical Regression Analysis for immediate suggestibility (Yield 1 and Shift).

A hierarchical regression analysis was used to examine if age, Group, and Sex (Model 1) memory and IQ (Model 2), and impulsivity and executive function (Model 3) predicted Yield 1 and Shift (immediate) suggestibility. For Yield 1 only Model 1 was significant ($p < .001$; $Adjusted R^2 = .24$). Only Group added significantly to the final Model ($\beta = 0.43$, $p < .05$). None of the three models were significant for Shift.

	B	SE B	B	Sig.
Yield 1:				
Age	-2.30	3.69	-0.08	0.54
Group	3.03	1.40	0.43	0.04
Gender	0.52	0.89	0.07	0.56
Delayed recall	-0.18	0.09	-0.38	0.05
IQ	0.02	0.02	0.16	0.31
Executive function	-0.07	0.09	-0.20	0.45
Impulsivity	0.00	0.09	0.00	0.99
<i>Adjusted R² = .29; $\Delta R^2 = .08$; $p = 0.08$ for step 2</i>				
<i>Adjusted R² = .28; $\Delta R^2 = .02$; $p = 0.50$ for step 3</i>				
Shift:				
Age	0.67	1.03	0.09	0.52
Group	0.09	0.39	0.05	0.82
Gender	0.21	0.25	0.11	0.41
Delayed recall	-0.06	0.02	-0.47	0.02
IQ	0.00	0.01	0.12	0.47
Executive function	-0.06	0.02	-0.64	0.03
Impulsivity	0.06	0.02	0.64	0.02
<i>Adjusted R² = .13; $\Delta R^2 = .07$; $p = 0.14$ for step 2</i>				
<i>Adjusted R² = .28; $\Delta R^2 = .10$; $p = 0.06$ for step 3</i>				

Discussion

Despite the recognition that individuals with FASD are significantly more likely to encounter the CJS (Popova et al., 2011), this is the first attempt to empirically assess a hypothesised key area of weakness in adolescents with FASD: interrogative suggestibility.

As hypothesised, individuals with FASD demonstrated a significantly higher level of total suggestibility compared to the control group, when independently measured immediately and after one week. The findings support the findings from a pilot study by Brown et al. (2011)

which compared immediate suggestibility scores from a small sample of individuals with FASD (n=7) to normative scores in the UK general population and normative scores from a court-referred sample.

The second hypothesis that there would be a significant relationship between Immediate and repeat suggestibility at one-week follow was also supported. This is consistent with a previous study (Singh & Gudjonsson, 1984). Of note is the finding of a large group difference in the correlations between the two Shift scores (immediate and one week apart). The large correlation ($r_s = .72$) between the two Shift scores among the FASD Group is in sharp contrast with that found for the Control Group ($r_s = .29$). The finding regarding Shift in the Control Group is consistent with those Singh and Gudjonsson (1984) found in their study of normal functioning individuals ($r_s = .23$).

The correlations between immediate and repeat suggestibility in the current and Singh and Gudjonsson (1984) studies involved the participants being asked the 20 questions without the story being read out to them again. This methodology is different to the same test, or a parallel test being administered in full again, either by the same or another psychologist. When this was done then the test-retest correlations between all the suggestibility scores fell between .73 to .92 among three separate samples ($r_s = .73, .79, .80$ for Shift). Therefore, the FASD Group in the current study reacted like the entire test had been administered again, unlike the Control Group. This is a novel finding that requires further research.

A distinction must also be made between repeat and delayed suggestibility. Unlike repeat suggestibility, which can either be measured as in the present study or by re-administration of the same or parallel test, delayed suggestibility using the Gudjonsson Suggestibility Scales refers to the extent to which the leading questions have been incorporated into subsequent memory recollection (Gudjonsson et al., 2016; Ridley & Gudjonsson, 2013). Delayed suggestibility is powerfully influenced by history and severity of trauma symptoms (Gudjonsson et al., 2020). Regarding immediate suggestibility, Shift is the measure most strongly associated with severity of trauma symptoms (Childs et al., 2021; Gudjonsson et al., 2020).

