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Risk Factors for Suicidality in Clinical Populations of Adolescents

Word Count: 15651 +57

Section A:

Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

Word Count: 7778+28

Section B:

Investigating the Impact of Bullying on Suicidality in a Clinical Sample of Adolescents  
with Autism Spectrum Conditions

Word Count: 7902+29

A thesis submitted in partial fulfilment for the requirements of Canterbury Christ Church

University for the degree of Doctor of Clinical Psychology.

April 2018

Salomons

Canterbury Christ Church University

**CANTERBURY CHRIST CHURCH UNIVERSITY**  
**Doctorate in Clinical Psychology (D.Clin.Psychol.)**

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## Acknowledgments

With thanks to:

Johnny, Jo and John for your plentiful support and guidance.

Jyoti, Sumithra, Andrea and George for offering your expertise in NLP which made this project possible.

My friends for listening sympathetically.

My course colleagues for not talking about it.

My parents who I know would be proud of me even if I hadn't written anything.

Jack for occasionally telling me to stop procrastinating and for doing all the cooking.

## Project Summary

**Section A:** This section is a systematic review and meta-analysis. It identifies recent longitudinal studies of clinical populations of adolescents which investigate risk factors for suicidality. The study included longitudinal studies with a variety of different outcomes. A wide range of risk factors were identified in the systematic review. Meta-analysis identified that anxiety, deliberate self-harm and past suicide attempts at baseline predicted suicidality at follow up. The implications of these findings for clinicians working with adolescents with mental health problems is discussed.

**Section B:** This quantitative study investigates the impact of bullying at baseline on suicidality at follow-up in a clinical population of 680 adolescents with autism spectrum conditions (ASCs). Natural Language Processing (NLP) was used to extract mentions of bullying and suicidality from the free-text fields of adolescents' Electronic Health Records (EHRs). This study found that bullying, and additionally gender, diagnosis of psychosis or depression, and the absence of an intellectual disorder predicted suicidality at follow-up. Clinical implications include increasing the involvement of mental health clinicians in preventing bullying.

# Contents

Section A.....	12
Abstract.....	13
Introduction.....	14
Suicidality.....	16
Nomenclature.....	16
Advantages and drawbacks .....	16
Models .....	17
Why study adolescents separately? .....	18
Previous reviews .....	20
Aims and rationale .....	22
Method .....	24
Design.....	24
Data analytic plan.....	24
Eligibility criteria .....	24
Search terms .....	25
Included.....	26
Identification .....	26
Screening.....	26
Eligibility.....	26

Data sources .....	27
Study selection .....	27
Data extraction .....	27
Data extraction and coding.....	28
Assessing quality.....	28
Meta-analysis .....	28
Heterogeneity.....	29
Continuous exposures.....	29
Publication bias.....	29
Results.....	30
Narrative synthesis .....	30
Design.....	30
Measures .....	30
Sample .....	31
Quality .....	31
Summary of combined studies .....	32
Risk factors.....	47
Biological.....	47
Psychological – diagnoses .....	47
Other psychological factors .....	48
Social/demographic .....	49

Meta-Analysis .....	50
Discussion .....	52
Main outcomes .....	52
Missing risk factors .....	53
The spectrum of suicidality – heterogeneity of outcome .....	54
Models of suicide .....	54
Clinical utility.....	56
Strengths and limitations.....	56
Conclusion .....	59
References.....	60
Section B.....	71
Abstract.....	72
Introduction.....	73
Background .....	73
Definitions.....	74
Suicidality.....	74
Bullying .....	75
ASCs.....	76
Adolescence.....	76
Bullying, ASCs and Suicidality .....	78
Potential confounders.....	79



Models of suicide .....	80
Rationale.....	81
Hypotheses .....	82
Primary hypothesis: .....	82
Secondary hypothesis: .....	82
Method .....	83
Design.....	83
Data.....	83
Defining suicidality .....	86
Ethics .....	86
Participants .....	87
Procedure.....	88
Justification of sample size.....	89
Results.....	90
Characteristics of the sample.....	90
Missing data and excluded participants .....	92
Cox regression.....	94
Discussion.....	98
Hypotheses .....	98
Further research.....	100
Strengths and limitations.....	101

Clinical records.....	102
Longitudinal research .....	103
The bullying and suicidality search strategy .....	103
The problem of intent .....	104
Applications .....	105
Conclusion .....	106
References.....	107

## **Tables and Figures**

Table 1- Identified associations .....	21
Figure 1 - PRISMA 2009 Flow diagram.....	26
Figure 2 – PsychINFO Search Strategy .....	27
Table 2 - Included Articles .....	35
Table 3 - Meta Analysis.....	51
Table 4 - Characteristics of baseline sample by suicidality over follow-up .....	91
Table 5 - Characteristics of baseline sample by bullying .....	93
Table 6 - Suicidality regression analysis .....	95

## **Appendices**

Appendix A – Letter to Authors .....	121
Appendix B – Meta Analysis data extraction form .....	122
Appendix C – Quality Assessment .....	123
Appendix D – Meta-analysis – publication bias .....	125
Appendix E – Graphs.....	126
Appendix F – Bullying Application Specification.....	132
Appendix G – Manual for Suicidality Coding .....	134
Appendix H – Ethical Approval .....	136
Appendix I – Analysis of missing data .....	137

## Section A

Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

## Abstract

Suicide is one of the main causes of death in young people. Risk factors for suicide common to all age groups include diagnosis of mental illness, drug or alcohol misuse, self-harm, and social isolation. However, child and young person specific factors have also been identified, such as bullying, and educational stress. This study provides a systematic review and meta-analysis of these risk factors within clinical populations to provide an up-to-date overview of risk factors relevant to clinical services. The prospective risk factors for suicidality in adolescents were identified and their effect strength and clinical utility determined.

MEDLINE, Psychinfo and EMBASE® databases were searched from 01/01/2007 to 01/10/2017, reviewed journal articles published in English were included. Longitudinal studies with participants  $\leq 19$  years at follow-up were included where suicidality was included as an outcome at follow-up, where participants were users of mental health services at baseline.

All patient-relevant exposures at baseline, including demographic characteristics, diagnostic information and scores on normed outcome measures were included in this review. Narrative synthesis and meta-analysis were employed to synthesise results. A quality checklist for longitudinal studies was used to appraise all studies.

20 studies were identified, of which 10 were included in the meta-analysis. Anxiety, past suicide attempts and deliberate self-harm (DSH) at baseline were identified as risk factors for suicidality at follow-up. Clinicians working within Child and Adolescent Mental Health Services (CAMHS) may be able to develop interventions which target risk factors. Further longitudinal research is needed to identify risk and protective factors for suicidality in young people.

Keywords: Suicidality, adolescence, risk factors, longitudinal

## Introduction

Suicide is a leading cause of death worldwide for people aged 10-19-years. In 2015 suicide led to the deaths of 67,149 young people internationally (World Health Organization, 2017). In the UK suicide is the 2<sup>nd</sup> leading cause of death in males aged 15-19 and the 6<sup>th</sup> leading cause of death in females of this age group (Office for National Statistics, 2017). Whilst some risk factors for suicide are common across all ages (e.g. mental illness, self-harm, social isolation), others are specific to children and adolescents (e.g. bullying, exam stress) (Parellada et al., 2008).

Suicidal adolescents can be challenging to manage and mental health services address suicide within a framework of prevention. Suicide prevention is often conceptualised as a task for individual clinicians, who are typically required to conduct a risk assessment to inform their clinical decision making about care pathways (Subotsky, 2003). Risk assessments may be used to identify whether a patient is part of a high-risk or low-risk group for suicide (Eagles, Klein, Gray, Dewar, & Alexander, 2001); improved triage of people presenting to mental health services is cited as a rationale for research in this field. However, reviews of the literature in the field of adult suicide research indicate that accurately predicting suicide outcome is not currently possible (Chan et al., 2016; Franklin et al., 2017). Though it is not currently possible for clinicians to determine whether a patient will go on to complete suicide; at a service level, identifying groups at higher risk of suicide would improve targeting of suicide prevention initiatives and facilitate the development of better interventions aimed at preventing suicide.

With a knowledge of common and modifiable social and clinical risk factors for suicide, clinicians develop treatment plans which aim to reduce suicide risk. For example, clinical services may be able to act by removing the risk factor (e.g. reducing quantity of ligature

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

points in inpatient wards/preventing paracetamol purchases by children) or by delivering interventions to those identified as at higher risk of suicide. Static risk factors are exposures which are unchangeable, for example ethnicity or exposure to perinatal depression. Dynamic risk factors are exposures which are changeable, for example bullying or depression diagnosis.

