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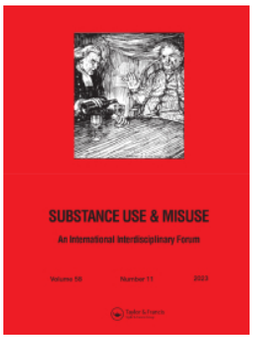

Substance Use & Misuse

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/isum20

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To cite this article: Catharine Montgomery, Amanda Atkinson, Andrew Jones & Harry Sumnall (2023): Little Evidence for the Role of Disgust Sensitivity in Implicit Disgust to Images of White People Engaged in Injecting Drug Use (IDU), Substance Use & Misuse, DOI: 10.1080/10826084.2023.2247054

To link to this article: https://doi.org/10.1080/10826084.2023.2247054

Published online: 21 Aug 2023.

SUBSTANCE USE & MISUSE
https://doi.org/10.1080/10826084.2023.2247054

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ORIGINAL ARTICLE

Little Evidence for the Role of Disgust Sensitivity in Implicit Disgust to Images of White People Engaged in Injecting Drug Use (IDU)

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ABSTRACT

Background: Previous research has shown that People Who Inject Drugs (PWID) are subject to public stigma, which affects access to, and provision and quality of, treatment and support services. Less is known about the socio-cognitive processes that support the development and maintenance of public stigma toward PWID. The present study investigated the role of disgust sensitivity in implicit disgust to injecting drug use. *Methods*: 126 participants took part in an online Implicit Association Task (IAT) measuring implicit disgust to pictorial stimuli of injecting drug use or medical injecting. Participants also completed The Disgust Scale Revised, Injecting Phobia Scale (Short Form), Attitudes to People Who Use Drugs (PWUD) scale and a substance use inventory. *Results*: Average IAT score was negative indicating significantly higher implicit disgust to injecting drug use. Hierarchical linear regression found that injecting phobia predicted implicit disgust to injecting drug use. Questionnaire measures of disgust did not predict implicit disgust. While animal reminder disgust and injecting phobia were significantly correlated with each other, animal reminder disgust did not predict implicit disgust scores. *Conclusions*: On the basis of our findings, stigma toward PWID may not be a result of feelings of disgust toward injecting drug use. We discuss findings in the context of the underlying cortical processes supporting implicit and explicit representations of disgust. Future research should seek to investigate neurophysiological evidence for disgust to and stigmatization of injecting drug use and the potential role of domains of disgust in this.

KEYWORDS

Injecting drug use; disgust; stigma; implicit bias; IAT

Introduction

Stigma refers to biased attitudes and/or behaviors toward individuals belonging to a particular group, who are perceived to possess a characteristic that is contrary to a social norm (Link & Phelan, 2006; Stafford & Scott, 1986). People Who Use Drugs (PWUD) are one such group who are highly stigmatized (Sumnall et al., 2021a), although this is dependent upon the substances used and the characteristics of those who are using it (McElrath & McEvoy, 2001, Pennay & Measham, 2016). People who inject drugs (PWID) are particularly stigmatized, with studies reporting participants' low levels of warmth, greater social distance, and preference for punitive responses toward PWID, including by non-injecting PWUD (e.g., Broady et al., 2020; Capitanio & Herek, 1999; Herek et al., 2003). Negative attitudes toward PWUD further increase social inequality and reinforce discrimination as they result in less public and policy support for PWUD, which can undermine high quality and evidence-based service provision (Andersen & Kessing, 2019; Lancaster et al., 2017). To further compound this, when feelings of stigma are internalized by PWUD, these internalized feelings can present barriers to seeking treatment, and are associated with increased health risk behaviors (Bayat et al., 2020; Biancarelli et al., 2019; Rivera et al., 2014).

In addition to socio-demographic characteristics (e.g., Broady et al., 2020; Lim et al., 2013), there are many psychological factors that contribute to stigmatizing attitudes and discrimination practices toward PWUD. From a psychosocial perspective, beliefs about the controllability of stigmatized behavioral attributes, media representations of PWUD (e.g. Atkinson et al., 2019; Atkinson & Sumnall, 2020), the popular use of pejorative labels such as "addict" and "junkie" (Ashford et al., 2019; Lancaster et al., 2017), and framing substance use as a failure of personal morality (MacCoun, 2013) have all been identified as factors which promote negative outgroup stereotypes and perpetuate public stigma toward PWUD. Conversely, presentation of substance use as a behavior stemming from Adverse Childhood Experiences (ACE), for example, or describing structural barriers to accessing treatment have been associated with less stigmatizing attitudes toward PWUD (Kennedy-Hendricks et al., 2017; Sumnall et al., 2021a). While such studies help to explain external processes, which can influence stigmatization of an outgroup, they do not identify internal cognitive mechanisms for development and maintenance of stigma toward PWUD. Dehumanization,

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making subtle or blatant judgements about the humanness of an out-group relative to the in-group, was found to be one such cognitive mechanism that could promote social distancing from, and increased stigmatization of, people who use heroin (Sumnall et al., 2021b). Subtle and blatant dehumanization toward people who use heroin was relatively greater when compared to the general population, other stigmatized groups (e.g., people who are homeless, obese, people with serious mental illness) and people who use less stigmatized drugs such as cannabis (Sumnall et al., 2021b). Dehumanizing and stigmatizing attitudes toward PWUD may also reflect in-group strategies of moral disengagement, whereby dehumanizing of out-group members is associated with reduced empathy toward the outgroup (e.g., PWUD) and also increases in hostility and stigmatization (Boysen et al., 2020). Increased social distancing, and perceptions of dangerousness, and higher levels of support for discriminatory and aggressive policies targeting out-groups have all been observed following subtle dehumanization of other stigmatized groups (Fontesse et al., 2021; Kersbergen & Robinson, 2019; Martinez, 2014; Martinez et al., 2011).