The FASD group in our study changed their responses significantly more (shift) upon receipt

of negative feedback compared to the control group, in coherence with the findings from Brown et al. (2011). However, our findings only partly supported the premise that individuals with FASD were more impaired in the ability to cope with interrogative pressure. This is because our effect sizes were consistently larger for yield before negative feedback when compared to the effect sizes of the shift scores. Cognitive uncertainty is suggested to increase upon receipt of negative feedback leading to a shift in responses (Drake & Bull, 2011; Gudjonsson & Pearse, 2011). After one week, the difference in the shift between the two groups became non-significant. In the non-FASD literature, shift is suggested to be an attempt by interviewees to improve their performance in reaction to interrogative pressure applied by interviewers (Gudjonsson, 2003a). Anxiety, avoidance, and social processes are suggested to create a negative perception of the interrogative situation leading to a reduced ability to cope with negative feedback, leading to a shift in responses (Drake, 2010; Gudjonsson, 2003b). In this study, it is theoretically possible that after one week, anxiety levels from negative feedback were lower compared to the immediate assessment.

The present study found that individuals with FASD have significantly higher impulsivity, consistent with the literature (e.g., Furtado & de Sa Roriz, 2016; Kodituwakku & Kodituwakku, 2014). As also anticipated, the average IQ of individuals in the FASD group was found to be lower than that of the control group as found in previous studies (Rasmussen, 2005). However, the range of IQ scores in the FASD group was above the minimum threshold required to access support in legal proceedings (IQ < 70).

There was no correlation between suggestibility and age in the FASD group, contrary to the wider literature (Bruck & Melnyk, 2004; Gudjonsson et al., 2016). Due to a developmental increase in cognition with an increase in age, age is suggested to be negatively correlated with suggestibility (Melinder et al., 2006; Redlich & Goodman, 2003). It was anticipated that memory recall will be negatively correlated with suggestibility and positively with IQ; however, this was not evidenced in this study. It could be possible theoretically, that the testing mode may have impacted this unexpected finding.

The regression analysis in this study suggests that having a diagnosis of FASD significantly predicts higher levels of acceptance to leading or questions (as measured by 'yield'). None of the three models were significant with shift as output variable; however, the regression result

suggests that having lower memory recall, low executive function and higher levels of impulsivity may result in higher levels of change in responses after receipt of negative feedback.

Legal implications of findings

There are potential legal implications from the findings of the present study. Firstly, the suggestibility assessments were conducted remotely with milder interrogative pressure in comparison to real interrogation scenarios. In real-life scenarios with higher levels of interrogative pressure, uncertainty, and expectations, individuals with FASD may be at risk of being more suggestible. While GSS assessments do not indicate that the assessed individual is incapable of providing reliable testimony, it reflects the vulnerabilities that may impact testimonies under interrogation. Findings from this study suggest that individuals with FASD are significantly vulnerable to leading questions and interrogative pressure. A range of other professions, within the criminal justice system and beyond, may also benefit by taking note of these preliminary findings, since individuals with FASD are likely to encounter a range of other professionals (Gibbs et al., 2018; Gilbert et al., 2021).

The average IQ of the FASD sample was above 70 despite their vulnerabilities; this finding highlights the importance of considering other vulnerabilities in addition to IQ when assessing the needs of individuals with FASD in legal proceedings. This is especially important because the suggestibility scores obtained from the current study are comparable to individuals with intellectual disability (Gudjonsson & Henry, 2003). Despite having comparable suggestibility scores with individuals that have intellectual disability, FASD-impacted individuals do not automatically have access to mitigated sentencing when in contact with the CJS. Furthermore, legal processes and prison/bail conditions are often transmitted in lengthy, complicated statements. With an IQ below the neurotypical individuals, individuals with FASD may find it difficult to comprehend their rights. McLachlan et al. (2014) for example found that individuals with FASD are likely to waive their Miranda rights (due to lack of understanding) during arrests by the CJS, thereby making them vulnerable to self-incriminatory statements. Finally, the poor memory seen in this study highlights another key vulnerability: individuals with FASD may find it challenging to remember events leading to the CJS encounter, their bail,

or sentencing obligations. Nadel and colleagues (2012) argue that memory is a crucial asset during CJS, and a poor memory could bear significant implications for individuals with FASD.