There is a wealth of research into risk factors for suicidal behaviour in adolescents and many risk factors have been identified (Pelkonen & Marttunen, 2003). However, most studies in the field are cross-sectional. Cross-sectional studies can identify correlates, but longitudinal designs are needed to identify dynamic risk factors. This is because correlational studies cannot determine whether the exposure preceded the outcome. Longitudinal studies of suicidal risk in adolescents tend to focus on clinical populations. For clinicians, developing a clear understanding of the risk factors associated with suicidality in the populations that they are likely to encounter is more useful than understandings of risk across the general population. In the UK, less than 2% of children will be in contact with CAMHS in any month (NHS England, 2016). Research based on clinical cohorts may be more meaningful to clinicians as it may be that there are differences in the characteristics of clinical populations compared to the general population. Despite an increasing number of studies being published in this field, there has not been a recent review of the literature.

Understanding risk factors for suicidality in adolescents may enable the development of improved actuarial assessments of suicide risk (British Psychological Society, 2016). These tools would provide clinicians with an efficient means of assessing risk in their patients. The ability to draw on knowledge of main risk factors for self-harm forms part of the competency framework for clinicians working in CAMHS (University College London, N.D.). In order to effectively identify risk factors, clinical psychologists need access to up to date and clear information.

## **Suicidality**

### **Nomenclature**

This paper will refer to the concept of ‘suicidality’, commonly used in the literature.

Suicidality includes three components: completed suicide, suicide attempts and behaviour, and suicidal ideation, as per the Beck classification and nomenclature scheme (Beck, Kovacs, & Weissman, 1979). Suicide has been defined as death as a result of DSH, or injury or poisoning of undetermined intent (World Health Organization, 1992). Defining *suicide attempts* proves difficult because of the difficulty of determining the lethality and intent behind acts of DSH. This paper adopts one common definition of suicide attempt as a behaviour which does not result in death, for which there is evidence that the person had the intent to kill themselves, this may or may not result in injury (Suicide Prevention Resource Center, 2006). *Suicidal behaviour* includes attempts but also includes preparatory acts (e.g. writing notes or collecting materials). *Suicidal ideation* can be passive or active: passive ideation is characterised by thoughts about wanting to be dead/die; active ideation involves thoughts of the act of killing oneself or planning suicidal behaviours (Posner, Oquendo, Gould, Stanley, & Davies, 2007).

### **Advantages and drawbacks**

There are both advantages and drawbacks to studying suicidality rather than suicide, suicide attempt, suicidal behaviour or suicidal ideation separately. One reason to study suicidality is that suicide is a low base-rate behaviour. Even in high-risk clinical samples, large numbers of participants are needed to obtain significant results. Suicidality acts as a proxy for suicide because it captures a wide range of thoughts and behaviours strongly associated with suicide, which are far more common. A limitation to the use of suicidality as the outcome of interest is that no standard measure or definition exists for this construct. This study assumes that



different measures of suicidality are measuring the same outcome, therefore assuming the outcomes should have the same risk factors. Aggregating the results of multiple studies which have suicidality as their outcome, one might assume that the same outcome is being measured. However, it may be the case that different forms of suicidality are heterogeneous, rather than existing on a spectrum of severity, and, as a result, have different risk factors.

DeJong, Overholser, and Stockmeier (2010) found that suicidal thoughts and behaviours may not fully generalise to suicide, with different correlates and predictors.

### Models

There are many different models that seek to organise the complex information that exists about suicide. Baumeister (1990) posited that escape from unbearable situations or states of mind lead to suicidality. He developed a six-step model which begins with a discrepancy between expectations and perceived reality which is experienced as failure. In the second step individuals interpret failure as due to personal qualities and blame themselves. Third, self-blame leads to cognitive distortion in comparing oneself with unachieved standards. In a fourth step this distorted comparison causes negative emotions. Fifth, escape from reality is attempted through focussing on immediate goals and sensory experiences. This leads to a final state of reduced inhibition in which suicidal behaviours occur.

The comprehensive cognitive model of suicide (Wenzel & Beck, 2008) suggests that hopelessness is a core component of suicide which disrupts beliefs about the self, others and the future. According to this model, heightened vulnerability is caused by traits of impulsivity, aggression, difficulties problem solving, over-general memory, maladaptive coping, perfectionism and neuroticism. This vulnerability, in combination with stressful life events leads to suicide biases and suicidal schemas. Cognitive biases are systematic thinking errors, which are biased towards an individuals beliefs or preferences (Gratton, Cooper, Fabiani, Carter, & Karayanidis, 2018). Suicidal biases in attention, information processing

and memory lead to selective processing of stimuli related to suicide and make it more difficult for suicidal individuals to think of reasons for living. Impulsive attempts are associated with schemas characterised by perceiving situations and states of mind as unbearable; whereas, non-impulsive attempts are characterised by schemas of chronic hopelessness. Cha, Najmi, Park, Finn, and Nock (2010) found that an attentional bias to suicide preceded suicide attempts in a prospective study of adults presenting to an emergency department.

The developmental model posits that genes, biological factors (e.g. in-utero environment), and early childhood adversity interact with accumulated life stressors leading to vulnerability (Séguin, Beauchamp, Robert, DiMambro, & Turecki, 2014). Therefore, some adolescents according to this model would be more sensitive to negative life events and more likely to choose suicidal acts in response to environmental pain.

The interpersonal theory of suicide (IPTS) theorises that an individual will die by suicide if they have both suicidal ideation (the desire to die) and the acquired capability for suicide (Stewart, Eaddy, Horton, Hughes, & Kennard, 2017). Van Orden et al. (2010) propose that suicidal ideation is a result of a combination of thwarted belongingness and perceived burdensomeness, whilst the capability for suicide is formed of increased pain tolerance and lowered fear of death. Some preliminary evidence suggests that the IPTS may be useful in understanding the diverse risk factors for suicide identified in adolescence (Stewart et al., 2017).

### **Why study adolescents separately?**

Adult-related research investigating risk factors for suicidality does not necessarily translate to adolescent populations. Adolescence is a period of significant bio-psycho-social change which is distinct from both earlier childhood and adulthood. Cross-cultural studies indicate

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

that adolescence is a widely recognised life stage starting around puberty and ending with adulthood (Brown, Larson, & Saraswathi, 2002). In many societies, the onset of adolescence is celebrated through rituals or ceremonies associated with anticipated adult roles (Richter, 2006). It is a period of multiple transitions in education, employment, relationships and living situation (Richter, 2006).

Adolescence is recognised as a period of heightened risk-taking (Galvan, Hare, Voss, Glover, & Casey, 2007). This emergence of risk-taking behaviour is described by Baumrind (1987) as a normal developmental phenomenon marked by changes to biological, psychological and social processes. Many diagnosed mental health problems begin in adolescence (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003). A British survey of 15-16-year-olds found that 15% had experienced suicidal ideation (Hawton, Rodham, Evans, & Weatherall, 2002).

Research suggests that adolescents (12-17 years) and adults (18 years and older) that attempt suicide have different mental health diagnoses. Adolescents are more likely to be diagnosed with adjustment or anxiety disorders, whereas adults are more likely to be diagnosed with affective disorders (Parellada et al., 2008). Parellada et al. (2008) found that adults were significantly more certain of the possible fatal outcome when making suicide attempts, compared with adolescents. In adolescent populations, comprehension of lethality may be limited (Posner et al., 2007). This means that actions unlikely to result in death (e.g. jumping from a low bridge) may be taken with a sincere belief that death is a likely outcome, and conversely, acts which are highly likely to result in death might be intended only to result in harm.

It cannot be assumed that adult-sample derived risk factor research can be imposed on adolescence. It should be examined whether risk factors for adolescents differ from those of adults. Suicide ideation and attempts often first appear in adolescence (Stewart et al., 2017), their relationship with risk factors may change over time, with changes to biological,

psychological and social functioning. Developmental tasks associated with adolescence may make some risk factors more important in adolescence than in adulthood. For example, the task of identity formation may increase the salience of peer relationships or school performance when compared to adults. Additionally, risk factors from childhood (e.g. childhood trauma) may be more salient due to recency effects.

### **Previous reviews**

Previous reviews of risk factors for suicidality in adolescents have focussed on cross-sectional, population-based studies (Beautrais, 2000; Evans, Hawton, & Rodham, 2004; Steele & Doey, 2007). Reviews of individual risk factors indicate that sexual minority status, involvement in bullying or cyberbullying, childhood abuse and maltreatment, and ASC diagnoses are associated with suicidal ideation and behaviours (Hannon & Taylor, 2013; Holt et al., 2015; Marshal et al., 2011; Miller, Esposito-Smythers, Weismore, & Renshaw, 2013; Van Geel, Vedder, & Tanilon, 2014). As static factors, sexuality and ASC can be assumed to precede suicidality, however, bullying, as a dynamic factor, cannot be established as a risk factor through cross-sectional designs. It is unclear whether longitudinal research supports the findings of cross-sectional studies.

