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INDEPENDENT LEARNING PROJECT

Yuck: The Influence of Disgust on the Venipuncture Experience

By

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Abstract

Objectives: To determine if anxiety and disgust (synonym yuck) predict pain outcomes for adults and adolescents undergoing venipuncture. To validate the use of the *Colour Analogue Scale- Yuck* (CAS-Yuck) in this sample and investigate potential parental influence on adolescents' outcomes.

Methods: We recruited a convenience sample of adults (N=50) and adolescents (N=46, aged 13-18) undergoing venipuncture. Data were collected on disgust propensity, pain-catastrophising and state anxiety of participants and adolescents' parents (N=40). The investigator measured participants' pain-related distress during the venipuncture. Following the procedure, participants reported their state anxiety, pain and disgust levels towards the needle.

Results: Significant positive correlations were detected between CAS-Yuck and Disgust Scale Revised (DS-R), even when controlling for anxiety and age. Self-reported disgust, anxiety and pain-catastrophising were correlated with self-reported pain and with observable pain-related distress. In multivariate analyses, disgust uniquely predicted self-reported pain but was not a significant predictor of observed distress, when controlling for anxiety, pain-catastrophising and age. However, anxiety uniquely predicted self-reported pain and observed distress. Self- reported disgust was a stronger correlate and potential predictor of pain intensity than anxiety. Parental and child anxiety and disgust propensity were positively correlated.

Conclusions: Use of the CAS-Yuck was validated in adults and adolescents. Self-reported disgust was the strongest correlate and potential predictor of self- reported pain intensity, while anxiety was a significant predictor of self-reported pain and observed pain-related distress. Parental and adolescent disgust levels were correlated, providing insight into the developmental acquisition of disgust.

List of Abbreviations

Colour Analogue Scale	(CAS)
Colour Analogue Scale- Yuck	(CAS-Yuck)
The Disgust Scale -Revised	(DS-R)
Blood- Injection- Injury	(BII)
Pain-catastrophising Scale	(PCS)
State-Trait Anxiety-State	(STAIS)
Colour Analogue Scale- Pain	(CAS-Pain)
Faces Pain Scale- Revised	(FPS-R)
Children Anxiety and Pain Scale	(CAPS)
Standard deviation	(SD)
Pearson's product- moment correlation coefficient	(r)
Spearman's rank correlation coefficient	(ρ)
Standardised beta coefficient	(β)

1.0 Introduction

Disgust is a complex, multi- dimensional emotion which is regarded as an aversive response towards potentially contaminated stimuli (Olatunji, Cisler, McKay, & Phillips, 2010). The word, "disgust", literally means "bad taste", illustrating its rank as a negatively-appraised emotion (Haidt, McCauley & Rozin, 1994; Olatunji et al, 2010). The complexities of disgust lie in its numerous dimensions, elicitors and functions.

Disgust can be classified into categories such as: distaste, core, animal-reminder, interpersonal and socio-moral disgust (Stevenson, Oaten, Case, Repacholi, & Wagland, 2010). Table I displays how each sub-type is induced by different stimuli and serves a specific function (Rozin, Haidt & McCauley, 2008; Stevenson et al., 2010). The evolutionary purpose of disgust may have been to prevent consumption of contaminated foods or contraction of contagious illness (Vaitl, Schienle & Stark, 2005; Schmidt, 2008). However, disgust has evolved to take up new functions that preserve bodily integrity or prevent engagement in socially or morally inappropriate behaviour (Olatunji et al., 2010; Rozin et al., 2008). Despite the diverse nature of the disgust sub-types they are reconciled by the common purpose they serve: to protect oneself from a form of contamination.

Table I: Functions and Elicitors of the Domains of Disgust

	0. Distaste	**1. Core**	**2. Animal-reminder**	**3. Interpersonal**	**4. Socio-moral**
Function	Protect body from bitter tastes	Protect body from disease/ infection	Protect body and soul	Protect body, soul and social order	Protect social order
Elicitors	Bad tastes	Food (e.g. rotting meat), Body products (e.g. faeces), Animals (e.g. maggots)	Sex-related elicitors (e.g. incest), Death, Hygiene concerns, Breach of bodily integrity (e.g. open wounds)	Direct and indirect contact with ill, strange or immoral people	Morally offensive concepts

Stevenson et al. (2010) have recently described a general trend in disgust acquisition whereby concrete disgust elicitors (e.g. maggots) are acquired before abstract elicitors (e.g. moral offenses). Moderate correlations in disgust and contamination sensitivity have been reported between parents and their children (Rozin, Fallon, & Mandell, 1984). Although parent-child transmission may play a role in disgust acquisition (Davey, Forster & Mayhew, 1993; Stevenson et al., 2010; Rozin et al., 2008), there is little literature to support this.

Disgusting entities are described as being 'yuck' or 'yuk', a term used in common parlance among both adults and children. The Oxford Dictionary defines 'yuck' as a slang expression of strong distaste. Children use 'yuck' to describe unpalatable foods (e.g. vegetables) and with the intent to promote avoidance (Pooley & Fiddick, 2010). Adults use this pseudonym in newspaper articles and internet forums to describe something that opposes social decorum or certain ethical codes. The 'yuck factor' has been described as society's strong negative emotional reaction towards biotechnological advances, such as cloning (Niemelä, 2010). This collective repugnance contributes to altering public policy, thus achieving social order (Schmidt, 2008). The 'yuck factor' has been suggested as the impetus behind determining what actions breach moral boundaries (Niemelä, 2010). Hence, 'yuck' appears to correspond to several dimensions of disgust, ranging from distaste to socio-moral disgust (See Table I).

Recent studies in our Department have demonstrated that for children aged 3-9, disgust was a unique significant predictor of self- reported needle pain when controlling for fear, young age and use of a topical anaesthetic (Du et al., 2009). Thus, children of this age group were able to distinguish between disgust and fear. Notably, children's disgust did not uniquely predict observable pain distress (Du et al., 2009).

In order to measure needle-specific disgust or 'yuck', Du et al. (2009) utilised the *Colour Analogue Scale* (CAS), a visual scale commonly used to measure pain (McGrath et al., 1996). Visual analogue scales have been reliably used in non- pain settings by adults and adolescents to measure positive/negative affect, depressive and anxiety symptoms (Lothmann et al., 2010; Bowen et al., 2010). However, Du et al.

(2009) were not able to validate the use of *Colour Analogue Scale- Yuck* (CAS-Yuck) with another measure of disgust, such as The Disgust Scale Revised (DS-R). The DS-R measures disgust propensity (the tendency to experience disgust) towards situations unlikely to have been experienced by young children. Hence it was not an age-appropriate measure. Thus, to fully appraise the novel role of disgust in children's pain outcomes, the CAS-Yuck must be validated, thereby confirming the suitability of yuck as a pseudonym for disgust.

Fear refers to an individual's current emotive response to a specific pending threat (e.g. receiving a needle) whilst anxiety is a more general, preparatory response to a potential future threat (e.g. the possibility of receiving a needle) (Carleton & Asmundson, 2009). These terms are often used interchangeably and will be hitherto used in this manner.