Limitations

The sample employed in the current study is the largest sample used till date in the assessment of interrogative suggestibility in individuals with FASD. However, it is possible that small effect sizes were not detected due to the currently employed sample size. Adolescents having a diagnosis of FASD with extremely high impulsivity could not participate in the study as parents/caregivers felt they were unable to accommodate remote testing environments beyond a few minutes.

Future research recommendations

Generally, larger studies on the interrogative suggestibility of the FASD population will be useful. Other factors such as anxiety, socially desirable responding, credulity, and formal measures of executive functioning will be useful to examine alongside suggestibility, in order to understand the mechanism of suggestibility in the FASD population.

Conclusion

It is strongly recommended that CJS establishes whether suspects, witnesses and victims of crimes may have been impacted by prenatal alcohol exposure, because this may be a source of significant vulnerability. For those known or suspected to have been prenatally exposed to alcohol, it will be important for the CJS to adopt better investigative interviews with less reliance on suggestive/leading questions and provide FASD-aware support.

Declaration of competing interest: The authors have no competing interest to declare.

Funding: No funding was received for this study.

Acknowledgements

The authors would like to thank participants who took part in this study and Layla Carey who served as an independent coder for the memory recall of the GSS. Thank you to the organisations who assisted in advertising this study: NationalFASD, FASDHub Scotland, 10GM, Alcohol Exposed Pregnancy (AEP) group; potato group.

References

- Bartlett, J. (2019). Introduction to sample size calculation using G* Power. In. British Psychological Society (BPS). (2020). Psychological assessment undertaken remotely. <https://www.bps.org.uk/guideline/psychological-assessment-undertaken-remotely>
- Brown, N. N., Gudjonsson, G., & Connor, P. (2011). Suggestibility and Fetal Alcohol Spectrum Disorders: I'll tell you anything you want to hear. *The Journal of Psychiatry & Law*, 39(1), 39-71.
- Brown, J., Wartnik, A., Aiken, T., Watts, E., Russell, A., Freeman, N., ... & Cich, J. (2016). Fetal Alcohol Spectrum Disorder and Suggestibility: Tips for Criminal Justice Interviewers. *Journal of Law Enforcement*, 5(4).
- Brown, J., Asp, E., Carter, M. N., Spiller, V., & Bishop-Deaton, D. (2020). Suggestibility and confabulation among individuals with Fetal Alcohol Spectrum Disorder: A review for criminal justice, forensic mental health, and legal interviewers. *International Journal of Law and Psychiatry*, 73, 101646.
- Bruck, M., & Melnyk, L. (2004). Individual differences in children's suggestibility: A review and synthesis. *Applied Cognitive Psychology*, 18(8), 947-996.
- Childs, S., Given-Wilson, Z., Butler, S., Memon, A., & Gudjonsson, G. (2021). Vulnerability to interrogative suggestibility from negative events. A comparison of separated asylum-seeking youth and aged-matched peers. *Personality and Individual Differences*, 173
- Chrobak, Q. M., & Zaragoza, M. S. (2013). The misinformation effect: Past research and recent advances. *Suggestibility in legal contexts: Psychological research and forensic implications*, 21-44.
- Drake, K., & Bull, R. (2011). Individual differences in interrogative suggestibility: Life adversity and field dependence. *Psychology, Crime & Law*, 17(8), 677-687.
- Drake, K. E. (2010). The psychology of interrogative suggestibility: A vulnerability during interview. *Personality and Individual Differences*, 49(7), 683-688.
- Furtado, E. F., & de Sa Roriz, S. T. (2016). Inattention and impulsivity associated with prenatal alcohol exposure in a prospective cohort study with 11-years-old Brazilian children. *European Child & Adolescent Psychiatry*, 25(12), 1327-1335. <https://doi.org/10.1007/s00787-016-0857-y>
- Fuster, J. (2015). *The prefrontal cortex*. Academic press.
- Gilbert, D. J., Allely, C. S., Mukherjee, R. A. S., & Cook, P. A. (2022). Foetal alcohol spectrum disorder and Investigative interviewing: A systematic review highlighting clinical and legal implications and recommendations. *Behavioral Sciences & the Law*, 40(1), 170-185.
- Gilbert, D. J., Mukherjee, R. A. S., Kassam, N., & Cook, P. A. (2021). Exploring the experiences of social workers in working with children suspected to have fetal alcohol spectrum disorders. *Adoption & Fostering*, 45(2), 155-172.
- Gilbert, D. J., Hickman, N; Allely, C. S., Mukherjee, R. A., & Cook, P. A.(Under peer review). 'We'd be very chuffed if we keep them out of prison': Parents report of predisposing factors to criminal justice encounters of children with Fetal Alcohol Spectrum Disorders (FASD).
- Gilbert, D. J., Hickman, N; Allely, C. S., Mukherjee, R. A., & Cook, P. A.(Under peer review). 'I