Another sociomoral factor suggested to have a role in dehumanization and stigma is disgust, an emotion with distinctive physiological, behavioral and cognitive elements (Tybur et al., 2009). While disgust has been defined as a defensive mechanism that has evolved to protect against harm by promoting withdrawal from food contaminants (Vicario et al., 2017), it has also been observed in relation to non-food stimuli suggesting that it has a more wide-ranging function that extends to interpersonal and social interactions (Rozin et al., 1993; 2008). Disgust has been observed toward sexual acts (Haidt et al., 1994), moral judgements, physical and psychological threats (Tybur et al., 2009). Stigma and disgust have been found to be strongly related to each other. In one fMRI study, comparing activation to stigmatized faces (obesity, facial piercings, transsexual, and unattractive categories) and control faces, control faces were rated as significantly less disgusting than all other categories (Krendl et al., 2006). In another study, desire for increased social distance from PWID was demonstrated in a survey investigating perceptions of people who use opioids; only 10% of respondents rated opioid users as strong (compared to weak), 27% as deserving (compared to worthless) and only 15% would want an opioid user marrying into their family (McGinty et al., 2018). In a US general population sample, 70% of respondents agreed that PWID are "disgusting" and "a threat to society", which seems to have a moral basis as 90% of respondents agreed that injecting drug use was "just plain wrong" (Capitanio & Herek, 1999). Moreover, while some facets of disgust may have an evolutionary basis, it is likely that stigma and disgust have a reciprocal relationship and in the context of PWUD, the development of disgust and prejudices toward different social groups is dictated by learned behaviors and socio-political influence (see Tyler, 2020). One facet of disgust, disgust propensity (a general tendency to respond with disgust to a particular situation i.e. how likely a person is to be disgusted, see e.g. Schienle et al., 2022), has also been found to be related to stigma toward homosexuality (Olatunji, 2008), obesity (Vartanian, 2010), and cancer patients (Pryor et al., 2004). Disgust sensitivity (the strength of a disgust response to a particular stimulus i.e. how strong a disgust response is, see e.g. Tybur et al., 2018) has been shown to predict avoidance behavior to anxiety provoking stimuli (Nicholson & Barnes-Holmes, 2012), and is related to a range of psychopathologies (e.g. eating disorders, separation anxiety). Disgust sensitivity can facilitate anxiety and stress brought on by external stimuli through its interaction with other human emotions such as guilt and shame (Davey, 2011), and in the present study we propose that these mechanisms interact to strengthen disgust toward PWUD.

The model of disgust described by Olatunji et al. (2007) including 3 domains of disgust, is used in the present study. *Core* disgust is characterized by innate disgust responses such as food rejection after ingestion of offensive stimuli e.g., eating monkey meat; *Animal Reminder* disgust is characterized by disgust toward stimuli that remind us of our animal origins and mortality e.g., touching a dead body; and *Contamination* disgust is characterized by disgust to disease/illness spread by humans e.g., drinking from someone else's cup. It is proposed that disgust elicitors related to death, aggression and sexuality promote disgust as they remind us of our animal nature i.e., that we are not that different to animals. This results in social distance from, and exclusion of, outgroup members for fear of contamination. In this way, holding stigmatizing or dehumanizing attitudes and disgust appear to have developed from sometimes maladaptive protective mechanisms designed to prevent contamination/harm of the self (Hodson & Costello, 2007), and would be expected to have a reciprocal relationship whereby an increase in one would promote an increase in the other. Moreover, disgust-inducing stimuli not only promote hypo-mentalisation (attributing fewer human characteristics to stimuli we find disgusting) which could increase dehumanizing attitudes toward such stimuli (Sherman & Haidt, 2011), but also guide moral evaluations of others (Schnall et al. 2008). The links between animalistic dehumanization and disgust have been demonstrated using a dehumanization implicit association task (IAT), where disgusted participants show the highest dehumanizing biases (between outgroup and animals) relative to non-disgusted participants (Buckels & Trapnell, 2013).