Disgust and fear are similar as they are both negatively-valenced, highly-arousing and withdrawal-associated emotions (Woody & Teachman, 2000). However fear, is triggered primarily by threat cues whilst disgust can be elicited by a wide range of stimuli (Rozin et al, 2008). Disgust and fear can be differentiated by their distinctive response patterns in heart rate, facial expression, neural activity and cognitive appraisals (Cisler, Olatunji & Lohr, 2009).

The physiological response to disgust consists of a biphasic pattern, initially involving a sympathetic response, which increases heart rate, followed by a parasympathetic response, which decreases heart rate and blood pressure (Olatunji, Williams, Sawchuk & Lohr, 2006). The sudden drop in blood volume may lead to feelings of faintness (Page, 2003). Disgust is commonly associated with levator labii muscle movement, anterior insula activation and the cognitive appraisal that a neutral substance can become contaminated if it touches a disgust elicitor (Cisler et al., 2009; Stevenson et al., 2010). Conversely, fear is associated with a sympathetic response (heart rate acceleration and increase in blood pressure), amygdala activation and cognitive processes focusing on danger (Cisler et al., 2009).

Needle phobia involves a marked fear of needles associated with avoidance and distress and is categorised under Specific Phobia Blood- Injection- Injury (BII) subtype in DSM-IV, a group of phobias that includes fear of blood, injury or any invasive medical procedure phobia (Viar, Etzel, Ciesielski & Olatunji, 2010). Needle phobia has a lifetime prevalence of 3.5% and an age of onset of 5.5 years (Viar et al., 2010).

The two main responses in needle phobia are fear and disgust. When exposed to BII-relevant stimuli, the self-reported disgust levels of adult BII-phobics were higher than their self- reported levels of fear (Olatunji et al., 2010). Self- reported disgust is more likely to predict avoidance of BII- relevant stimuli than self- reported fear for BII-phobics (Olatunji et al., 2010; Olatunji et al., 2007). BII- relevant stimuli are perceived as potentially contaminated, thus eliciting the disgust response (Olatunji et al., 2010). BII- phobic individuals also display elevated disgust towards non- BII-relevant stimuli (e.g. maggots) (Olatunji et al., 2010).

Physiologically, BII phobics respond to BII- relevant stimuli with a biphasic heart rate (Viar et al., 2010). The initial fear-mediated response involves sympathetic activation whilst the latter part involves an increased parasympathetic input, which is associated with fainting, a characteristic feature of BII phobia (Olatunji et al., 2010). Although this latter phase is observed in disgust, the extent to which disgust accounts for the fainting response in BII phobia is not known (Gerlach et al., 2006; Olatunji et al., 2010). More-over, the relationship between disgust and fainting among needle phobics may be mediated by anxiety (Viar et al., 2010).

This study was performed in follow up to Du et al.'s (2009) study in children to explore how anxiety and disgust experienced by adults and adolescents undergoing venipuncture affect needle pain outcomes. Usage of the term 'yuck' as a pseudonym for disgust and the influence of parental anxiety and disgust was investigated. Finally, the effect of anxiety and disgust on heart rate, which is being used as a surrogate measure for fainting risk, was examined.

2.0 Methods

2.1 Recruitment and Participants

Participants were recruited from the pathology outpatients' waiting room at Prince of Wales Hospital. The sample consisted of 50 adults (24 males, 26 females) aged 23 -82 and 46 adolescents (24 males, 22 females) aged 13–18, undergoing blood collection via venipuncture. If present, the adolescent's parent/guardian also participated (N= 40).

2.2 Measures

2.2a. Adult and Adolescent Measures

The Disgust Scale-Revised (DS-R; Haidt, McCauley, & Rozin, 1994, modified by Olatunji et al., 2007) is a self-report questionnaire that assesses an individual's disgust propensity. It comprises of 25 items in three subscales of: Core disgust (including food, animals and body products), Animal-reminder disgust (death and envelope violations) and Contamination disgust (concerns about interpersonal transmission of essences). Subjects were asked to indicate on a 5-point scale as to how much he/she either agreed with the statements (0 = "strongly disagree" to 4 = "strongly agree") or found the statements disgusting (0 = "not disgusting" to 4 = "extremely disgusting"). The total score ranged between 0 and 100. The DS-R has good internal consistency (Cronbach's alpha = .87) and split-half reliability (Olatunji et al., 2007).

Pain Catastrophizing Scale (PCS; Sullivan & Pivik, 1995). This scale is a 13-item questionnaire that assesses thoughts and feelings that individuals experience when they are in pain. The scale consists of three subscales measuring rumination, magnification, and helplessness. Participants rated the extent to which they experienced each of the statements using a 5-point scale (0 = "not at all" to 4 = "extremely"). The total score ranged between 0 and 52. Previous research demonstrates that the PCS has adequate psychometric properties, with good temporal stability (Pearson's r = 0.92) and adequate internal consistency (Crombez et al., 1999). Parents completed a parent version of the PCS, which has established psychometric properties and uses similar questions to the PCS to assess parents'

feelings when their child is in pain (Goubert, Eccleston, Vervoort, Jordan, & Crombez, 2006).

State-Trait Anxiety Inventory-State (STAIS; Spielberger, Gorsuch, & Lushene, 1970). The STAI is a 40-item scale that measures both state and trait anxiety. In this study, the first 20 items (STAIS) were used to assess state anxiety (i.e. how the participant feels right now). Parental state anxiety was measured *before* the needle whilst participants' state anxiety was measured *after* the needle. Participants/parents rated the extent to which they agreed with the statements using a 4-point scale (1 = "not at all" to 4 = "very much so"). The total score ranged between 20 and 80. Internal consistency estimates range between .83 and .94 (Spielberger et al., 1970).

Colour Analogue Scale (CAS; McGrath et al., 1996). The CAS provides vivid gradations in colour, area and length so that participants could clearly see how different scale positions reflected different values in self-reported pain/disgust intensity (see Appendix 1). Participants moved a sliding bar up or down to the position that showed how painful and then how 'yuck' they found the venipuncture. The scale has numerical ratings on the back, and is scored 0 to 10 (0 = "no pain/yuck" and 10 = "very much pain/yuck"). The scale has discriminant validity. Visual analogue scales have been reliably used in non- pain settings by adults and adolescents to measure positive/negative affect, depressive and anxiety symptoms (Lothmann et al., 2010; Bowen et al., 2010).

The following two measures were utilized solely in the adolescent population:

Children Anxiety and Pain Scale (CAPS; Kuttner & LePage, 1989). This scale comprises two sets of five faces, one for anxiety and one for pain. For this study, only the Anxiety set was used. Participants were asked to point to the face displaying how scared they felt during the needle. Chosen faces are scored by counting left-to-right from 0 (no fear) to 4 (most fear). The scale has good convergent validity (Goodenough, Roschar, Cole, Piira, & Kuttner, 2004).

Faces Pain Scale Revised (FPS-R; Hicks, von Baeyer, Spafford, Korlaar, & Goodenough, 2001). The FPS-R provides six faces depicting increasing gradations of pain severity. Participants were asked to choose a face to indicate how painful the needle was. The scale is scored 0 to 10 (0 = "no pain" and 10 = "very much pain"). This scale has strong construct and criterion validity, as well as good test-retest reliability (Stinson, Kavanagh, Yamada, Gill, & Stevens, 2006).