Previous reviews of risk factors have tended to include both general population and clinical cohorts in the same analyses. There may be a significant difference in the impact of dynamic risk factors on adolescents who are already being treated for mental health problems compared with peers who are not using mental health services. This may have led to an inaccurate estimate of the predictive power of certain risk factors in clinical populations. Additionally, the strength of the association between risk factors and outcome may be stronger or weaker (Cheng, Chen, Chen, & Jenkins, 2018; Hawton, Casañas i Comabella, Haw, & Saunders, 2013).

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

Table 1 shows biological, psychological and social/demographic risk factors that have been identified by previous reviews.

*Table 1- Identified associations*

Biological (Beautrais, 2000; Evans et al., 2004; Steele & Doey, 2007)	Psychological (Beautrais, 2000; Evans et al., 2004; Hannon & Taylor, 2013; Steele & Doey, 2007)	Social/Demographic (Beautrais, 2000; Evans et al., 2004; Holt et al., 2015; Steele & Doey, 2007)
<ul style="list-style-type: none"> <li>- Poor physical health</li> <li>- Physical disability</li> <li>- Genetic factors (from twin studies)</li> <li>- Low levels of serotonin</li> </ul>	<ul style="list-style-type: none"> <li>- Any mental disorder</li> <li>- Depression</li> <li>- Anxiety disorder</li> <li>- Eating disorder</li> <li>- ASC</li> <li>- Behavioural disorders, juvenile offending, antisocial behaviour (in female but not male adolescents)</li> <li>- Self-esteem</li> <li>- Hopelessness</li> <li>- Sleep difficulties</li> </ul>	<ul style="list-style-type: none"> <li>- Older age of adolescent</li> <li>- Gender (attempts more common in female, completed varies by nationality)</li> <li>- Ethnic minority status</li> <li>- Substance use/ illicit drug use</li> <li>- Alcohol use</li> <li>- Smoking</li> <li>- Sexual minority status</li> <li>- Low socio-economic status</li> <li>- Sexually active (not controlling for age)</li> <li>- Physical and/or sexual abuse</li> <li>- Suicidal behaviours in family members</li> <li>- Suicidal behaviours in peers</li> <li>- Suicide in media</li> <li>- Parent's cohabitation status</li> <li>- Poor communication with family</li> <li>- Family discord</li> <li>- Impaired parent-child relationships</li> <li>- Family drug and alcohol use</li> <li>- Family mental health problems</li> <li>- Poor academic performance</li> <li>- Poor school attendance</li> <li>- Negative attitudes towards school</li> <li>- Misconduct in school</li> <li>- School dropout</li> <li>- Poor relationships with peers</li> <li>- Access to firearms</li> <li>- Rural living (not controlling for firearms access)</li> <li>- Gang involvement</li> <li>- Obesity</li> <li>- Bullying</li> <li>- Stressful life events</li> </ul>

## Aims and rationale

This study sought to identify recent prospective studies in clinical populations of adolescents where suicidality is included as an outcome prior to 20 years of age. Suicidality was chosen as a metric because there was insufficient literature exclusively addressing completed suicide, suicide attempts or suicidal ideation. In so far as it could be determined, DSH without suicidal intent was not included in this review. Whilst DSH without suicidal intent is associated with suicidality, there is evidence to suggest that these two outcomes have different risk factors in adolescents and warrant separate study (Mars et al., 2014). Studies employing a longitudinal design were selected in order to capture the impact of dynamic risk factors.

Given the range of studies with varying methodologies and sample types, a meta-analysis provided a means to assess the magnitude of identified risk factors. To summarise the findings, the magnitude of the combined effect of all risk factors and the magnitude of each individual risk factor category will be included. Meta-analytic methods were deemed appropriate because of the substantial variation in risk factor magnitudes between studies. Meta-analytic methods use dynamic weighting to overcome difficulties in determining the true magnitude of risk factors. Decisions about the predictive power of a risk factor cannot be based on the results of a single study. Meta-analysis provides a mechanism for objective synthesis of data across multiple studies. By presenting the results of a meta-analysis of included studies, it will be possible to better understand variability in results across studies.

This study's aims were:

- To identify risk and protective factors for suicidality in clinical populations of adolescents and assess their overall effect size.

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

- To draw conclusions regarding the longitudinal relationship between suicidality in adolescence and its potential determinants whilst considering confounders and methodological limitations.
- To understand and quantify the variability in results across studies.

## Method

### Design

This research used a systematic literature search. Findings were narratively synthesised and meta-analysed where data was available.

### Data analytic plan

First, the descriptive characteristics of this literature was calculated, including number of prediction cases across time, outcome and sample type, as well as follow-up lengths and the number of participants with a suicide-related outcome. Second, the ability of the specific categories of risk and protective factors to predict suicidality was calculated, whilst accounting for publication bias.

### Eligibility criteria

Language – only English language articles were included

Longitudinal prediction – only longitudinal studies were included to capture studies which identify dynamic risk factors. Potential risk factors had to be clearly measured at baseline.

Publication date – articles published between 2007-2017 were included to capture only the most up-to-date research in this field.

Age range – only articles in which the age at follow-up was less than or equal to nineteen were included. Whilst chronological age is just one of several ways to define adolescence, and the upper age limit used to define adolescence can be as high as 25 years (Hawton, Saunders, & O'Connor, 2012), services are frequently divided based on legal definitions of adulthood.

Clinical sample – only study populations in which all participants were known to mental health services at baseline were included. Mental health services were defined as services



## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

intended to treat adolescents with diagnosable mental disorders or in crisis (e.g. Accident and Emergency). School counselling clinics and GP practice registers were not included.

Outcome – only studies which predicted suicidality (not DSH without intent to die) using a quantitative design were included.

### **Search terms**

Search terms were identified based on an initial examination of the literature and the identification of similar systematic search strategies employed in related studies.

See Figure 1 for a PRISMA flow diagram (Moher, Liberati, Tetzlaff, Altman, & Group, 2009) of the overall process.

**Search terms:**

*child\* or boy\* or girl\* or infant\* or juvenil\* or minor\* or paediatric\* pediatric\* or school\* or adolesc\* or pre-adolesc\* or preadolesc\* or pubert\* or pubescen\* or prepube\* or pre-pube\* or high-school or teen\* or young or youth\* or student\**

AND

*longitudinal\* or predict\* or prospective\* or future or later or follow\* or risk\* or protect\* or gene\**

AND

*suicid\*, self-harm, self-injury, self-directed violence, self-mutilation, deliberate self-harm, DSH, nonsuicidal self-injury, NSSI, self-cutting, self-burning, self-poisoning*