Disgust sensitivity has been investigated in the context of substance use beliefs (Oosterhoff & Shook, 2017) where sexual and moral disgust sensitivity were associated with greater support for drug laws and lower substance use. The latter was partially mediated by individual beliefs regarding substance-related harm suggesting that disgust to other PWUD could be mediated by the same mechanism (i.e. fear of contamination/harm *via* contagion). Moreover, PWUD have a higher likelihood of contracting and thus transmitting infectious disease (Harris et al., 2016; Kolla et al., 2020; Zibbell et al., 2018) and public health campaigns have capitalized on this by promoting fear and disgust in their presentation of PWUD and smokers (see Lupton, 2015 for discussion). In line with this, it may be that PWID are viewed with heightened disgust relative to PWUD due to the method of administration (Herek et al., 2003), and the concept of Blood Injection Injury (BII) phobia. BII phobia has

a median onset age of 5.5 years (Bienvenu & Eaton, 1998), and is influenced by learned behaviors including classical conditioning (repeated pairing of needle and pain) and fear modeling (from e.g. parents) (see Merckelbach et al., 1996 for review). Interestingly, heightened disgust sensitivity has been shown to increase fainting responses in those with BII phobia, and disgust evoking images can increase fear reporting in experimental paradigms suggesting that fear and disgust are linked (see Woody & Teachman, 2000 for review). Campaigns aimed at preventing substance use have capitalized on these disgust associations, utilizing images of IDU and paraphernalia to emphasize the perceived threat (see Mold, 2021 for review), further strengthening the threat-relevance of such items. Thus, BII phobia could potentially influence perceptions of disgust related to images of injecting drug use.

In addition while it is clear that attitudes to PWUD play a role in disgust sensitivity, there are a number of personal characteristics (e.g. gender, age) which can affect a disgust response, both alone and in combination with other personal and situational factors. For example, disgust sensitivity is subject to gender differences, with women exhibiting consistently higher levels of disgust than men (see Al-Shawaf et al. 2018 for review), a highly replicable state and trait response (Tybur et al., 2009) with large effect sizes (Al-Shawaf et al., 2015). Disgust Sensitivity has been shown to demonstrate a constant decline across the life course (Curtis et al., 2004) with older participants exhibiting lower levels of DS. However, age has a less clear-cut role in attitudes toward PWUD with both younger (16-29) and older (60+) cohorts reporting more negative attitudes (Singleton, 2010), while evidence on gender differences in attitudes to PWUD is sparse. In addition to characteristics of the perceiver, characteristics of the individual being judged have also been shown to play a role in the allocation of blame, stigma and disgust. While gender of the person being judged seems to yield more equivocal results with men and women equally as likely to be perceived negatively due to their substance use (Meyers et al., 2021), research indicates that there are significant racial biases in perceptions of disgust (Liu et al., 2015) with racial biases indicating that black Americans are more likely to be arrested and imprisoned for drug related offenses despite white Americans using substances to a similar level (El-Sabawi & Oliva, 2022). Similarly, there are racial and ethnic disparities in sentencing in the UK, including for drug offenses (Veiga et al., 2023). Black people in some UK cities are disproportionately searched in relation to drug possession offenses and are more likely to be arrested on drugs charges (Eastwood et al., 2013). Prior research has investigated representations of minority ethnic groups in public understanding of drug harms (cf El-Sabawi & Oliva, 2022), and identified historical over-representation of young black males in media depictions of drug-related crime which may have effects on public perception of drug use (Cushion et al., 2010).

In summary, PWUD and in particular PWID are stigmatized and dehumanized; people report feelings of disgust toward PWUD, and disgust, dehumanization and holding stigmatizing attitudes appear to serve the self as protectors of physical, psychological and moral integrity. Despite the general body of research in disgust, stigma and health, and examinations of stigma toward PWUD, there are few studies investigating the link between disgust and stigma toward PWUD. The link between animalistic dehumanization and disgust observed in previous research suggests that stimuli related to injecting drug use would promote disgust, which in turn could promote social distance and stigmatization of PWID. However, as research on unconscious bias and prejudice demonstrates, these biases are not always available to conscious awareness, with explicit and implicit prejudice predicting different aspects of stigmatizing attitudes (Boniecki & Jacks, 2002). Implicit disgust is similar to implicit or unconscious bias. Moreover, different implicit aspects of disgust have been shown to relate to avoidance behaviors with implicit disgust *propensity* related to obsessing and washing concerns after contamination and implicit disgust *sensitivity* predicting avoidance behaviors (Nicholson & Barnes-Holmes, 2012). Measuring implicit disgust (with an IAT as used in the present study) allows us to assess these unconscious biases, and mitigate any conscious control over explicit cognitions in relation to the images. For example, people may declare that they do not find IDU disgusting relative to medical injecting (which could either be their conscious knowledge about their own cognitions, or socially desirable responding in an attempt not to appear prejudiced). The present study therefore sought to investigate implicit cognitive processes (i.e. those which we are not consciously aware of). We assessed implicit disgust to injecting drug use using a pictorial Implicit Association Task; based on previous research, we included demographic characteristics (age, gender), attitudes to PWUD, Injecting Phobia and core, contamination, animal reminder and moral disgust as predictors ($N = 8$) in our model. It was hypothesized that implicit disgust to injecting drug use would be predicted by attitudes to PWUD and disgust sensitivity.

Method

Design

A cross-sectional design, where participants completed an online computerized Implicit Association Task (IAT) and questionnaire.