2.2b. Observational Measures

The Faces Legs Activity Cry Consolability Scale (FLACC Scale; Merkel et al., 1997). During the procedure, the investigator observed the participant and rated their pain distress behaviour using the FLACC Scale. The FLACC is an observational scale assessing five categories of behaviour: facial distress, leg movements, general activity such as lying quietly or rigid and jerking, whether the participant cried and whether he/she could be consoled. Each category is scored on a 0-2 scale, which results in a total score between 0 and 10. The scale is ideal for procedural pain that entails brief pain events such as venipuncture and is suitable for children and adults (von Baeyer & Spagrud, 2007). The FLACC has excellent inter-rater reliability and good convergent validity (Merkel et al., 1997).

2.3 Apparatus

Pulse oximeter. A *PulseOx5500™ FingerUnit* oximeter was attached by the investigator to the participants' index finger to assess pulse-rate before, during and after the venipuncture.

2.4 Procedure

This was a cross sectional observational study involving a convenience sample of adults, adolescents and parents/guardians. The detailed protocol of the procedure is presented in Appendix 2. Participants were approached in the waiting room by the investigator and provided with a verbal and summarised written description of the study. Written and informed consent were obtained from participants and their parent/guardian (if <18 years). Participants completed a basic demography questionnaire about themselves and about their accompanying parent/guardian, if they were an adolescent. Demographic data is summarised in Table II.

Parents completed three pre-procedural questionnaires measuring disgust propensity (DS-R), pain-catastrophising (PCS) and state anxiety (STAIS). Participants completed the former two pre- procedural questionnaires. An oximeter was attached to the participants' index finger to assess pulse-rate at four time points: (1) in the waiting room; (2) immediately before the venipuncture; (3) immediately after the venipuncture; (4) five minutes after the venipuncture.

During the venipuncture, the investigator observed and rated participants' pain distress using the FLACC scale. Following the procedure, all participants responded to self- report measures of pain (CAS-Pain), disgust (CAS-Yuck) and anxiety (STAIS). Adolescents responded to additional self-report measures of pain (FPS-R) and anxiety (CAPS).

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Table II. Distribution of Demographic Characteristics for Participants and Parents

	Adult (N = 50) N (%)	Adolescent (N = 46) N (%)	Parent (N = 40) N (%)
Gender			
Males	24 (48.0%)	24 (52.2%)	8 (17.4%)
Females	26 (52.0%)	22 (47.8%)	29 (63.0%)
Ethnicity			
Caucasian	37 (74.0%)	33 (71.7%)	N/A
Non- Caucasian	13 (26.0%)	13 (28.3%)	
Birth order			
Firstborn	17 (34.0%)	27 (58.7%)	
Second	20(40.0%)	15 (32.6%)	N/A
>Third	13 (26.0%)	4 (8.7%)	
Length of time since last immunisation/venipuncture			
< 1 week ago	4 (8.0%)	11 (23.9%)	
< 1 month ago	22 (44.0%)	16 (34.8%)	N/A
<1 year ago	17 (34.0%)	13 (28.3%)	
> 1 year ago	1 (2.0%) [1]	5 (10.9%) [2]	
Previous fainting experience			
Yes	4 (8.0%)	3 (6.5%)	N/A
No	46 (92.0%)	43 (93.5%)	
Relationship to adolescent			
Mother	N/A	N/A	31 (67.4%)
Father			8 (17.4%)
Guardian			1 (2.2%)
	Mean (SD)	**Mean (SD)**	**Mean (SD)**
Age	46.30 (16.40)	15.26 (1.64)	45.53 (4.82)
Number of siblings	2.04 (2.39)	1.72 (1.21)	N/A

[1] 6 participants (12%) could not remember
[2] 1 participant (2.2%) could not remember

2.5 Statistical Methods

Data were analysed using the statistical software package PASW Statistics 18 (SPSS Inc, 2009). In describing demographic and descriptive characteristics of the sample, means and standard deviations (SD) were used for continuous variables (e.g. DS-R) while frequencies and percentages were used for categorical variables (e.g. gender).

2.5a.Associations between age, gender and study measures

Pearson's product- moment correlation coefficient (*r*) was used to determine the linear relationship between participants' age, DS-R, PCS, STAIS, CAS-Yuck, CAS-Pain, FPS-R, CAPS and FLACC. The relationship between participants' gender and the afore-mentioned variables was investigated using Spearman's rank correlation coefficient (ρ). Parental scores on DS-R, PCS and STAIS were analysed with their child's scores for continuous measures (e.g. DS-R, PCS, etc.) using Pearson's correlation coefficients. Literature demonstrates that certain factors (e.g. anxiety, age) are known to confound some relationships between variables. Thus partial correlations were used to control for these factors.

Independent samples t-tests were performed to determine if the mean scores for DS-R, PCS, STAIS, CAS-Yuck, CAS-Pain, FLACC, FPS-R and CAPS were significantly different between (1) age groups (adults vs adolescents); (2) gender and (3) individuals with and without history of fainting during venipuncture

2.5b.Predictors of self-reported pain and observable pain-related distress

A sequential multiple regression analysis was performed on the (1) total population; (2) adult population and (3) adolescent population to determine if participant disgust explained a unique variance on self-reported pain and observable pain-distress, whilst controlling for chosen variables. These variables differed depending on the population analysed and were chosen according to significance of bi-variate correlations and after consulting literature. The correlation between explanatory variables included in the regression models did not exceed 0.70, thus forming a robust model which excludes collinearity (Peat et al., 2008).

Variables were entered into the regression model in descending order of their Spearman's/Pearson's correlation coefficient. The regression analysis was performed for CAS-Pain and FLACC. An additional regression analysis for FPS-R was performed for adolescents.

Note: CAS-Yuck, which measures needle- specific disgust, was preferred over the generalised DS-R as the disgust measure to be used in the regression model

2.5c.Predictors of anxiety

A sequential multiple regression analysis was performed separately on the (1) total population; (2) adult population and (3) adolescent population to determine if participant catastrophising explained a unique variance on self-reported anxiety as measured by (1) STAIS and (2) CAPS, whilst controlling for chosen variables. Variables chosen were established predictors of anxiety and included: age, pain and disgust (Deacon & Abramowitz, 2006). Parental anxiety was also included when analysing adolescents (Burstein, Ginsburg & Jenn-Yun Tein, 2010). Variables were entered into the regression model in descending order of Pearson correlation coefficient.

2.5d.Relationship between heart rate and disgust/anxiety

The change in heart rate between the afore-mentioned time points (1, 2, 3 and 4) were computed into six new variables (i.e. difference in pulse between time 1&2, 1&3, 1&4, 2&3, 2&4, 3&4). These variables were graphed against CAS-Yuck and STAIS on separate scatterplots.

3.0 Results

The distribution of adult and adolescent data is shown in Table III. Table IV shows the distribution of parental data. When considering the maximum scores achievable for the study measures (see Methods), participants' scores were in the medium to low range. The only significant differences between adult and adolescent measures was for pain- catastrophising ($t(94) = -3.630$, $p < 0.001$). These data indicate overall similarity between the two samples.