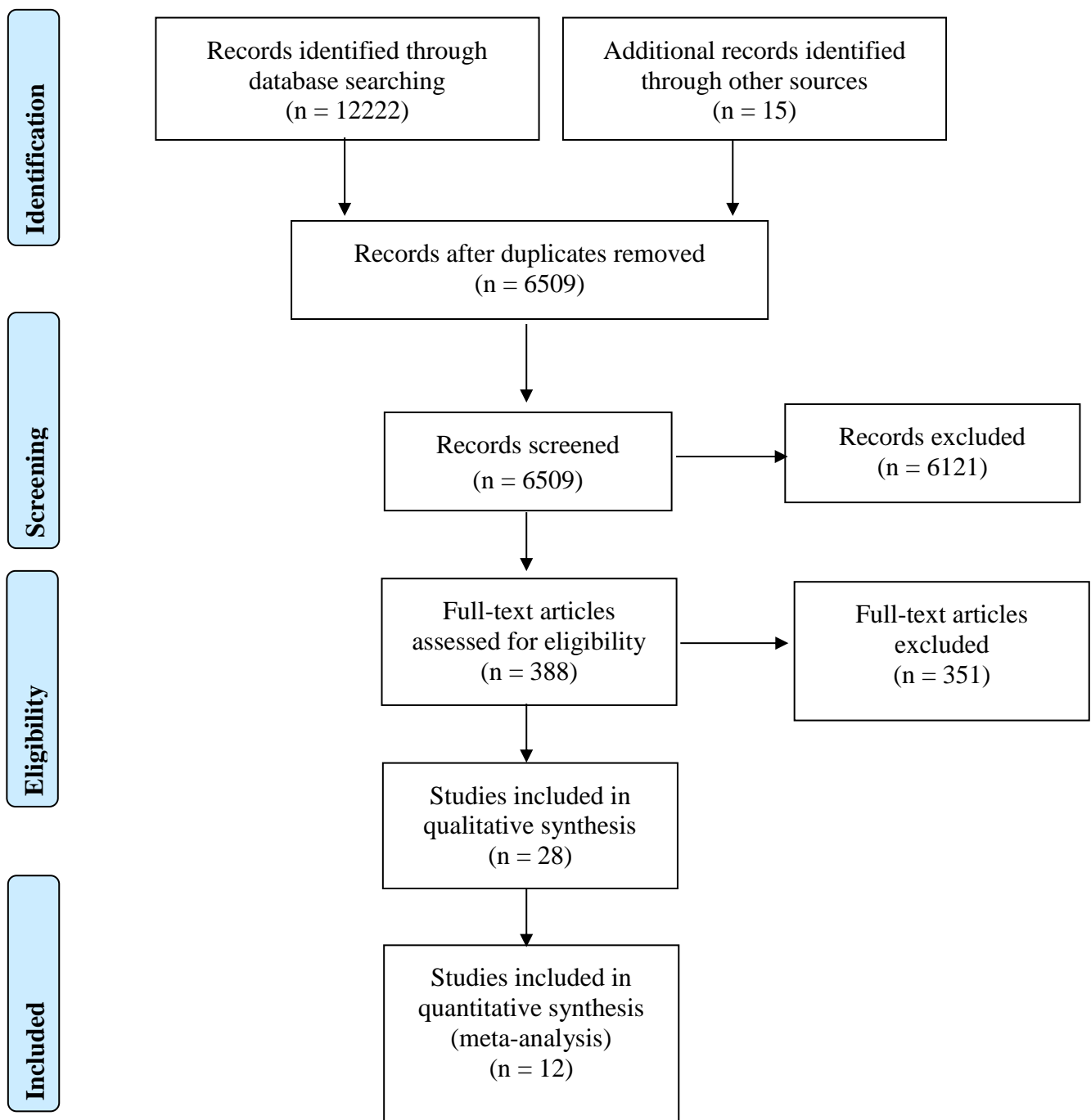


Figure 1 - PRISMA 2009 Flow diagram

## Data sources

Searches were conducted in PsycINFO, Medline and Web of Science (search conducted from 01/01/2007 to 01/10/17). A full electronic search strategy for PsychINFO is included in figure 2. Additional papers were identified through reference lists and citing articles searches of included studies using Google Scholar (n=15).

Figure 2 – PsychINFO Search Strategy

1. (child\* or boy\* or girl\* or infant\* or juvenil\* or minor\* or paediatric\* pediatric\* or school\* or adolesc\* or pre-adolesc\* or preadolesc\* or pubert\* or pubescen\* or prepube\* or pre-pube\* or high-school or teen\* or young or youth\* or student\*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
2. (longitudinal\* or predict\* or prospective\* or future or later or follow\*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
3. (risk\* or protect\* or gene\*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
4. exp Attempted Suicide/ or exp Suicidal Ideation/ or exp Suicide/
5. \*Attempted Suicide/ or \*Suicidal Ideation/ or \*Suicide/
6. suicid\*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]
7. 4 or 5 or 6
8. 1 and 2 and 3 and 7
9. Limit 8 to papers from 01/01/2007 onwards

## Study selection

The search produced many potentially relevant articles. N = 388 articles were identified based on initial screening of titles and abstracts against eligibility criteria. Any articles that were clearly irrelevant or clearly did not meet criteria were excluded. Full-text versions of these articles were acquired and screened. This led to a final 28 articles being included in the review. Of these, 20 were based on original data and eight reanalysed the data of original studies also included in the review.

## Data extraction

A data extraction form was created to extract relevant data from each of the included studies. Author, year, title, setting, age range and mean, gender, sample size, baseline characteristics, outcomes relating to suicidality risk. The papers chosen for inclusion were summarised

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

(Table 1). Eight studies included in this review used the same data. The results of these studies were synthesised, their results and quality were assessed and included as though they were a single study to avoid duplicating results. Of these articles, only 12 included sufficient data to be included in the meta-analysis. All other authors were contacted to request their data in order that they might be included in the review.

### **Data extraction and coding**

Each paper was examined for relevant risk factors. Each risk factor was coded for author, year, country, follow-up length (months), clinical sample type (e.g. inpatient or outpatient), sample size, age range, outcome assessment method, and study quality (details below). In addition, for meta-analysis, relevant study statistics were extracted. The form used for data extraction for meta-analysis is attached as an appendix (Appendix B). All variables providing a binary suicidality outcome association were extracted, where two or more studies reported an association between suicidality at follow-up and a test variable at baseline data was meta-analysed.

### **Assessing quality**

Papers were scored using the quality of reporting of observational longitudinal research checklist developed by Tooth, Ware, Bain, Purdie, and Dobson (2005). This 33-item checklist was considered appropriate because it provides a structured checklist of criteria to assess the validity of observational longitudinal studies. The checklist criteria relate to recruitment, data collection, biases, analysis rationale, population and generalisability.

### **Meta-analysis**

Meta-analysis was performed using STATA version 14 (StataCorp., 2015) software. A random-effects model was employed, providing estimates of both within and between-study variance with an estimate of the distribution of effects. Given the diversity of sample

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

populations included in this report, it was hypothesised that there would be large between-study variance. This analysis included studies that used suicide attempts, suicidal ideation, or suicide attempts/ideation as the outcome of interest.

Risk factors from two or more studies were included in the analysis. Risk ratios were calculated where sufficient data was provided. Overall weighted effect sizes were calculated for all risk factors reported in two or more studies.

Differences in effect size magnitude across specific risk factors were examined. The prediction was weak across all risk factors. Risk factor estimates from only two unique studies were included. Estimates drawn from so few studies are potentially unstable and represent extreme approximations. Whilst these risk factors have been included to highlight areas for future research, further inferences cannot be drawn from these results.

### Heterogeneity

Statistical heterogeneity was assessed by calculating the I-squared statistic, which measures the percentage of variation that is not due to chance.

### Continuous exposures

As individual patient data was not available, continuous exposures were not included in the meta-analysis. Instead, these are described in the narrative portion of the review.

### Publication bias

For analyses with at least three studies, publication bias was assessed using Funnel Plots, Orwin's fail-safe N (robustness of effect), Egger's test of the intercept (test whether results have been biased by smaller less precise studies producing the largest effects) and Duval and Tweedie's trim and fill (imputes effect size based on an estimate of the number of studies not included due to publication bias).

## Results

### Narrative synthesis

#### Design

All studies employed a longitudinal design, where exposure variables were collected at baseline, with suicidality data collected at follow-up. Some studies followed up participants at discharge from inpatient services (Glenn et al., 2017; Miller, Esposito-Smythers, & Leichtweis, 2016), which in some cases was as little as one day. However, most studies included follow-ups at set intervals which varied from three weeks to two years. Some studies included multiple follow-ups at set intervals over a certain period, whilst other studies only included one follow-up. Studies with multiple follow-ups often identified trajectories of increasing or decreasing suicidality and sought to identify baseline characteristics which predicted trajectories.

Regression analysis was employed by all studies to identify risk factors. However, the way outcomes were reported varied significantly between studies. In some studies, only the results of the final regression model were reported. In others, trajectory group modelling was employed to identify different suicidality trajectories, then baseline predictors of trajectory group membership were identified. This led to challenges when it came to extracting data for analysis and made it unclear whether non-significant results had been reported.

#### Measures

A wide variety of different normed outcome measures were used to assess suicidality as well as direct questions about attempts (i.e. intent, lethality, number, age). Hawton, Bergen, et al. (2012), examining completed suicide, used reported death by suicide as a measure.

### Sample

Age range varied between studies, with the lower limit varying from 7-13 years and the upper age limit varying from 15-19 years of age. The studies originated in countries in North America and Europe. The clinical setting of the studies was varied. Eleven studies recruited participants from psychiatric inpatient settings or A&E departments, two studies recruited participants with specific diagnoses, one study recruited participants from a population of childhood sexual abuse survivors, others recruited from general outpatient services.

### Quality

A summary of the criteria and the results of individual scores is included (Appendix C). Scores ranged from 13-32, (median 17.5). All studies stated their hypotheses; defined their target population, sampling frame and population; stated their methods of data collection; described the type of analysis they conducted; described the longitudinal analysis methods employed, and related their results back to the study population. Only one study justified the number of participants in the study (Berona, Horwitz, Czyz, & King, 2017; Czyz, Berona, & King, 2016; Czyz & King, 2015; Czyz, Liu, & King, 2012; King, Jiang, Czyz, & Kerr, 2014), this may be because the studies included in the review tended to be collecting naturalistic data in clinical settings, participants were patients asked to take part rather than actively recruited from larger populations. Only one study (Prinstein et al., 2008) included a quantitative assessment of bias, this is concerning, because there may have been biases that affected the results of the included studies leading to overconfidence in results. The observational nature of the studies meant that control groups were not included.