Participants

A convenience sample was recruited from the UK general public (*via* advertised call for participants on the research team's professional twitter accounts) and students (call for participants *via* email) at two universities in the North-West of England. Participants were eligible to take part if they were aged over 18 years and resided in the UK. Participants were excluded if they reported ever having received structured drug treatment for a substance use disorder, if they had no access to the internet, or if they did not possess an internet compatible device. To reduce demand characteristics and potential for bias, the study was advertised as *"Attention*

to Emotive Images". A priori power calculations were performed using G*Power 3.1 (Faul et al., 2007) indicating that to detect a medium effect size (f^2 = 0.15) for predicting implicit disgust in a multiple linear regression (Fixed model, R^2 increase; power 0.95; α = 0.05; 8 predictors), a minimum sample of 107 was required.

Overall, 182 experiment attempts were recorded on Inquisit web (version 6.5.1). Incomplete datasets (n = 19) were excluded. Participants who attempted the task on a mobile device (N = 37) were also excluded as the IAT used was not compatible with mobile devices. The final sample comprised 126 complete responses (46 male; mean age 25.03 ± 9.02). Data was collected between March and June 2021.

Materials

An abridged version of the *Substance use inventory* (Montgomery et al., 2005) was used to record self-reported substance use in the last year and lifetime in the sample.

Attitudes toward PWUD were assessed as per Sumnall et al. (2021b) using 19 questions taken from Singleton's (2010) attitude to people who use drugs survey. Questions were scored on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) and assess attitudes toward people with a history of drug dependence (e.g., *Parents should not let their children play with the children of someone with a history of drug dependence*; *People with a history of drug dependence are too often demonized in the media* (reversed scored)). Higher total scores represent more negative attitudes. Cronbach's α = 0.84, indicating a good level of internal consistency.

The Disgust Scale Revised (TDS-R; Olatunji et al., 2007) is a 25-item questionnaire assessing 3 types of disgust—Core disgust (12-items, characterized by core disgust responses such as food rejection after ingestion of offensive stimuli e.g. eating monkey meat), Animal Reminder disgust (8 items, characterized by disgust toward stimuli that remind us of our animal origins and mortality e.g. touching a dead body) and contamination disgust (5 items, characterized by disgust to disease/illness spread by humans e.g. drinking from someone else's cup). TDS-R has been shown to be a valid and reliable measures of these three facets of disgust in previous research (see e.g. van Overveld et al., 2011). Items in section 1 of the questionnaire are scored 0/False − 1/True; items in section 2 are scored 0/not disgusting, 0.5/slightly disgusting, 1/very disgusting. Total scores for each subscale are calculated by summing response to all items within that scale after reverse scoring, and a total score summing all items can be used to assess disgust sensitivity. Core disgust (Cronbach's α = 0.70) and Animal Reminder disgust (Cronbach's α = 0.73) showed good levels of internal consistency in the present study as did the overall scale (Cronbach's α = 0.75). However, contamination disgust demonstrated low levels of internal consistency and the results pertaining to this subscale should be treated with caution (Cronbach's α= .45).

Moral disgust was assessed using the seven-item subscale of the Three Domains of Disgust Scale (TDDS), which assesses disgust that motivates the avoidance of social-norm violators (e.g. *Forging someone's signature on a legal document; Intentionally lying during a business transaction*) (Tybur et al., 2009). Items were scored on a Likert scale (0 = Not disgusting at all, to 6 = Extremely disgusting) with higher scores representing greater disgust. Previous research suggests that while the scale has excellent reliability demonstrated by high internal consistency, it is not highly correlated with other domains of disgust and is more variable across different socio-political contexts (Olatunji et al., 2012). In the present study, Cronbach's α = 0.86, indicating a good level of internal consistency.

The Injecting Phobia Scale-Short Form (IPS-SF Olatunji et al., 2010) is a 7-item questionnaire comprised of items from the *Injecting Phobia Scale-Anxiety Contact Fear* items (e.g., Giving a blood sample by having a finger pricked; Getting an intravenous injection). The scale has been shown to be a valid and reliable measure of injecting phobia with excellent construct validity and test-retest reliability (see e.g. Olatunji et al., 2010). Participants were asked to read each item and rate how much anxiety they would experience if they were in the situation, on a scale from 0 = no anxiety to 4 = most anxiety. Cronbach's α = 0.91, indicating a high level of internal consistency.

Implicit Association Test (IAT): The IAT (Greenwald et al., 1998) assesses the strength of subconscious associations between different concepts and has been used in experimental and social psychology to measure and assess implicit bias across a number of domains (e.g., racial biases, gender biases (Maina et al., 2018; Wang-Jones et al., 2017). While the IAT has been criticized for having poor test-retest reliability and being influenced by external factors such as time of day, mood and wider cultural context (de Houwer, 2002), we opted to use the IAT based the fact it is flexible and can be adapted to test a variety of abstract, related or unrelated concepts and can test associations and strength of associations between concepts (Greenwald et al., 2020). The IAT involves participants having to allocate stimuli quickly and accurately into two affective attribute categories (e.g., pleasant vs. disgusting) and two target categories (e.g., injecting drugs vs. medical injecting) by using a left and right response key. The attribute and target categories were assigned to the response keys in two separate possible combinations. The IAT used in the present study used 20 images depicting injecting drug use (taken from media representations of injecting drug users and online image banks under CCBY licence) and 20 images of medical injecting (taken from online image resources under CCBY licence) to provide structurally similar images showing the same injecting paraphernalia and skin penetration as injecting drug use, but without the association with drugs (e.g. clinical settings vs street injection; sterile gloves; clear injection solutions vs brown heroin solutions). Initially, image banks were created by two researchers who were not involved in the present study. The images in each bank were rated for injecting drug use/medical injecting content by the research team and 20 images from each image bank with the highest scores were