Table III: Distribution of adult and adolescent responses to study measures

	Adults Mean (SD)	**Adolescents Mean (SD)**	**95% Confidence Interval of Difference of Means**
Disgust Propensity (DS-R)	51.86 (16.98)	58.17 (14.76)	-12.79, 0.16
Pain-Catastrophising (PCS)	10.66 (12.25)	19.41(11.29)	-13.54, -3.97 *
Anxiety (STAIS)	28.94 (9.85)	27.87 (9.58)	-2.87, 5.01
Anxiety (CAPS)	N/A	0.59 (0.96)	N/A
Yuck (CAS)	1.46 (2.17)	2.47 (3.11)	-2.11, 0.09
Pain (CAS)	1.77 (2.00)	2.16 (2.18)	-1.24, 0.45
Pain (FPS-R)	N/A	1.74 (2.13)	N/A
Distress (FLACC)	0.74 (1.56)	1.20 (2.13)	-1.21, 0.30

* $p < 0.001$

Table IV: Distribution of parental responses to study measures

	Mean (SD)
DS-R	53.62 (16.38)
PCS	26.62 (11.06)
STAIS	35.50 (11.79)

3.1 Associations between age, gender and study measures

Significant associations demonstrated in Table V were investigated further. Notable findings include a moderate positive correlation between DS-R and CAS-Yuck (r = 0.383, p< 0.01). Age was negatively correlated with (1) DS-R (r = -0.243, p< 0.05) and (2) PCS (r = -0.376, p< 0.01). Anxiety (STAIS) was positively correlated with (1) CAS-Yuck (r = 0.333, p< 0.01) and (2) PCS (r = 0.250, p< 0.05). CAS-Yuck was positively correlated with PCS (r = 0.246, p< 0.05).

Table V: Correlations between study measures in the combined sample of adults and adolescents (N= 96)

	Age	**Gender**	**DS-R**	**PCS**	**STAIS**	**CAS-Yuck**
Age	1	-0.105	-0.243*	-0.376**	-0.019	-0.198
Gender		1	0.114	0.101	0.197	0.184
DS-R			1	0.459**	0.283**	0.383**
PCS				1	0.250*	0.246*
STAIS					1	0.333**

** p< 0.01, * p< 0.05

Note: ρ is displayed for all correlations involving gender. r is displayed for all other relationships.

3.1a.Validating CAS-Yuck

DS-R and CAS-Yuck continued to be associated when controlling for (1) age (r = 0.352, p < 0.001); (2) anxiety (r = 0.319, p< 0.01) and (3) pain- catastrophising (r = 0.313, p< 0.01).

3.1b.Associations between yuck, anxiety and pain-catastrophising

PCS and CAS-Yuck were no longer associated when controlling for anxiety (r = 0.178, p> 0.05). However helplessness, a dimension of catastrophising, continued to be associated with CAS-Yuck when controlling for anxiety (r = 0.234, p < 0.05). PCS and anxiety were no longer correlated when controlling for CAS-Yuck (r =0.184, p> 0.05). However the correlation between anxiety and CAS-Yuck was maintained when controlling for PCS (r = 0.289, p < 0.01).

3.1c.Influence of gender and fainting

Females (mean =2.469, SD =2.393) reported more pain (t(81.734) = -2.487, $p< 0.05$) than males (mean =1.438, SD =1.590). Additionally, individuals with a history of fainting (mean =25.43, SD =12.594) reported greater pain- catastrophising (t(94) = -2.374, $p< 0.05$) than those who had not fainted (mean =14.02, SD =12.217).

3.2 Parental measures and their associations

3.2a.Parent-child

As shown in Table VI, a positive correlation was detected between parental and child disgust propensity (DS-R) ($r = 0.469$, $p < 0.01$). A positive correlation was also observed between parental state anxiety and their child's (1) PCS ($r = 0.438$, $p < 0.01$); (2) STAIS ($r = 0.415$, $p < 0.01$) and (3) CAS-Yuck ($r = 0.340$, $p < 0.05$). No significant correlations were observed between parental measures and their child's pain or distress.

3.2b.Inter-parental

A moderate-strength positive correlation was demonstrated between parental PCS and parental (1) DS-R ($r = 0.383$, $p < 0.05$) and (2) STAIS ($r = 0.386$, $p < 0.05$).

Table VI: Correlations between parental measures and adolescent measures (N=40)

	Parent			**Adolescent**			
	DS-R	**PCS**	**STAIS**	**DS-R**	**PCS**	**STAIS**	**CAS-Yuck**
Parental DS-R	1	0.383*	0.123	0.469**	0.240	0.016	0.173
Parental PCS		1	0.386*	0.127	0.113	-0.121	-0.012
Parental STAIS			1	0.036	0.438**	0.415**	0.340*

** $p< 0.01$, * $p< 0.05$

Note: r is displayed for all relationships.

3.3 Associations between pain, distress and potential predictors

When comparing adults and adolescents there were common predictors of pain (PCS, Anxiety, Yuck) (see Table VII) and distress (DS-R, PCS, Anxiety) (see Table VIII). However age, DS-R and Yuck were significant predictors of pain and/or distress in adults, but did not predict pain and/or distress in adolescents.

Due to the similarities in predictors, both age groups were combined in order to examine the unique effects of these potential predictors on pain and distress, whilst controlling for other variables in a multi-variate analysis. To account for differences in predictors between groups (i.e. age, DS-R, yuck) multi-variate analyses were also performed separately on adult and adolescent populations (see Appendix 3).

Table VII: Correlations between pain and its potential predictors in adults (N=50) and adolescents (N=46)

	Adults	**Adolescents**	
	CAS-Pain	**CAS-Pain**	**FPS-R Pain**
Age	-0.288*	-0.010	-0.018
Gender	0.176	0.272	0.267
DS-R	0.406**	0.287	0.243
PCS	0.443**	0.224	0.311*
Anxiety (STAIS)	0.440**	0.643**	0.676**
Anxiety (CAPS)	N/A	0.467**	0.534**
CAS-Yuck	0.638**	0.508**	0.575**

** $p < 0.01$, * $p < 0.05$

Note: ρ is displayed for all correlations involving gender. *r* is displayed for all other relationships.

Table VIII: Correlations between distress and its potential predictors in adults (N=50) and adolescents (N=46)

	Adults	**Adolescents**
	FLACC	**FLACC**
Age	-0.328*	-0.206
Gender	0.219	-0.035
DS-R	0.336*	0.317*
PCS	0.522**	0.317*
Anxiety (STAIS)	0.320*	0.628**
Anxiety (CAPS)	N/A	0.609**
CAS-Yuck	0.398**	0.264

** $p < 0.01$, * $p < 0.05$
Note: ρ is displayed for all correlations involving gender. *r* is displayed for all other relationships.

Table IX demonstrates significant predictors of pain and distress when examining the combined sample of adults and adolescents. A significant positive correlation was detected between CAS-Pain and (1) Female gender (r = 0.217, p< 0.05); (2) DS-R (r = 0.359, p< 0.01); (3) PCS (r = 0.347, p< 0.01); (4) Anxiety (r = 0.531, p< 0.01) and (5) CAS-Yuck (r = 0.562, p< 0.01). FLACC Distress was positively correlated with (1) DS-R (r = 0.334, p< 0.01); (2) PCS (r = 0.419, p< 0.01); (3) Anxiety (r = 0.471, p< 0.01) and (4) CAS-Yuck (r = 0.327, p< 0.01). FLACC distress was negatively correlated with age (r = -0.227, p< 0.05).