The validity of observational longitudinal studies is threatened by unmeasured confounding. Unmeasured exposures, which affect both suicidality and measured risk factors, may have led to spurious associations being identified. Only three studies explicitly controlled for

confounding. No studies controlled for unmeasured confounding. Consequentially, the generalisability of the findings of these studies cannot be established with confidence.

### **Summary of combined studies**

Additional information summarising all studies is included in Table 2.

#### *Study 2*

Berona et al. (2017), Czyz et al. (2016), Czyz and King (2015), King et al. (2014), Czyz et al. (2012), King, Kerr, Passarelli, Foster, and Merchant (2010) are a group of published articles all based on the data from a single original RCT examining the effectiveness of youth support teams to prevent adolescent suicide attempts (King et al., 2009). This study included 448 adolescents aged 13-17years who had been psychiatrically hospitalised due to suicidality. Three hundred and eighty-eight adolescents completed at least one follow-up assessment. The original intervention was found to have no effect on suicidality at three, six or 12-month follow-up. The subsequent articles published results of reanalysis of the original data. Berona et al. (2017) found that dysregulated and internalising profiles of emotion regulation predicted suicide attempts. Czyz et al. (2016) found that rehospitalisation over the follow-up period was associated with greater risk of suicide attempts. Czyz and King (2015) found that higher hopelessness at baseline was associated with persisting suicidal ideation, whereas severity of suicidal ideation was not associated with subsequent suicide attempts. King et al. (2014) found that suicidal ideation predicted suicide attempt over the follow-up period in female adolescents but not in males and that a history of multiple suicide attempts at baseline predicts subsequent suicide attempts in both genders. Czyz et al. (2012) found that improvements in family connectedness over the follow-up period found that improvements in peer connectedness predicted a reduction in the severity of suicidal ideation in female adolescents at three months. Improvements in family connectedness was associated with



reduced severity of suicidal ideation in adolescents of both genders if they had not made multiple suicide attempts at baseline. King et al. (2010) found associations between parental mental health problems, a history of multiple suicide attempts, severity of suicidal ideation at baseline and severity of functional impairment at baseline predicted suicide attempt over the follow-up period. A weakness of these articles is that post-hoc analysis increases the risk of type 1 error. A strength of this study is the RCT conditions under which the original data was collected has allowed the authors access to a high-quality data set collected by independent evaluators.

### *Study 20*

Selby, Yen, and Spirito (2013); Stone, Liu, and Yen (2014); Yen et al. (2015); Yen et al. (2012) are a group of published articles based on data from a single study. The original article by Yen et al. (2012) recruited 119 patients presenting with suicidality aged 12-18 from an inpatient psychiatric unit. One hundred and four patients completed follow-up measures six months after discharge. The outcome of interest was suicide attempts (actual and interrupted). At baseline black race, recent high suicidal ideation scores, post-traumatic stress disorder and borderline personality disorder, diagnosed by the Schedule for Affective Disorders and Schizophrenia for School-Age Children – Present and Lifetime Version (Kaufman et al., 1997), childhood sexual abuse, low scores on positive affectivity, and high scores on aggression predicted time to suicide event. However, only race, sexual abuse, affectivity and aggression remained significant following regression analysis. This may be because diagnosis of PTSD and borderline personality disorder were highly correlated with childhood sexual abuse. Re-analysis of the data found that ratings of affect sensitivity, behavioural dysregulation, and peer invalidation at baseline significantly predicted suicidal ideation at follow-up. This article also reported that ratings of each of these constructs had significant associations with next-week ratings of ideation and suicidal ideation had positive significant

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

associations with next-week ratings on affect sensitivity (Yen et al., 2015). Selby et al. (2013) published findings that recent, self-generated, stressful life events predicted suicide attempts (actual and interrupted) in girls. This 2013 paper, reported findings that male inpatients that experienced higher self-reported family invalidation were more likely to attempt suicide over the follow-up period. Limitations of this study include its relatively small sample size, the checklist measure employed to assess life events, and the increased risk of type 1 error due to post-hoc analysis.

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

Table 2 - Included Articles

#) Author (year), country	Sample	Sampling Response rate	Outcome measures	Key results	Limitations
1) Rosenbaum Asarnow, Berk, Zhang, Wang, and Tang (2017), USA	Age 10-18, presenting to A&E with suicidality, able to consent and parental consent given, English speaking. N = 170	Consecutive patients recruited over a 2.5-year period, all those meeting eligibility criteria were asked to enrol. 94% of baseline completed follow-up.	Questionnaires given at baseline, 18-month follow-up  At baseline: demographics, prior suicidality and DSH (Youth Risk Behaviour Survey and Child Behaviour Checklist), mental health (Center for Epidemiological Studies- Depression, Primary Care PTSD Screen, Child Behaviour Check List, Service Use and Adjustment Problem Screen), stress (Life Events Scale), family conflict (Conflict Behaviour Questionnaire), family support (Medical Outcomes Study Social Support Scale), service use  At follow-up: Suicide attempts (Diagnostic Interview Schedule for Children – suicide items)	Significant predictors of <b>suicide attempt</b> : suicide attempt at presentation (vs. ideation), self-harm, low levels of delinquency	Limited observations of change over the follow-up interval. Sample was also too small to evaluate predictors of suicide deaths. Relatively few boys in the sample.
2) Berona et al. (2017)  Czyz et al. (2016)  Czyz and King (2015)	Age 13-17, hospitalized (suicidal at admission),  parent and child consent given, within an hour's drive of study site, no severe cognitive	All young people meeting eligibility criteria at two psychiatric hospitals over a three year period were asked to enrol. 43% of those asked to participate were enrolled of which	Questionnaires given at baseline, 6 weeks, 3 months, 6 months and 12 months follow- up  At baseline: Demographics, Suicide attempts (Diagnostic Interview Schedule for Children – suicide items, Suicidal Ideation Questionnaire – Junior), DSH and abuse history (Schedule for Affective Disorders and Schizophrenia for School- Aged Children – Present and Lifetime),	Four profiles identified: Subclinical, primarily internalising, moderately dysregulated and severely dysregulated. Dysregulated profiles predicted <b>suicide attempts</b> within 3 months post discharge. An improvement from baseline in peer connectedness was a protective factor at 3 months. Internalising profile predicted <b>suicide attempt</b> and <b>rehospitalisation</b> at 12 months post discharge	Gender distribution, selection bias, family psychiatric history did not differentiate between disorders, reliant on retrospective

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

King et al. (2014)	impairment, not transferred to medical or residential placement. N = 388	79.2% completed follow-up.	behaviour problems and internalising/externalising (Youth Self Report), hopelessness (Beck Hopelessness Scale), depression (Children's Depression Rating Scale – Revised), anxiety (Multidimensional Anxiety Scale for Children), alcohol and substance misuse (Personal Experiences Screen Questionnaire), functional impairment (Child and Adolescent Functional Assessment Scale), connectedness (Perceived Emotional/Personal Support Scale), family psychiatric history (Family History Screen) Follow-up: Enquiring if young person had been rehospitalised or made a suicide attempt, repeats of connectedness measures	Improvements in family connectedness was a protective factor at all follow-ups. Higher baseline hopelessness associated with <b>persisting suicidal ideation</b> . Suicidal ideation severity at baseline is not an adequate marker of subsequent <b>suicide attempt</b> . Suicidal ideation predicts subsequent <b>suicide attempts</b> in girls but not boys. History of multiple suicide attempts at baseline predicts <b>suicide attempts</b> . Rehospitalisation over follow-up period associated with greater risk of <b>suicide attempts</b> . Parental mental health problems, baseline history of multiple suicide attempts, severity of suicidal ideation and severity of functional impairment predicted <b>suicide attempt</b>	recall at follow-up.
3) Brabant, Hébert, and Chagnon (2014) Canada	Age 12-18, female, past sexual abuse, service user, no intellectual disability, n=52	Caseworkers asked to identify eligible participants and invite them to participate in the study. 70.2% of participants completed follow-up.	Questionnaires given at baseline, 12-month follow-up  At baseline: Demographics, depression (Beck Depression Inventory), PTSD (Children's Impact of Traumatic Events Scale – Revised), suicidal ideation (Scale for Suicide Ideation), suicide attempts (Single question "In the last 12 months, how many times did you try to commit suicide?"), sexual abuse characteristics collected from caseworkers. At follow-up: Depression, suicidal ideations, PTSD and suicide attempts reassessed	Depressive symptoms, PTSD symptoms, and past suicide attempt predict <b>suicidal ideation</b> at follow-up	Reliant on self-report, exclusively female participants, selection bias, high percentage of drop-outs.