selected to be used as stimuli in the IAT. Stimuli utilized ethnically white PWID and medical injectees only, to control for potential implicit racial bias. Control pictures for pleasant vs. disgusting were taken from the Open Affective Standardized Image Set (OASIS—Kurdi et al., 2017). Images with high negative valence and high arousal ($N = 20$) were selected to represent disgust, and images of positive valence ($N = 20$) were selected to represent pleasant. The image bank can be found here.

The IAT consisted of seven blocks. In Blocks 1 and 2, participants practice categorizing the images as "pleasant" and "disgusting" and target stimuli into the categories "drugs" and "medicine", using the response keys E (left) and I (right). All stimuli were presented twice in each block ($N = 40$ trials/block). In blocks 3 ($N = 40$ trials) and 4 ($N = 80$ trials), participants categorize stimuli belonging to one target category and one attribute category (e.g., drugs and pleasant) with one response key and stimuli belonging to the other target category or the other attribute category (e.g., medicine and disgusting) with the other response key. During block 5 ($N = 80$ trials), participants reversed the response option used in blocks 3 and 4 (e.g. if 'drugs' were previously sorted using the right response key, they were now sorted using the left response key). In blocks 6 ($N = 40$ trials) and 7 ($N = 80$ trials), participants performed the reversed combination of targets and attributes (e.g., drugs and unpleasant vs. medicine and pleasant. An IAT effect score ("d") was calculated by computing the difference score for reaction times between the medicine/drug use categories and dividing this by the pooled SD of response times (Greenwald et al., 2003). IAT d scores were coded so that negative values indicated implicit disgust to IDU vs. medical injecting (RT for pleasant + medicine/disgust + IDU) - (RT for pleasant + IDU/disgust + medicine)).

Procedure

Participants completed a single online experiment and questionnaire hosted on Inquisit Web v6.5.1 (Millisecond Software LLC, Seattle, WA, USA), and this took approximately 20 min to complete. Participants completed the IAT followed by randomized blocks of questions on demographics (age, gender, education, ethnicity, employment); Attitudes to PWUD; substance use history (lifetime and last year use of a number of substances); TDS-R, Moral disgust and IPS-SF. At the end of the study, participants were presented with debriefing information summarizing the aims of the study and providing information about support services for substance use. Participants could also opt to enter their email address to be entered into a prize draw to win a store voucher. The study was approved by LJMU Research Ethics Committee.

Statistical analysis

Data were tested for normality using the Kolmogorov-Smirnov tests. Moral disgust, attitudes to PWUD and total disgust sensitivity were normally distributed (ps > .05). All other variables were significantly different from normal ($p < .05$), thus median and range are also reported for descriptive statistics. Hierarchical regression was used to assess the predictive power of individual factors on implicit disgust with implicit disgust to IDU was the outcome variable. It was decided that gender and age would be entered in block 1—both have been shown to be related to disgust sensitivity and removing variance due to demographic factors in model 1 would more clearly delineate the relative contributions of subsequent predictors; attitudes to PWUD were entered in block 2; Injecting phobia in block 3; finally, TDS-R and moral disgust scores we entered in block 4 to allow us to assess any unique variance in implicit disgust to IDU after removal of variance due to other predictors. Assumptions for regression were met, specifically, homoscedasicity and linearity were not violated, and while the overall data were not normally distributed, inspection of residuals indicate that there were no extreme outliers in the analyses. There was limited evidence of multi-collinearity with Variance Inflation Factors <1.5 for all predictors.

Results

Participant characteristics (education, employment status, ethnicity, previous substance use) and descriptive statistics for the IAT and questionnaire measures are displayed in Table 1. The average d score for the IAT was negative indicating a stronger implicit association between implicit disgust and injecting drug use relative to medical injecting (with only 3 participants in the whole sample achieving positive scores indicating the opposite). A one sample Wilcoxon signed rank test showed that d scores differed significantly from zero $W(125) = 50.00$, $p = .001$.

Correlations were performed to investigate the relationship between implicit disgust and attitudes to PWUD, injecting phobia and the four domains of disgust (animal reminder, moral disgust, contamination disgust and core disgust). The correlations are displayed in Table 2. Of note, injecting phobia was significantly correlated with all implicit and explicit disgust variables, with the exception of contamination disgust, while contrary to expectations, implicit disgust to injecting drug use was only correlated with injecting phobia. In line with previous research on demographic factors, gender was significantly positively related to core disgust and overall disgust sensitivity indicating females exhibited higher levels relative to males. Age was significantly negatively related to injecting phobia, animal reminder disgust and overall disgust sensitivity indicating lower scores with increasing age. Moral disgust was significantly positively related to age indicating higher moral disgust with increasing age.