Table IX: Correlations between pain, distress and potential predictors in total sample (N=96)

	CAS-Pain	**FLACC**
Age	-0.195	-0.227*
Gender	0.217*	0.082
DS-R	0.359**	0.334**
PCS	0.347**	0.419**
STAIS	0.531**	0.471**
CAS-Yuck	0.562**	0.327**
CAS-Pain	1	0.488**

** p< 0.01, * p< 0.05

Note: ρ is displayed for all correlations involving gender. r is displayed for all other relationships.

3.4 Predictors of self-reported pain and observable pain-related distress

With CAS-Pain as the dependent variable, the final model accounted for 45.5% of the variance in self-reported pain ($F_{4,91}$=20.811, $p < 0.001$) (see Table X). Disgust was a significant predictor of self-reported pain (standardised beta coefficient (β) =0.392, $p < 0.001$), followed by anxiety (β =0.345, $p < 0.001$) when controlling for all other variables in the model, such as pain- catastrophising and gender.

Table X: Multivariate predictors of self- reported pain (CAS) in total sample (N=96)

Predictor variable	**β**	**Adjusted R^2**
Disgust	0.392***	0.455
Anxiety	0.345***	
Pain- catastrophising	0.154	
Gender	0.084	

*** $p< 0.001$

With FLACC as the dependent variable, the model accounted for 31.4% of the variance in observable pain-related distress ($F_{4,91}$=11.858, $p < 0.001$) (see Table XI). Anxiety was a significant predictor of observable distress (β=0.363, $p < 0.001$), followed by pain- catastrophising (β=0.262, $p < 0.01$) when controlling for all other variables in the model, such as disgust and age.

Table XI: Multivariate predictors of observed distress (FLACC) in total sample (N=96)

Predictor variable	**β**	**Adjusted R^2**
Anxiety	0.363***	0.314
Pain- catastrophising	0.262**	
Disgust	0.123	
Age	-0.097	

*** $p< 0.001$, ** $p< 0.01$

3.5 Predictors of anxiety

With anxiety as the dependent variable, the model accounted for 27.4% of the variance in anxiety ($F_{1,94}$=36.833, $p < 0.001$) (see Table XII). Pain was a significant predictor of self-reported anxiety ($\beta = 0.531$, $p < 0.001$).

Table XII: Predictors of anxiety (STAIS) in total sample (N=96)

Predictor variable	**β**	**Adjusted R^2**
Pain	0.531***	0.274

*** $p< 0.001$

As discussed previously, some measures predicted anxiety in adults but not in adolescents and vice versa. Hence, regression analyses were also performed separately in the adult and adolescent populations (see Appendix 4).

3.6 Relationship between heart rate and disgust/anxiety

No significant correlations were observed between change in pulse and participant disgust and anxiety.

4.0 Discussion

This study was performed to (1) validate the use of the CAS-Yuck and to determine if anxiety and disgust (2) predict pain outcomes and (3) correlate with heart rate and fainting risk. (4) Parental influence on adolescents' anxiety, disgust and needle pain outcomes was also investigated.

Adults and adolescents were relatively homogenous with significant between-group differences emerging only for pain-catastrophising, which was higher among adolescents as expected (Crombez et al., 2003). Consistent with literature, younger age was associated with higher disgust propensity and greater pain distress (Crombez et al., 2003; Olatunji et al., 2007; Rozin et al., 2008). Contrary to the literature, age had no significant effect on anxiety, disgust or pain (Gullone & King, 1993). This may be due to the characteristics of the adolescent sample, which consisted of some outpatients who were accustomed to receiving venipuncture. This familiarity may have affected adolescents' self-reported pain and anxiety levels.

Consistent with the literature, females reported greater pain-intensity (Crombez et al., 2003). Although previous studies have demonstrated that females report greater fear levels (Gullone & King, 1993), gender did not seem to influence either anxiety or disgust in our study

A significant correlation was demonstrated between participants' scores for the CAS-Yuck, with their scores for the DS-R. This correlation remained significant even when controlling for potential confounders like anxiety and age, which have been associated with disgust (Cisler et al., 2009). The DS-R was an age-appropriate measure for our sample with good internal consistency (Olatunji et al., 2007). More-over, the CAS itself has been extensively validated in pain contexts even in children as young as five years (McGrath et al., 1996). Hence, this validates the use of the 'Yuck' Scale by Du et al. (2009) to measure children's disgust responses to needle pain, thus confirming that 'yuck' is a valid pseudonym for disgust across various age groups.

Consistent with current literature, self- reported pain and observable distress significantly increased with increasing self-reported anxiety and pain catastrophising (Crombez et al., 2003). Self-reported disgust and disgust propensity were also significantly associated with self- reported pain and observable distress. Notably, among adolescents, self-reported disgust was not correlated with observable distress (as measured by FLACC).

Self- reported disgust emerged as the strongest significant predictor of self- reported pain intensity whilst anxiety was the second strongest predictor. These results agree with numerous adult studies where blood-injection-injury (BII) phobic individuals respond with greater disgust versus fear/anxiety when exposed to appropriate stimuli (Olatunji, Williams, Sawchuk & Lohr, 2006).

In the current study, anxiety was found to be a stronger predictor of observable pain-related distress than pain- catastrophising. Interestingly, higher anxiety and pain-catastrophising levels significantly predicted greater observable distress whilst higher disgust levels did not. Thus, anxiety predicted pain which was observable to the investigator as measured by the FLACC scale. Although disgust predicted self-reported pain, this pain-related distress was not apparent to the investigator. Similar findings were reported in children (Du et al., 2009).

Pain-catastrophising, anxiety and yuck were significantly inter-correlated. However, only the relationship between yuck and anxiety remained significant when controlling for pain- catastrophising. Previous studies in adults have reported high correlations between disgust and anxiety ($r = 0.68$-0.90) (Olatunji et al., 2007; Smits et al., 2002). Such associations may be due to imprecise emotional labelling where individuals mistake disgust for fear (Woody and Teachman, 2000). This can occur if an individual develops anxiety about experiencing unpleasant disgust sensations (Cisler et al., 2009). Thus disgust is elicited first and fear is evoked as a secondary appraisal.

Notably, the association between yuck and catastrophising was not significant when controlling for anxiety. Thus the relationship between yuck and pain-catastrophising appears to be mediated by anxiety. However, when controlling for anxiety, there was a significant moderate correlation between disgust and helplessness, a dimension of catastrophising. Izard's (1991) proposition that disgust has elements of negative self-evaluation may explain the relationship between disgust and the notion that one is helpless. This is interesting in light of the little or no extant literature on the relationship between catastrophising and disgust. Further research is needed to explore the relationship between these two measures.

The interesting relationships observed between pain-catastrophising, disgust and anxiety prompted the researchers to further examine whether these measures predicted anxiety. When examining anxiety predictors, pain emerged as the only significant predictor. However the literature suggests that younger age, fear of fainting and disgust are implicated alongside pain in predicting anxiety during venipuncture (Deacon & Abramowitz, 2006). Although it is known that pain-catastrophising thoughts underpin anxiety (Crombez et al., 2003), pain-catastrophising did not uniquely predict anxiety in this study.

The correlation between parental and child anxiety, which was observed in this study, has been well established in the literature (Burstein et al., 2010). This study demonstrated a significant moderate positive correlation in disgust propensity between adolescents and their parents. Moreover, the generalised nature of the DS-R indicates that parents and their child demonstrate similar disgust reactions to a variety of disgusting situations.