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

4) Brent et al. (2009), USA	Age 12-18, recent suicide attempt (90 days), major unipolar mood disorder diagnosis, moderate symptoms of depression, parental content, no substance misuse, no bipolar disorder, no psychosis, no developmental disorder. N=124	Adolescents meeting eligibility criteria across 5 hospital sites were invited to participate. 34.9% of adolescents meeting eligibility criteria consented to participate.	6-month follow-up, given their choice of treatment, questionnaires given at baseline, suicidality and attempts assessed at 6-week intervals  At baseline: Suicidality (intent, lethality, number of previous attempts, age of first attempt, Columbia Suicide History Form, Beck Suicide Intent Scale, Scale for Suicidal Ideation), mental health (Schedule for Affective Disorders and Schizophrenia for School-Age Children, Present and Lifetime Version), depression (age of onset, duration, number of previous episodes, Children's Depression Rating Scale- Revised, Beck Depression Inventory), hopelessness (Beck Hopelessness Scale), anxiety (Multidimensional Anxiety Scale), aggression (Aggression Questionnaire), emotional lability and impulsivity (Emotionality, Activity, Sociability, and Impulsivity Survey, an interview rating of the number of symptoms for borderline personality disorder, history of maltreatment (Childhood Experiences Questionnaire), family climate (Family Adaptability and Cohesion Evaluation Scale II.) At follow-up: suicidality reassessed	Higher self-rated depression, suicidal ideation, family income, number of previous attempts, history of sexual abuse predicted <b>suicide events (ideation or attempt) and attempts</b> . Lower family cohesion and lower maximum lethality of previous attempts predicted <b>suicide events and attempts</b>	Small sample size, selection bias, information about life events not collected
5) Burns, Cortell, and Wagner (2008), USA	Age 13-18, hospitalised following a suicide attempt, n=85	Consecutive admissions to psychiatric hospitals across four sites. 95.3%	Questionnaires given at follow-up, service use and suicide ideation and attempts assessed at 6 monthly follow-ups for 2 years.	Treatment compliance did not predict <b>suicidal ideation or attempt</b> .	Large proportion of participants were white female. Most

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

		of participants completed at least one follow-up	At baseline: demographics, family history (Cohen's structured Family History Interview), mental health and suicidality (Diagnostic Interview Schedule for Children Versions 1&2.3, Youth and Parent Forms), service use (asked to report on treatment use, reason for termination, medication compliance, and perceived helpfulness) At follow-ups: service use, mental health and suicidality reassessed.		data based on self-report. Small sample size.
6) Consoli et al. (2015), France	Age 13-17, presented to A&E for suicide attempt, able to give informed consent, n = 107 at follow-up	Over 12 months 5 paediatric emergency departments invited all eligible adolescents to participate. 64% of participants completed follow-up	Questionnaires given at baseline and follow-up after 6 months  At baseline: demographics, coping (Adolescents Coping Scale), Reasons for Living Inventory for Adolescents, Spirituality Scale, General Assessment of Functioning, mental health (Schedule for Mood Disorders and Schizophrenia for School Age, Version Current and Past Episode), depression (Beck Depression Inventory), hopelessness (Beck Hopelessness Inventory), Suicidality (Posner Scale), substance use (Dependence Questionnaire for Adolescents), borderline personality symptomatology (Abbreviated Self-Questionnaire of the Diagnostic Interview for Borderline Personality Disorder), self-esteem (Rosenberg Self-Esteem Rating Questionnaire), impulsivity (Eysenk Questionnaire), Buss-Durke Hostility Inventory, Reasons for Living Inventory for Adolescents, Temperament and Character Inventory.	Major depressive disorder, higher depression scores and higher Temperament and Character Inventory scores for self-transcendence predicted <b>suicide reattempt</b> . Higher coping scores in hard work and achievement was a protective factor.	Sample size limited power, 6-month follow-up may have been too short, recruitment differed between sites which may have introduced bias, some important risk factors were not assessed (relationships and life events).

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

		At follow-up: treatment given, suicidality, depression and hopelessness reassessed.			
7) Gallagher, Prinstein, Simon, and Spirito (2014), USA	Age 12-15, psychiatric inpatients, no intellectual disability, no psychosis, n=144	Eligible participants admitted to a psychiatric inpatient facility were invited to participate. 88.5% of eligible adolescents were recruited. 73% of participants completed follow-up.	Baseline assessment during admission, follow-up at 9 and 18 months  Baseline: Suicide (Suicidal Ideation Questionnaire), psychiatric symptoms (The Diagnostic Interview Schedule for Children, Fourth Edition, Adolescent report; Social Anxiety Scale for Adolescents), loneliness (The Loneliness and Social Dissatisfaction Scale), social support (The Social Support Scale for Children and Adolescents)  Follow-up: All measures repeated	Social anxiety symptoms at baseline predicted <b>suicidal ideation</b> at follow-up. A multiple mediation model indicates that baseline social anxiety is related to loneliness at 9-months which effects <b>suicidal ideation</b> at 18 months. Social anxiety did not effect <b>suicidal ideation</b> through perceived social support (friends or parent)	Predominantly white participants, disproportionately female, reliant on self-report
8) Glenn et al. (2017), USA	Age 13-19 years, psychiatric inpatients, history of suicidality, no possible medical/organic cause of psychiatric disorder, no missing suicidal history data, admission lasting more than 1 day. N=276	Two waves of collection from a psychiatric treatment unit. All eligible adolescents were invited to participate over two 18 month collection windows. No details of response rate have been provided.	Assessed at admission and discharge, questionnaires given at admission, suicidality reassessed at discharge  At baseline: Demographics collected, DSH and suicidality (Self Injurious and Suicidal Thoughts and Behaviours Interview), mental health (Mini-International Neuropsychiatric Interview for Children and Adolescents, Child Version), implicit identification with death (Death Implicit Association Test)  At follow-up: suicidality and implicit identification with death reassessed	Implicit identification with death at admission significantly predicted their <b>suicide ideation severity</b> at discharge in adolescent's whose admission lasted for at least two weeks	Admission/discharge design resulted in variable time to follow-up, very short follow-up period. Suicide ideation at discharge may have been biased by adolescents' tendency to underreport when they wish to be released from hospital

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

9) Goldstein et al. (2012), USA	Age 7-17, diagnosis of bipolar disorder, no schizophrenia, no intellectual disability, no ASC, no mood disorder secondary to substance misuse or medication or medical illness, able to give informed consent. N=413	Recruited from outpatient clinics, inpatient clinics, advertisements and referrals over 6 years at 3 university sites. Recruitment rate not detailed. 92.6% retention rate.	Baseline assessment, and follow-up every 9 months for up to 6 years  Baseline: Demographics, history of treatment, history of abuse, alcohol use, diagnosis+ DSH + suicidal ideation + severity + smoking + alcohol use (Kiddie Schedule for Affective Disorders and Schizophrenia for School-Aged Children– Present and Lifetime Version), socioeconomic status (Hollingshead Four Factor Index of Social Status), primary caregivers psychiatric history (Structured Clinical Interview for DSM-IV), psychiatric history of first and second degree relatives (Family History Screen), family conflict (Conflict Behaviour Questionnaire), life events (Life Events Checklist), family environment (Family Adaptability and Cohesion Evaluation Scales–II), global functioning (Children’s Global Assessment Scale), Follow-up: Longitudinal Interval Follow-up Evaluation	Female participants were more likely to make a <b>suicide attempt</b> over the follow-up period. Bipolar subtype did not predict outcome. At baseline severity of depressive episode and family history of depression predicted suicide attempts over the follow-up period. Over any 8-week period of follow-up greater number of weeks spent with threshold depression, substance use disorder, and mixed mood symptoms and greater number of weeks spent receiving outpatient psychosocial services predicted greater likelihood of a <b>suicide attempt</b> in that period	Limited assessment of life events, reliant on self-report, predominantly white sample.
10) Greenfield et al. (2008), Canada	Adolescents (age range not stated), presenting to A&E requiring psychiatric consultation, not admitted to hospital for medical or	Patients presenting consecutively to an emergency department meeting eligibility criteria. 95% of eligible adolescents consented to participate of	Questionnaires collected at baseline, suicidality assessed at 6-month follow-up  Baseline: Borderline personality disorder (Abbreviated Diagnostic Interview for Borderlines), diagnosis (Diagnostic Interview Schedule for Children), functioning (Children’s Global Assessment Scale), suicidality (Pfeffer’s Spectrum of Suicidal Behaviour Scale), stressors	<b>Suicidal ideation/attempts</b> at follow-up associated with borderline personality disorder, previous suicide attempts, drug use and female gender.	Diagnosing borderline personality disorder in under-18s is unusual



## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

	surgical needs, n = 286	which 92% completed follow-up measures.	(Coddington Life Events Scale), family conflict (Index of Family Relations) Full battery repeated at follow-up		
11) Hawton, Bergen, et al. (2012), UK	Age= 10-18 years presenting to hospital with self-harm n = 5205	All adolescents meeting eligibility criteria who presented to five study hospitals over a seven-year period were included.	Demographic, clinical and hospital management data collected by clinicians, health records used to provide follow-up data over a 10-year window  Baseline: demographics, date and method of self-harm, psychosocial assessment, previous self-harm, current and previous psychiatric treatment. Follow-up: clinical records provided data on representation to hospital and death.	<b>Completed suicide</b> was associated with male gender, cutting at baseline, self-harm prior to baseline and prior psychiatric treatment.	Missing data, data limited to routinely collected hospital data
12) Huth-Bocks, Kerr, Ivey, Kramer, and King (2007), USA	Age 12-17, psychiatrically hospitalised, suicidality, >19 score on the Child and Adolescent Functional Assessment Scale Self-Harm Subscale, able to give informed consent n=289	All eligible adolescents admitted to two psychiatric hospitals over a two-year period were invited to participate. 35% of eligible adolescents consented to participate of which 81% completed follow-up measures.	Longitudinal case control design used to examine race differences, follow-ups conducted 5-8.7 months after discharge  Baseline: Reynolds Adolescent Depression Scale, Beck Hopelessness Scale, Suicidal Ideation Questionnaire-Junior, and Suicide Probability Scale, Spectrum of Suicide Behaviour Scale, demographics, clinician rated suicidality and suicide attempt Follow-up: clinician rated suicidality and suicide attempt.	All measures predicted follow-up <b>clinician rated suicidality and suicide attempt</b>	Limited sample size and power.
13) Miller et al. (2017), USA	Age 12-16, female, at least one mental health concern	Participants recruited from a wide range of	Longitudinal, 18-month multi-wave study, questionnaires completed at baseline. Follow-ups at three-month intervals	Suicidal ideation at baseline was associated with greater risk of <b>suicide attempts</b> over follow-up period	Reliance on self-report and low power.

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

	within previous 24 months, not current inpatients, caregiver willing to participate, n=220	referral sources, including local inpatient units outpatient facilities, local and mass emails to university employees. 91% of participants completed at least one follow-up.	Baseline: Demographics, Suicidal ideation and behaviours (Self-Injurious Thought and Behaviours Interview), depressive symptoms (Mood and Feelings Questionnaire), stress (Child Chronic Strain Questionnaire), sexual/physical abuse (PTSD section of Mini International Neuropsychiatric Interview for Children and Adolescents) Follow-up: Suicidality, stress and depressive symptoms measures repeated	Greater age at baseline was associated with increased risk of <b>suicidal ideation</b> but <b>not attempts</b> .  Higher mean scores for depressive symptoms were associated with increased risk of ideation and higher than usual depression at any follow-up point was associated with increased risk of <b>suicidal ideation</b> at that time point.  Higher than usual stress was associated with greater risk of <b>suicidal ideation</b> at that time point.  In adolescents with a history of abuse, periods of higher than usual depression, or stress were more likely to engage in <b>suicidal behaviour</b> .	
14) Miller et al. (2016), USA	Age 12-18, admitted to a partial hospitalisation programme for crisis stabilisation, English speaking, at least one caregiver able to provide consent, no current psychosis, able	All eligible adolescents using a partial hospitalisation service were invited to participate over an 11-month period. 92% of eligible adolescents decided to participate.	3-4-week follow-up, data collected as part of routine clinical practice at admission and discharge.  Baseline: Interpersonal Needs Questionnaire, mental health (Youth Inventory-4), suicidality (Suicide Ideation Questionnaire) Follow-up: repeated at discharge	Thwarted belongingness affects depression symptom severity over time, which predicts <b>suicidal ideation</b> .	Too short a follow-up period. Predominantly white female sample, small sample size limited power.

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

	to give informed consent. N=143				
15) Prinstein et al. (2008), USA	Age 12-15, recruited from a psychiatric inpatient facility, no history of psychosis, no intellectual disability, n=143	All adolescents meeting eligibility criteria at a psychiatric inpatient facility were invited to participate. 88.3% of eligible candidates took part of which 93% completed at least one follow-up.	Assessed during admission and every three months post-discharge for 18 months  Baseline: Suicidality (Suicidal Ideation Questionnaire), DSH, mental health (Diagnostic Interview Schedule for Children Version 4, Youth and Parent Forms), depression (Children's Depression Inventory), externalising (Delinquency Behaviour Questionnaire, Behavioural Assessment System for Children), Hopelessness (Hopelessness Scale for Children)	Changes in ideation predicted <b>suicide attempts</b> . Higher adolescent-reported depressive symptoms, lower parent reported externalising symptoms, and higher frequencies of DSH predicted weaker <b>suicidal ideation</b> remission slopes.	Only inpatients recruited, limited power.
16) Sanchez-Gistau et al. (2013), Spain	Age 9-17, first episode psychosis, psychotic symptoms of less than 6 months duration, no intellectual disability, no pervasive developmental disorder, no neurological disorders, no history of head trauma with loss of consciousness,	All eligible adolescent service users of three child and adolescent psychiatry departments were invited to participate over 2.5 years. 74.5% of sample completed follow-up.	Assessed at baseline, 12 and 24 months.  Baseline: Suicidal behaviour (Clinical Global Impression for Severity of Suicidality), premorbid adjustment (Premorbid Adjustment Scale), functional impairment (Children's Global Assessment Scale), psychotic symptoms (Positive and Negative Syndrome Scale), depression (Hamilton Depression Rating Scale), mania (Young Mania Rating Scale), diagnoses (Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version), IQ (Wechsler Intelligence Scale for Children – Revised or Wechsler Adult Intelligence Scale – Version Three)	History of suicide prior to psychotic episodes, severe depressive episodes and antidepressant treatment were associated with being classified as high suicide risk at baseline. Being classified as high suicide risk predicted <b>suicide attempts</b> during follow-up.	Modest sample size, measure of suicidal behaviour has not been validated in children or adolescents.

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

	and no pregnancy. Occasional substance use was not an exclusion criterion if positive symptoms persisted for more than 2 weeks after a negative urine drug test. N=110		Follow-up: Repeated all measures except premorbid adjustment and IQ		
17) Tuisku, Pelkonen, Kiviruusu, Karlsson, and Marttunen (2012), Finland	Depressed adolescent (13-19 years) outpatients, n=189	Recruitment not detailed, 86.7% of sample completed follow-up measures	Interviewed at baseline and 1 year follow-up  Baseline: DSH and suicidal behaviour (Kiddie Schedule for Affective Disorders and Schizophrenia – Present and Lifetime Versions), depression (Beck Depression Inventory), psychosocial functioning (Global Assessment of Functioning), anxiety (Beck Anxiety Inventory), alcohol use (Alcohol Use Disorders Identification Test).	Alcohol use and mood disorder with Axis I comorbidity at baseline predicted both DSH and <b>suicide attempts or ideation</b> during follow-up.	Recruitment not detailed, limited power, significant differences between drop-outs and follow-ups.
18) Wilkinson, Kelvin, Roberts, Dubicka, and Goodyer (2011), UK	Age 11-17, major depressive disorder diagnosis, n=192	Recruited from trial population. 84.5% completed follow-up.	Assessed at baseline and 28-week follow-up  Baseline: Clinical symptoms and suicidal and DSH (Kiddie Schedule for Affective Disorders and Schizophrenia – Present and Lifetime Versions, Children’s Depression Rating Scale–Revised), family function	High suicidality, DSH, and poor family function at baseline were predictors of <b>suicide attempts</b> at follow-up.	Secondary analysis increases risk of type 1 errors.

Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

			(McMaster Family Assessment Device–12-Item General Functioning Scale), quality of current personal friendships (Cambridge Friendships Questionnaire) Follow-up: Kiddie Schedule for Affective Disorders and Schizophrenia – Present and Lifetime Versions repeated		
19) Wolff et al. (2017), USA	Age 12-18, English or Spanish speaking adolescent and parent, consent given, evaluated for suicidal ideation or attempt, diagnosis of depressive disorder, at least on of: DSH, prior suicide attempt or substance use disorder, no cognitive or developmental delay, no ASC spectrum condition, no psychotic disorder, no use of opiates more than 13 times in	Two adolescent psychiatric hospitals invited all eligible adolescents to participate over recruitment window. 69% and 72% of eligible adolescents participated (data reported separately for separate sites), 93% and 98% retention at 3 months.	Screeed for intellectual disability, then completed baseline assessments, follow-up at 3 and 6 months.  Baseline: Demographics and past hospitalisation, diagnosis (Kiddie Schedule for Affective Disorders and Schizophrenia – Present and Lifetime Versions), suicide (Suicide Ideation Questionnaire – Junior, Columbia-Suicide Severity Rating Scale), depression (Children’s Depression Inventory 2), anxiety (Screen for Child Anxiety Related Disorders), hopelessness (Hopelessness Scale for Children), sexual abuse history (Childhood Trauma Questionnaire), DSH (Self-Injurious Thoughts and Behavior Interview), emotion regulation (Difficulties in Emotion Regulation Scale) Follow-up: suicide re-evaluated	Semi-parametric group modelling identified suicide ideation trajectory group membership. Adolescents classified as in subclinical, declining or chronic suicidal ideation groups. Emotion dysregulation differentiated chronic from subclinical groups. Adolescents endorsing greater non-acceptance of emotional responses and more limited access to emotion regulation strategies were more likely to belong to the chronic than declining groups. Those in the chronic group also had the greatest number of <b>suicide attempts</b> and hospitalizations post-discharge.	6 month assessment only assessed symptoms over the last month, small sample size, did not assess relationships.