Hierarchical multiple linear regression was used to model the predictive effects of attitudes, injecting phobia and domains of disgust on implicit disgust to injecting drug use. Age and gender were entered in Step 1, attitudes to PWUD added in Step 2, injecting phobia added in Step 3, and TDS-R and moral disgust scores in Step 4. Model statistics are displayed in Table 3. Model 1 accounted for a non-significant 0.1% of the variance in implicit disgust.

Table 1. Participant characteristics & descriptive Statistics for IAT and questionnaire measures.

	N	%		
Education				
GCSE/Standards/equivalent	1	0.80		
A Level/Highers/BTEC/NVQ equivalent	66	52.40		
University Bachelors/NVQ equivalent	36	28.60		
Masters/NVQ equivalent	20	15.90		
Doctoral/Professional degree/NVQ equivalent	3	2.40		
Ethnicity				
Asian or Asian British	8	6.3		
Black or Black British	3	2.4		
White or White British	113	89.7		
Mixed or multiple ethnic groups	2	1.6		
Employment				
Unemployed	10	8.00		
Retired	1	0.80		
Prefer not to say	4	3.20		
Student	71	56.30		
Working full-time	17	13.50		
Working part-time	19	15.10		
Working self-employed	4	3.20		
Substance	**Never Used (N)**	**Used in Lifetime (N)**	**Used in last 12 months (N)**	
Amphetamines	108	13	5	
Alcohol	4	12	110	
Cannabis	35	41	49	
Cocaine	79	23	24	
Crack Cocaine	124	1	1	
Ecstasy	78	36	11	
Opioids	123	1	2	
	Mean	**SD**	**Median**	**Range**
Implicit Association Task				
D	−0.75	.33	−0.78	1.96
TDS-R				
Core Disgust	7.58	2.20	8.00	10.00
Animal Reminder Disgust	4.02	2.08	4.00	8.00
Contamination Disgust	1.27	0.98	1.00	4.00
Disgust Sensitivity	12.87	3.98	13.50	17.50
Moral Disgust	31.94	9.07	32.00	42.00
Attitudes to:				
People Who Use Drugs	39.54	9.50	40.00	37.00
Injecting Phobia (short form)				
	10.78	7.36	10.00	28.00

Model 2 accounted for an additional non-significant 0.2% of the variance in implicit disgust. Addition of injecting phobia in Model 3 resulted in a significant R^2 change, with Model 3 accounting for 6% of the variance in implicit disgust (an increase of 5.9%) $F(1,112) = 7.14$, $p = .009$; injecting phobia was a significant individual predictor $t(116) = 2.67$, $p = .009$. Addition of the questionnaire measures of disgust in Step 4 accounted for an additional 3.2% of the variance in implicit disgust, however the overall model was non-significant ($F(4,108) = .96$, $p = .43$)). Injecting phobia was the only significant individual predictor $t(116) = 2.32$, $p = .02$.

Discussion

The present study found no evidence for the relationship between implicit disgust to injecting drug use and sensitivity to animal reminder, core, contamination and moral disgust. Similarly, attitudes to PWUD and demographic variables such as age and gender were not predictors of implicit disgust. Injecting phobia emerged as the only significant predictor of implicit disgust toward injecting drug use. Our findings suggest that stigma toward PWID reported in other studies may not be a result of disgust toward injecting drug use.

While this was not in line with our predictions, given that a primary function of disgust is believed to be to protect from psychological or physical contamination (Matchett & Davey, 1991; Rozin et al., 2008; Woody & Teachman, 2000), the relationship with injecting phobia was not surprising. However, injecting phobia was positively correlated with the IAT score. While we did not make a specific prediction in relation to the direction of this relationship, it seems reasonable to expect that higher levels of injecting phobia would be related to higher levels of disgust to injecting drug use (i.e., reflected by an inverse relationship in the present study), due to factors such as increased (perceived) risk of contamination and disease from injecting drug use relative to medical injecting (Capitanio & Herek, 1999; Lloyd, 2013). It is unclear why this was not the direction of the relationship in the present study, but we provide a tentative explanation below. Dehumanization and stigmatization of outgroups such as PWID results in increased social distancing and perceptions of dangerousness and fear (Martinez, 2014; Martinez et al., 2011; Sumnall et al., 2021b). The interruption of mentalisation processes, which are used to assign human characteristics to disgust inducing stimuli and stigmatized groups, leads to acceptance of stigmatizing attitudes and behaviors toward a particular group of people

Table 2. Correlations between implicit disgust, attitudes and TDS-R measures.

	Attitude to PWUD	Injecting Phobia	Core Disgust	Animal Reminder Disgust	Contamination Disgust	Moral Disgust	Disgust Sensitivity	Age+	Gender
d	−0.058	.189*	.015	.131	−0.049	.077	.081	−0.028	.053
Attitude to PWUD	–	−0.106	.086	.065	.224**	.200**	.153*	.030	−0.134
Injecting Phobia	–	–	.196*	.489**	.129	−0.177*	.414**	−0.194*	.139
Core Disgust	–	–	–	.394**	.285**	.070	.812**	−0.086	.340**
Animal Reminder Disgust	–	–	–	–	.201*	−0.184*	.801**	−0.262**	.105
Contamination Disgust	–	–	–	–	–	.039	.487**	.030	−0.044
Moral Disgust	–	–	–	–	–	–	−0.036	.386**	.133
Disgust Sensitivity	–	–	–	–	–	–	–	−0.177*	.245**

*Correlation significant at $p < .05$.
**Correlation significant at $p < .01$.