Du et al. (2009) demonstrated no correlation between parental and child disgust for children aged 3-9. Thus, this demonstrates a developmental difference in disgust emergence. This lends support to the proposition that disgust is an innate response in young children and may become a learnt response as the child matures (Rozin et al., 2008; Stevenson et al., 2010). This finding highlights an important developmental difference between anxiety and disgust.

Whilst studies have demonstrated a strong positive correlation between parental anxiety and child distress during venipuncture (Wolfram & Turner, 1996), this was not observed in this study. Whilst parental anxiety was correlated with child disgust, parental disgust propensity was not significantly correlated with child disgust or pain outcomes, possibly because the DS-R did not relate specifically to needles.

No significant correlations were observed between change in pulse and participant disgust and anxiety. However it was observed that individuals with a history of fainting reported greater pain-catastrophising. Our study was limited in that pulse readings were not consistently taken at specific intervals due to time constraints at the pathology clinic, producing inconsistent results. The fluctuations in heart rate associated with blood-withdrawal would be less marked in a venipuncture setting compared to a blood donation setting, where larger amounts of blood are withdrawn. Additionally, the literature suggests that the afore-mentioned relationships may actually be more complex than once believed (Page, 2003), with fainting symptoms only being observed in individuals high in both disgust sensitivity and trait anxiety (Viar et al., 2010).

This study has highlighted the importance of disgust in needle-pain contexts and has validated a useful scale to measure this response. Further research is needed to investigate the relationship between disgust and pain catastrophising and further explore the mechanisms of disgust acquisition.

5.0 Conclusions

Use of the *Colour Analogue "Yuck Scale"* was validated in adults and adolescents. Self-reported disgust was the strongest significant predictor of self- reported pain intensity, while anxiety was a unique predictor of self-reported pain and observed pain-related distress. Parental and adolescent disgust levels were correlated, providing insight into the developmental acquisition of disgust.

References

Bowen, R.C., Mahmood, J., Milani, A. & Baetz, M. (2010). Journal of Affective Disorders. *Treatment for depression and change in mood instability*. (in press).

Burstein, M., Ginsburg, G.S. & Tein, J.Y. (2010). Parental anxiety and child symptomatology: An examination of additive and interactive effects of parent psychopathology. *Journal of Abnormal Child Psychology: An official publication of the International Society for Research in Child and Adolescent Psychopathology, 38*(7), 897-909.

Carleton, R.N. & Asmundson, G.J.G. (2009). The Multidimensionality of Fear of Pain: Construct Independence for the Fear of Pain Questionnaire-Short Form and the Pain Anxiety Symptoms Scale-20. *The Journal of Pain, 10*(1), 29-37.

Cisler. J.M., Olatunji, B., & Lohr, J.M. (2009). Disgust, fear, and the anxiety disorders: A critical review. *Clinical Psychology Review, 29*, 34 – 46.

Crombez, G., Bijttebier, P., Eccleston, C., Mascagni, T., Mertens, G., Goubert, L., & Verstraeten, K. (2003). The child version of the pain catastrophising scale (PCS-C) a preliminary validation. *Pain, 104*, 639-646.

Crombez, G., Vlaeyen, J.W., Heuts, P.H.T.G., & Lysens, R. (1999). Pain-related fear is more disabling than pain itself: evidence on the role of pain-related fear in chronic back pain disability. *Pain, 80,* 329–39.

Davey, G.C., Forster, L., & Mayhew, G. (1993). Familial resemblances in disgust sensitivity and animal phobias. *Behaviour Research & Therapy.* 31, 41 – 50.

Deacon, B. & Abramowitz, J. (2006). Fear of needles and vasovagal reactions among phlebotomy patients. *Journal of Anxiety Disorders, 20*, 946 – 960.

Du, S., Champion, D. & Yap, C.S.L. (2009). The differential impact of disgust and fear in venipuncture. (in press)

Gerlach, A. L., Spellmeyer, G., Vögele, C., Huster, R., Stevens, S. & Hetzel, G. (2006). Blood-injury phobia with and without a history of fainting: disgust sensitivity does not explain the fainting response. *Psychosomatic Medicine, 68*, 331–339.

Goodenough, B., Roschar, F., Cole, A., Piira, T., & Kuttner, L. (2004). Self-report of pain-related distress before and after pediatric venipuncture: A validation study of Children's Anxiety and Pain Scale. *Psychologica, 27*, 101 – 114.

Goubert, L., Eccleston, C., Vervoort, T., Jordan, A., & Crombez, G. (2006). Parental catastrophizing about their child's pain. The parent version of the Pain Catastrophizing Scale (PCS-P): A preliminary validation. *Pain, 123*, 254 – 263.

Gullone, E. & King, N.J. (1993). The fears of youth in the 1990s: Contemporary normative data. *The Journal of Genetic Psychology, 154,* 137 – 153.

Haidt, J., McCauley, C., & Rozin, P. (1994). Individual differences in sensitivity to disgust: A scale sampling seven domains of disgust elicitors. *Personality and Individual Differences, 16*, 701-713.

Hicks, C., von Baeyer, C., Spafford, P., van Korlaar, I., Goodenough, B. (2001). The faces pain scale-revised: toward a common metric in pediatric pain measurement. *Pain, 93*, 173 – 183.

Izard, C.E. (1991). *The psychology of emotions*. New York: Plenum Press.

Kuttner, L. & LePage, T. (1989). Face scales for assessment of pediatric pain: a critical review. *Canadian Journal of Behavioral Science, 21*, 198- 209.

Lothmann, C., Holmes, E.A., Chan, S.W., Lau, J.Y. (2010). Cognitive bias modification training in adolescents: effects on interpretation biases and mood. *Journal of Child Psychology and Psychiatry.* (in press)

McGrath, P., Seifert, C., Speechlet, K., Booth, J., Stitt, L., & Gibson, M. (1996). A new analog scale for assessing children's pain: an initial validation study. *Pain, 64*, 435 – 443.

Merkel, S.I., Shayevitz, J.R., Voepel-Lewis, T., & Malviya, S. (1997). The FLACC: A behavioral scale for scoring postoperative pain in young children. *Pediatric Nursing, 23,* 293 – 297.

Niemelä, J. (2010). What puts the 'Yuck' in the Yuck Factor. *Bioethics.* (in press)

Olatunji, B.O., Cisler, J., McKay, D. & Phillips, M.L. (2010). Is disgust associated with psychopathology? Emerging research in the anxiety disorders. *Psychiatry Research. 175*, 1–10.

Olatunji, B.O. & Cisler, J.M. (2008). Disgust sensitivity: Psychometric overview and operational definition. In B.O. Olatunji, & D. McKay (Eds.), *Disgust and its disorders: Theory, assessment, and treatment* (pp. 31 – 56). Washington: APA.

Olatunji, B.O. Smits, J.A.J., Connolly, K., Willems, J., & Lohr, J.M. (2007). Examination of the decline in fear and disgust during exposure to threat-relevant stimuli in blood-injection-injury phobia. *Journal of Anxiety Disorders, 21*, 445 – 455.