inevitably get in trouble...in one way or another': qualitative exploration of the vulnerabilities and experiences of justice system encountered individuals with fetal alcohol spectrum disorder.

- Gioia, G. A., Isquith, P. K., Guy, S. C., & Kenworthy, L. (2015). *BRIEF-2: Behavior rating inventory of executive function*. Psychological Assessment Resources Lutz, FL.
- Gudjonsson, G. H. (1987). A parallel form of the Gudjonsson Suggestibility Scale. *British Journal of Clinical Psychology, 26*(3), 215-221.
- Gudjonsson, G. H. (1992). Interrogative suggestibility: factor analysis of the Gudjonsson Suggestibility Scale (GSS 2). *Personality and Individual Differences, 13*(4), 479-481.
- Gudjonsson, G. H. (1997). *The Gudjonsson suggestibility scales*. Psychology Press Hove.
- Gudjonsson, G. H. (2003a). Psychology brings justice: The science of forensic psychology. *Criminal Behaviour and Mental Health, 13*(3), 159-167.
- Gudjonsson, G. H. (2003b). *The psychology of interrogations and confessions: A handbook*. John Wiley & Sons.
- Gudjonsson, G. H. (2006). The psychological vulnerabilities of witnesses and the risk of false accusations and false confessions. *Witness testimony. Psychological, investigative and evidential perspectives, 61-75*.
- Gudjonsson, G. H. (2018). *The psychology of false confessions. Forty years of science and practice*. Chichester: Wiley Blackwell.
- Gudjonsson, G. H., & Clark, N. K. (1986). Suggestibility in police interrogation: A social psychological model. *Social Behaviour*.
- Gudjonsson, G. H., & Henry, L. (2003). Child and adult witnesses with intellectual disability: The importance of suggestibility. *Legal and Criminological Psychology, 8*(2), 241-252.
- Gudjonsson, G. H., & Pearse, J. (2011). Suspect interviews and false confessions. *Current Directions in Psychological Science, 20*(1), 33-37.
- Gudjonsson, G., Vagni, M., Maiorano, T., & Pajardi, D. (2016). Age and memory related changes in children's immediate and delayed suggestibility using the Gudjonsson Suggestibility Scale. *Personality and Individual Differences, 102*, 25-29.
- Gudjonsson, G., Vagni, M., Maiorano, T., Pajardi, D. (2020). The relationship between trauma symptoms and immediate and delayed suggestibility in children who have been sexually abused. *Journal of Investigative Psychology and Offender Profiling, 17* (3), 250-263 2020;1-14. <https://doi.org/10.1002/jip.1554>.
- Gudjonsson, G. & Young, S. (2021). An investigation of 'don't know' and 'direct explanation' response style on the Gudjonsson Suggestibility Scale: A comparison of three different vulnerability groups. *Personality and Individual Differences, 168*. <https://doi.org/10.1016/j.paid.2020.110385>.
- Gudjonsson, G. H., Young, S., & Bramham, J. (2007). Interrogative suggestibility in adults diagnosed with attention-deficit hyperactivity disorder (ADHD). A potential vulnerability during police questioning. *Personality and Individual Differences, 43*(4), 737-745.
- Hamner, T., Salorio, C. F., Kalb, L., & Jacobson, L. A. (2022). Equivalency of in-person versus remote assessment: WISC-V and KTEA-3 performance in clinically referred children and adolescents. *Journal of the International Neuropsychological Society, 28*(8), 835-844.
- Hoyme, H. E., Kalberg, W. O., Elliott, A. J., Blankenship, J., Buckley, D., Marais, A.-S., . . . Abdul-