Table 3. Coefficients and t tests for individual predictors in hierarchical multiple regression analysis.

	Unstandardized and standardized coefficients			*Obtained t and p values*		*Obtained R values*		
	B	*SE* B	β	t^a	*p*	*R*	R^2	ΔR^2
Model 1						.034	.001	.001
Age	−0.001	.004	−0.032	−0.35	.73			
Gender	.008	.064	.012	.13	.90			
Model 2						.040	.002	.000
Age	−0.001	.004	−0.031	−0.34	.74			
Gender	.006	.065	.008	.89	.93			
Attitudes to PWUD	−0.001	.003	−0.021	−0.23	.82			
Model 3						.246	.060	.059
Age	.000	.004	.008	.08	.93			
Gender	−0.022	.065	−0.032	−0.35	.73			
Attitudes to PWUD	.000	.003	−0.005	−0.53	.96			
Injecting Phobia	.012	.004	.250	2.67	.009			
Model 4						.304	.092	.032
Age	−0.002	.004	−0.044	−0.45	.66			
Gender	−0.013	.071	−0.019	−0.19	.85			
Attitudes to PWUD	−0.002	.003	−0.047	−0.47	.64			
Injecting Phobia	.012	.005	.250	2.32	.02			
Core Disgust	−0.018	.016	−0.119	−1.09	.28			
Contamination Disgust	.017	.034	.049	.50	.62			
Moral Disgust	.006	.004	.171	1.66	.10			
Animal Reminder Disgust	.010	.019	.062	.53	.60			

(Fiske et al., 2004), further distancing the outgroup from the self (Kilian et al. 2021; Tapias et al., 2007). This social distancing and avoidance of outgroups has been seen in laboratory research on emotion perception (Reicher et al., 2016), toward individuals with mental health conditions (Dawydiak et al., 2020), and other stigmatized groups (Amodio, 2014). In the present study, the images of injecting drug use may have been perceived to be so far from the self, and belonging to the outgroup, that they were not related to participants' injecting phobia. Essentially, the context of the IDU images may not have been relatable or threat-relevant for participants. Conversely, the content of the medical injecting images were relatable, as most individuals could perceive receiving a medical injection (this study was undertaken during the COVID-19 pandemic, and the majority of the UK population had received a vaccination), and this resulted in higher injecting phobia being related to a higher *d* score (i.e. less implicit disgust to IDU relative to medical injecting). Disgust has been observed as the dominant response to threat-relevant stimuli (Sawchuk et al., 2002; Tolin et al., 1997), and in the present study we propose that medical injecting was more threat-relevant for our non-injecting drug use participants than the images of IDU. Future research should aim to investigate implicit disgust to IDU in high and low injecting phobia groups.

We also found that animal reminder disgust was highly positively correlated with injecting phobia. This is supportive of previous research where de Jong & Merckelbach (1998) found that heightened Blood Injection Injury phobia was more highly correlated with animal reminder disgust than core disgust. In addition, different types of disgust sensitivity have been shown to predict medical students' interest in medical careers with varying procedural intensity (Consedine et al., 2013); greater animal reminder disgust is associated with lower interest in emergency medicine while greater core disgust predicts lower interest in gynaecology/obstetrics. Moreover, disgust plays a key role in the development and maintenance of anxiety-related disorders such as spider phobia (Matchett & Davey, 1991) and Blood Injection Injury phobia (Olatunji et al., 2005). In line with this, individuals with heightened levels of anxiety have been shown to report significantly greater disgust sensitivity (Koch et al., 2002; Olatunji, 2009; Olatunji et al., 2007b). While these studies are supportive of the correlation between animal reminder disgust and injecting phobia, mediation analysis to test the relationship between animal reminder disgust, injecting phobia and implicit disgust showed no mediation.

When we consider the implicit nature of the IAT versus the explicit nature of the attitude scales and questionnaires used in the present study, the results are not as divergent from what might be expected. Initial automatic fear responses and moral judgements are rapid and involuntary, involving recruitment of the amygdala to detect threat and initiate the fight or flight response if required (Finnell, 2018). Amygdala activation has been observed in IATs of implicit racial bias (Phelps et al., 2000; Richeson et al. 2008) and implicit tasks involving presentation of dehumanized social groups such as PWUD and individuals who are homeless (Harris & Fiske, 2006; Krendl et al. 2012), corroborating its role in acute reactions to anxiety-provoking stimuli. However, after this initial amygdala activation, higher activity has been observed in the anterior cingulate cortex (ACC) and the medial and lateral prefrontal cortex, especially when required to moderate negative affect toward the presented images (Krendl et al. 2012). Taken together, these findings suggest that activation of the ACC allows an individual to identify the need for cognitive control in the task at hand, while areas of the prefrontal cortex allow an individual to regulate the unwanted prejudicial thoughts (Finnell, 2018). Requiring participants