Olatunji, B.O., Williams, N.L., Sawchuk, C.N., & Lohr, J.M. (2006). Disgust, anxiety and fainting symptoms associated with blood- injection- injury fears: a structural model *Journal of Anxiety Disorders, 20*, 23 – 41.

Page, A.C. (2003). The role of disgust in faintness elicited by blood injection stimuli. *Journal of Anxiety Disorders, 17*, 457 – 464.

Peat, J.K. & Barton, B. (2008). *Medical Statistics: a guide to data analysis and critical appraisal.* Massachusetts: Blackwell Publishing.

Pooley, A.J. & Fiddick, L. (2010). Social referencing "Mr. Yuk": The use of emotion in a poison prevention program. *Journal of Pediatric Psychology*, *35*(4), 327-339.

Rozin, P., Haidt, J. & McCauley, C.R. (2008). Disgust. In Lewis M., Haviland- Jones, J.M. & Barret, F.L. (Eds.), *Handbook of Emotions, Third Edition*. New York: The Guilford Press.

Rozin, P., Fallon, A., & Mandell, R. (1984). Family resemblance in attitudes to foods. *Developmental Psychology, 20*, 309 – 314.

Schmidt, C.W. (2008). The yuck factor: when disgust meets discovery. *Environmental Health Perspectives, 116* (12), A524-7.

Scott, J. & Huskisson, E.C. (1976). Graphic representation of pain. *Pain, 2,* 175–184.

Smits, J.A.J., Telch, M.J., & Randall, P.K. (2002). An examination of the decline in fear and disgust during exposure based treatment. *Behaviour Research and Therapy, 40*, 1243 – 1253.

Spielberger, C.D., Gorsuch, R.L., & Lushene, R.E. (1970). *STAI manual for state-trait anxiety inventory.* Palo Alto, CA: Consulting Psychologies Press.

Stevenson, R.J., Oaten, M.J., Case, T.I., Repacholi, B.M., & Wagland, P. (2010). Children's Response to Adult Disgust Elicitors: Development and Acquisition. *Developmental Psychology, 46* (1), 165–177.

Stinson, J.N., Kavanagh, T., Yamada, J., Gill, N., Stevens, B. (2006). Systematic review of the psychometric properties, interpretability and feasibility of self-report pain intensity measures for use in clinical trials in children and adolescents. *Pain, 125*, 143 – 157.

Sullivan, M.J., Pivik, J. (1995). The pain catastrophizing scale: development and validation. *Psychological Assessment, 7*, 524–32.

Vaitl, D., Schienle, A. & Stark, R. (2005). Neurobiology of fear and disgust. *International Journal of Psychophysiology*, 57(1), 1-4.

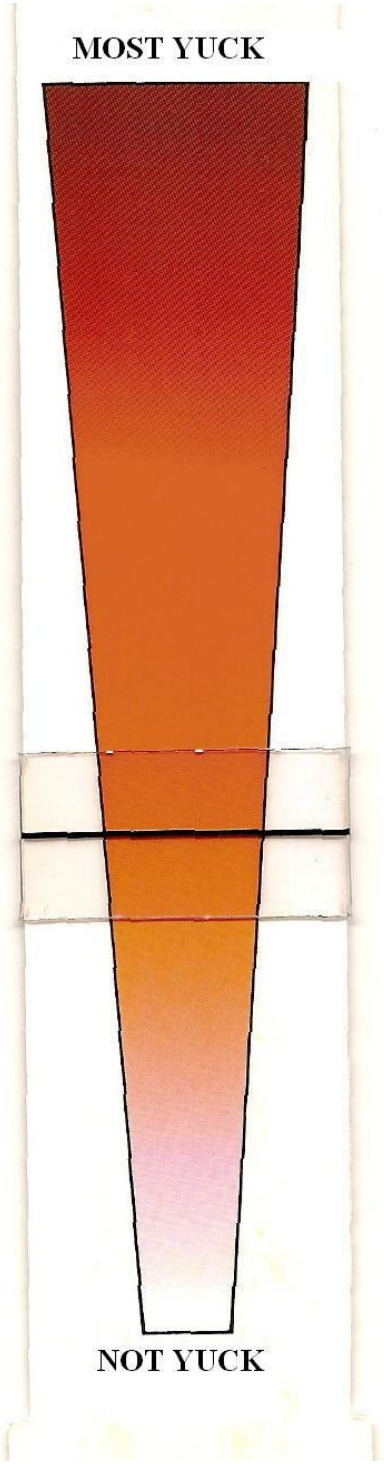
Viar, M.A., Etzel, E.N., Ciesielski, B.G. & Olatunji, B.O. (2010). Disgust, anxiety, and vasovagal syncope sensations: A comparison of injection-fearful and nonfearful blood donors. *Journal of Anxiety Disorders, 24*, 941–945.

von Baeyer, C.L. & Spagrud, L.J. (2007). Systematic review of observational (behavioral) measures of pain for children and adolescents aged 3 to 18 years. *Pain, 127*(1-2), 140-150.

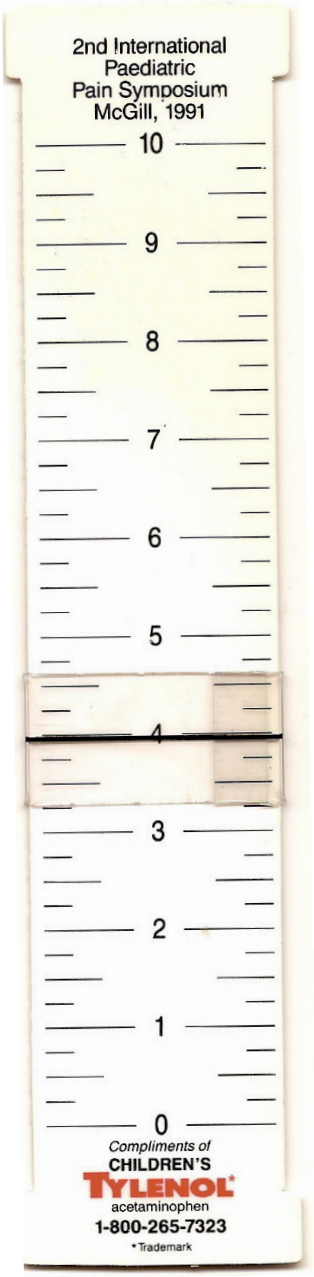
Woody, S.R. & Teachman, B.A. (2000). Intersection of disgust and fear: Normative and pathological views. *Clinical Psychology: Science and Practice, 7,* 291 – 311.

Wolfram, R.W. & Turner, E.D. (1996). Effects of parental presence during children's venipuncture. *Academic Emergency Medicine, 3,* 58 – 64.