- Rahman, O. (2016). Updated clinical guidelines for diagnosing fetal alcohol spectrum disorders. *Pediatrics*, *138*(2), e20154256.
- Kodituwakku, P., & Kodituwakku, E. (2014). Cognitive and behavioral profiles of children with fetal alcohol spectrum disorders. *Current Developmental Disorders Reports*, *1*(3), 149-160.
- Maras, K. L., & Bowler, D. M. (2012). Brief report: Suggestibility, compliance and psychological traits in high-functioning adults with autism spectrum disorder. *Research in Autism Spectrum Disorders*, *6*(3), 1168-1175.
- McLachlan, K., Roesch, R., Viljoen, J. L., & Douglas, K. S. (2014). Evaluating the psycholegal abilities of young offenders with fetal alcohol spectrum disorder. *Law and Human Behavior*, *38*(1), 10.
- Melinder, A., Endestad, T. O. R., & Magnussen, S. (2006). Relations between episodic memory, suggestibility, theory of mind, and cognitive inhibition in the preschool child. *Scandinavian Journal of Psychology*, *47*(6), 485-495.
- Mukherjee, R., Cook, P. A., Gilbert, D., & Allely, C. S. (2023). Overview of Offenders with Fetal Alcohol Spectrum Disorders. *Forensic Aspects of Neurodevelopmental Disorders: A Clinician's Guide*, 84.
- Nadel, L., Sinnott-Armstrong, W. P., & Sinnott-Armstrong, W. (2012). *Memory and law*. Oxford University Press.
- North, A. S., Russell, A. J., & Gudjonsson, G. H. (2008). High functioning autism spectrum disorders: An investigation of psychological vulnerabilities during interrogative interview. *The Journal of Forensic Psychiatry & Psychology*, *19*(3), 323-334.
- Otgaar, H., Schell-Leugers, J. M., Howe, M. L., Vilar, A. D. L. F., Houben, S. T. L., & Merckelbach, H. (2021). The link between suggestibility, compliance, and false confessions: A review using experimental and field studies. *Applied Cognitive Psychology*, *35* (2), 445-455. <https://doi.org/10.1002/acp.3788>.
- Popova, S., Lange, S., Bekmuradov, D., Mihic, A., & Rehm, J. (2011). Fetal alcohol spectrum disorder prevalence estimates in correctional systems: a systematic literature review. *Canadian Journal of Public Health*, *102*(5), 336-340.
- Rasmussen, C. (2005). Executive functioning and working memory in fetal alcohol spectrum disorder. *Alcoholism: Clinical and Experimental Research*, *29*(8), 1359-1367.
- Redlich, A. D., & Goodman, G. S. (2003). Taking responsibility for an act not committed: The influence of age and suggestibility. *Law and human behavior*, *27*(2), 141-156.
- Ridley, A. M., & Gudjonsson, G. H. (2013). Suggestibility and individual differences: psychosocial and memory measures. In Anne M Ridley, Fiona Gabbert, & David J La Rooy (Eds.), *Suggestibility in legal contexts. Psychological research and forensic implications* (pp. 85-106). Chichester: Wiley-Blackwell.
- Singh, K. K., & Gudjonsson, G. H. (1984). Interrogative suggestibility, delayed memory and self-concept. *Personality and Individual Differences*, *5*, 203-209.
- Streissguth, A. P., Bookstein, F. L., Barr, H. M., Sampson, P. D., O'Malley, K., & Young, J. K. (2004). Risk factors for adverse life outcomes in fetal alcohol syndrome and fetal alcohol effects. *Journal of Developmental & Behavioral Pediatrics*, *25*(4), 228-238.
- Wachi, T., Watanabe, K., Yokota, K., Otsuka, Y., & Hirama, K. (2019). The immediate and

delayed suggestibility examined by the online version of the Gudjonsson Suggestibility Scale 2. *Personality and Individual Differences*, 146, 20-25.

Wechsler, D. (2014). *WISC-V: Technical and interpretive manual*. NCS Pearson, Incorporated.