to deliberately control their objectivity in assessments of others' distress has been shown to activate similar areas (Bruneau et al., 2015). Thus, the lack of relationship between implicit and explicit measures of disgust in the present study could be explained by the differential requirements of the tasks (immediate fear response vs. more rational cognitive control). A meta-analysis comparing IAT and explicit self-report measures (Hofmann et al. 2005) also found that motivational bias when completing explicit reports (e.g., not wanting to appear to hold stigmatizing views) and meta-cognitive deficits (which could either result in a lack of introspection or a failure in memory) can both affect the integrity of the relationship between the IAT and explicit measures of bias. Consequently, future research should seek to include implicit and explicit measures of disgust toward injecting drug use, and assess task related changes in the amygdala, ACC and prefrontal cortex, in addition to facial EMG to investigate the role of fear and disgust related micro expressions in implicit disgust (de Jong et al., 2002).

There were a number of limitations to the present study. Firstly, the IAT is a controversial measure and it has been argued that responding might reflect knowledge of cultural views rather than personal salience/preference (Ottaway et al., 2001; Rothermund & Wentura, 2004). Moreover, while the IAT has been used to predict behavior in a range of situations (e.g., employment outcomes, mental health risk) it has better predictive validity in some populations (e.g., those at risk of suicide and Self-Harm; Nock et al. 2010) than others, and the results of the present study cannot indicate actual behavior toward PWID based on the IAT results. Test-retest reliability of the IAT has been to shown to be relatively weak (Nosek et al., 2005) with previous studies demonstrating that IAT score may be based on a combination of state and trait characteristics. In light of this, future research investigating disgust to IDU should seek to include additional measures of implicit bias such as the Implicit Relational Assessment Procedure (IRAP; Barnes-Holmes et al., 2006) which is a newer measure, based on the IAT, with good construct validity (Vahey et al., 2015). It is also noteworthy that significant correlations between the moral disgust scale and animal reminder disgust and injecting phobia were negative indicating that higher levels of moral disgust were associated with lower levels of injecting phobia and animal reminder disgust, While we did not make a specific prediction about the direction of this relationship, it is likely that the direction of these correlations reflects the validity of the moral disgust subscale as a measure of disgust (see Olatunji et al., 2012 for discussion). Study participants were primarily drawn from university students, hence findings are not generalizable. We chose the DS-R to assess disgust because of our specific interests in animal reminder disgust and its relation to IDU. However, it is possible that as the DS-R contains descriptions of certain situations that an individual might find disgusting, it is dependent on the context of those statements/descriptions (Olatunji et al., 2007). Moreover, of particular note for the present study, Tybur et al. (2009) have contended that there is empirical support for a distinct domain of animal reminder disgust and suggest that the domains are not necessarily conceptually separable. They also note that as TDS-R excludes moral disgust, it is not a comprehensive measure of disgust sensitivity. We included a separate measure of moral disgust from the TDDS in the present study to provide us with a more comprehensive assessment of facets of disgust. To confirm the relationship between facets of disgust and stigma toward IDU, future research should seek to further clarify the relationship between the different domains of disgust, physiological and neural response to substance related disgust elicitors and how such stimuli could develop and maintain stigmatization of PWUD. The images of medical injecting and IDU in the present study were also ethnically White to try and avoid the concomitant effects of implicit or explicit racial bias. While PWID are stigmatized as a group, in the USA Black people and people of color are more likely to be imprisoned for substance-related crimes (El-Sabawi & Oliva, 2022), while similar racial and ethnic disparities are observed in UK sentencing (Veiga et al., 2023) and arrest statistics (Eastwood et al., 2013). Thus it is possible that there are intersections between racism and substance related stigma that could have affected perceptions of the white injectees in our study. However, it is difficult to fully realize the link between these concepts in the scope of the present study; analyses of media representations of 'problematic' drug use in the UK have not tended to include analysis of ethnicity, and have focused on the representation of images of 'polluted' and 'contaminated' bodies (Ayres & Jewkes, 2012), the stigma of substance and welfare dependencies (Alexandrescu, 2020) and sympathetic representations of white middle class female decedents in drug-related deaths (Forsyth, 2001). As this study was conducted in the UK, focussing solely on White injectees, this limits the generalizability of the findings. Future research should replicate these findings using ethnically diverse participants and images, and seek to contextualize the language used when categorizing images (e.g., drug vs. medicine) in current cultural, socio-political and geographical environments. Finally, as data was collected during the Covid-19 pandemic, there may have been higher levels of disgust sensitivity, in particular contamination disgust, which may have affected our results.

In conclusion, the present study found no relationship between explicit assessments of disgust sensitivity and implicit disgust to injecting drug use. Injecting phobia was related to disgust to medical injecting over disgust to injecting drug use. Whilst the current findings suggest that implicit disgust may not underlie stigma toward PWID, future research should seek to clarify the role of implicit versus explicit cognitions in stigmatization processes.

Disclosure statement

The authors declare no conflict of interest.

Funding

The author(s) reported there is no funding associated with the work featured in this article.

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Data availability statement

Data will be made available on the institutional data repository site after acceptance.

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