Appendix 1: Colour Analogue Scale- Yuck

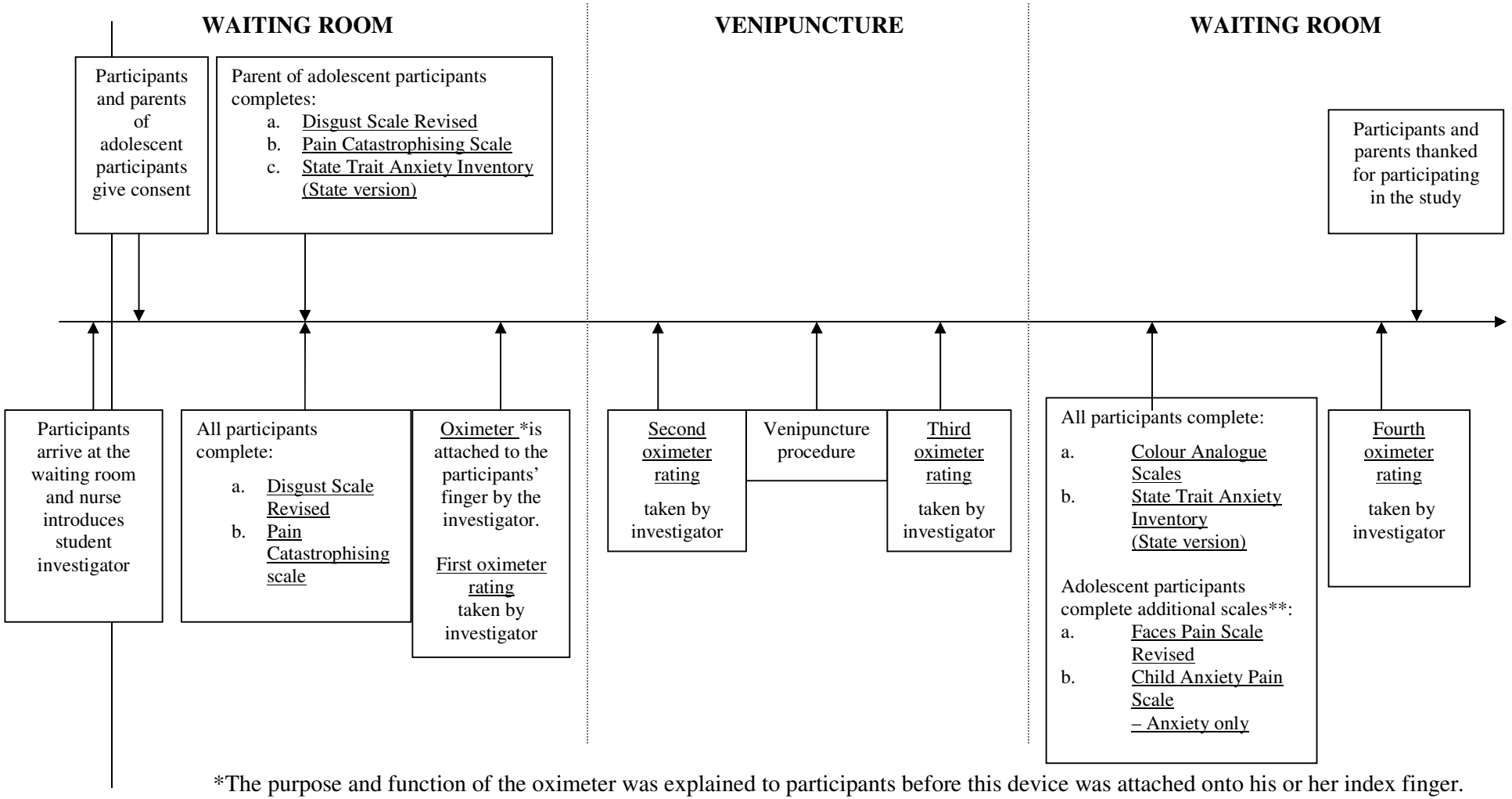


(Front view)



(Back view)

Appendix 2: Schematic Outline of Procedure



*The purpose and function of the oximeter was explained to participants before this device was attached onto his or her index finger.
**Adolescents complete additional questionnaires because they are in the median age range for adult and child questionnaires. Therefore, adolescents complete child *and* adult questionnaires to increase the accuracy of the various pain and anxiety measures.

Note: Nursing staff are only involved at 2 time points: (1) Introducing the investigator and (2) Carrying out the venipuncture. Questionnaires were done in the waiting room and hence, did not interfere with the duration of the standard medical procedure. Oximeter ratings were taken as unobtrusively and quickly as possible during the venipuncture.

Appendix 3: Multivariate Analysis for Pain and Distress

Population	CAS-Pain	FPS-R Pain	FLACC
Total	*Variance explained:* 45.5% *Predictors:* **Disgust** (β = 0.392***) **Anxiety** (β =0.345***) Pain-catastrophising Gender	N/A	*Variance explained:* 31.4% *Predictors:* **Anxiety** (β=0.363***) **Pain-catastrophising** (β=0.262**) Disgust Age
Adult	*Variance explained:* 48.3% *Predictors:* **Disgust** (β= 0.470***) Pain-catastrophising Anxiety Age	N/A	*Variance explained:* 33.5% *Predictors:* **Pain-catastrophising** (β= 0.389**) Disgust Age Anxiety
Adolescent	*Variance explained:* 52.8% *Predictors:* **Anxiety (STAIS)** (β =0.552 ***) **Disgust** (β =0.381**) Gender. Pain-catastrophising Parental anxiety	*Variance explained:* 63.4% *Predictors:* **Disgust** (β =0.491***) **Anxiety (STAIS)** (β =0.459***)	*Variance explained:* 42.9% *Predictors:* **Anxiety**[3] **(STAIS)** (β =0.666***)
	Variance explained: 34.8% *Predictors:* **Disgust** (β =0.422*) Anxiety (CAPS) Gender	*Variance explained:* 47.8% *Predictors:* **Disgust** (β =0.573**) Anxiety (CAPS)	*Variance explained:* 35.6% *Predictors:* **Anxiety (CAPS)** (β =0.723***) Pain- catastrophising Disgust Age

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Note: Variables were entered into the model in the order listed and significant and non-significant predictors are outlined. Since adolescents are in the median age range for adult and child questionnaires, two measures of anxiety (STAIS, CAPS) and two measures of pain (CAS, FPS-R) were used in the adolescent population. To take into consideration any difference between these measures, six multi-variate analyses were performed in the adolescent population.

[3] This was initially a *multiple* linear regression model. However, after the process of removing variables that did not contribute to explaining the variance in FLACC, only one predictor remained in the model, thus making this a linear regression model.

Appendix 4: Multivariate Analysis for Anxiety

Population	Anxiety (STAIS)	Anxiety (CAPS)
Total	*Variance explained:* 27.4% *Predictors:* **Pain** (β = 0.531***)	N/A
Adult	*Variance explained:* 17.6% *Predictors:* **Pain** (β= 0.440**)	N/A
Adolescent	*Variance explained:* 51.4% *Predictors:* **Pain (CAS)** (β= 0.614, p <0.001) **Parental anxiety** (β= 0.310**)	*Variance explained:* 49.7% *Predictors:* **Pain-catastrophising** (β= 0.354*) **Disgust** (β= 0.523**) Pain (CAS) Parental anxiety
	Variance explained: 48.3% *Predictors:* **Pain (FPS-R**) (β= 0. 609***) Parental anxiety	*Variance explained:* 50.3% *Predictors:* **Pain-catastrophising** (β= 0.346*) **Disgust** (β= 0. 481**) Pain (FPS-R) Parental anxiety.

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Note: Variables were entered into the model in the order listed and significant and non-significant predictors are outlined. Two measures of anxiety (STAIS, CAPS) and two measures of pain (CAS, FPS-R) were used in the adolescent population as they are in the median age range for adult and child questionnaires. To take into consideration any difference between these measures, four multi-variate analyses were performed in the adolescent population.