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

	last 90 days, no primary diagnosis of OCD or eating disorder. N=104				
20) Yen et al. (2015)	Age 12-18, fluent in English, admitted to psychiatric hospital for concerns about suicide risk, no evidence of current psychosis or cognitive impairment. N =119	All eligible adolescent inpatients at a psychiatric unit invited to participate. 75.6% retention rate.	Completed baseline interviews then followed up every two months for 6 months in total	Baseline ratings of affect sensitivity, behavioural dysregulation, and peer invalidation were predictors of <b>suicidal ideation</b> at follow-up; ratings of each of these constructs had significant associations with next-week ratings of ideation and <b>suicidal ideation</b> had positive significant associations with next-week ratings on affect sensitivity, behavioural dysregulation, and peer invalidation. Recent self-generated stressful life events predicted <b>suicide attempts (actual and interrupted)</b> in girls. Baseline black race, high suicidal ideation in the past month, post-traumatic stress disorder, childhood sexual abuse, borderline personality disorder, low scores on positive affectivity, and high scores on aggression predicted time to <b>suicide attempt</b> during follow -up. Following multivariate regression analysis, only race, sexual abuse, affectivity and aggression remained significant. Boys who experienced high perceived family invalidation were more likely to have a <b>suicide attempt</b> over follow-up.	Life events measured using checklist, small sample size
Stone et al. (2014)			Baseline: Diagnosis (Kiddie Schedule for Affective Disorders and Schizophrenia – Present and Lifetime Versions), course of disorder (Longitudinal Interval Follow-Up Evaluation - Adolescent version – Baseline), borderline symptoms (Childhood Interview for Borderline Personality Disorder), suicidality (Suicide Ideation Questionnaire), affective responsiveness (Affect Intensity Measure), aggression (Aggression Questionnaire), family functioning (Family Assessment Device), life events (Life Events Checklist – Child Form), negative affect (Negative Affect Self-Statement Questionnaire), DSH (Functional Assessment of Self-Mutilation), Follow-up: Longitudinal Interval Follow-Up Evaluation - Adolescent version – Follow-up		
Selby et al. (2013)					
Yen et al. (2012) , USA					

## **Risk factors**

### **Biological**

No biological factors were investigated by any of the studies included in this review.

### **Psychological – diagnoses**

Symptoms of mental disorders at baseline were associated with suicidality at follow-up across studies. Mood disorder and depressive symptoms at baseline were associated with suicidal ideation. A family history of depression predicted suicide attempt over the follow-up period in one study (Goldstein et al., 2012). Hopelessness at baseline was associated with persisting suicidal ideation at follow-up in one study (Berona et al., 2017; Czyz et al., 2016; Czyz & King, 2015; Czyz et al., 2012; King et al., 2014), and with clinician-rated suicidality and suicide attempt in another (Huth-Bocks et al., 2007). Gallagher et al. (2014) found that social anxiety symptoms at baseline were associated with suicidal ideation in at follow-up. Personality disorder symptoms and difficulties with affect regulation were associated with suicidality at follow-up in three studies (Berona et al., 2017; Czyz et al., 2016; Czyz & King, 2015; Czyz et al., 2012; Greenfield et al., 2008; King et al., 2014; Selby et al., 2013; Stone et al., 2014; Yen et al., 2015; Yen et al., 2012). PTSD symptoms at baseline were associated with suicidal ideation at follow-up in two studies (Brabant et al., 2014; Selby et al., 2013; Stone et al., 2014; Yen et al., 2015; Yen et al., 2012). In one study internalising profiles at baseline predicted suicide attempt over the follow-up period (Berona et al., 2017; Czyz et al., 2016; Czyz & King, 2015; Czyz et al., 2012; King et al., 2014), a second study found that externalising profiles predicted weaker remission in suicidal ideation over follow-up (Prinstein et al., 2008). Alcohol use predicted suicide ideation or attempt in one study (Tuisku et al., 2012). Drug use predicted suicidal ideation or attempt in two studies (Goldstein et al., 2012; Greenfield et al., 2008). One study found that the degree of functional impairment (the

## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

degree to which mental disorder impairs functioning) predicted suicide attempt over follow-up (Berona et al., 2017; Czyz et al., 2016; Czyz & King, 2015; Czyz et al., 2012; King et al., 2014).

### Other psychological factors

Prior suicidal ideation and/or attempts at/prior to baseline were associated with suicide ideation and/or attempts at follow-up in eight studies. Lower maximum lethality of past attempts at baseline was associated with suicidal ideation and attempts at follow-up in one study (Brent et al., 2009). Glenn et al. (2017) found that identification with death at baseline predicted suicidal ideation severity at follow-up. Two studies found that DSH at/prior to baseline was associated with suicide attempt over the follow-up period (Tuisku et al., 2012; Wilkinson et al., 2011), Prinstein et al. (2008) found that DSH at/prior to baseline was associated with a slower reduction in suicidal ideation over the follow-up period. Psychiatric treatment prior to baseline, including previous anti-depressant prescriptions (Sanchez-Gistau et al., 2013) and past hospitalisations (Hawton, Bergen, et al., 2012), was associated with suicide attempt and completed suicide in two studies. This is consistent with Wolff et al. (2017) who identified profiles of chronic/high-risk groups of adolescents whose suicide risk over a follow-up period is part of a pattern of chronic distress.

Several other psychological factors were found to predict suicidality over the follow-up period. Higher self-transcendence scores at baseline were found to predict suicide reattempt over the follow-up period; Consoli et al. (2015) found that higher coping scores for hard work/achievement acted as a protective factor negatively associated with suicide reattempt. In one study, aggression, behaviour dysregulation and delinquency were found to predict suicide ideation and attempt (Selby et al., 2013; Stone et al., 2014; Yen et al., 2015; Yen et al., 2012).



### Social/demographic

Age, race, socio-economic and gender effects were identified. In two studies female gender was associated with suicide ideation and/or attempts (Goldstein et al., 2012; Greenfield et al., 2008). However, male gender was associated with completed suicide (Hawton, Bergen, et al., 2012). Black race (in a white majority population) was associated with suicide attempt in one study (Selby et al., 2013; Stone et al., 2014; Yen et al., 2015; Yen et al., 2012). Miller et al. (2017) identified that older age at baseline predicted suicidal ideation but not attempts over the follow-up period. In Brent et al. (2009), lower family income was found to predict suicidal ideation and attempt.

Relationships with friends and family were associated with suicidality in some studies. Poor family function/family discord in two studies was associated with suicidal ideation and attempts over the follow-up period (Brent et al., 2009; Wilkinson et al., 2011). In one study, higher perceived family invalidation predicted suicide attempts in male participants (Selby et al., 2013; Stone et al., 2014; Yen et al., 2015; Yen et al., 2012). Peer invalidation at baseline was associated with suicidal ideation in one study (Selby et al., 2013; Stone et al., 2014; Yen et al., 2015; Yen et al., 2012).

Life events were found to predict suicidal ideation. Past sexual abuse predicted suicide attempt over the follow-up period in two studies (Brent et al., 2009; Selby et al., 2013; Stone et al., 2014; Yen et al., 2015; Yen et al., 2012). Miller et al. (2017) found that more self-identified periods of high stress predicted suicide attempt over the follow-up period. Another study found that self-generated stressful life events were associated with suicide attempts over the follow-up period (Selby et al., 2013; Stone et al., 2014; Yen et al., 2015; Yen et al., 2012).

## **Meta-Analysis**

Twelve studies were included in the meta-analysis. The results of the meta-analysis are fully reported in table 3. Additional analyses of publication bias are included as an appendix (Appendix D). Forest plots were created for all significant results, and where three or more studies were included funnel plots have also been created (Appendix E)

Among risk factors drawn from at least three studies, significant risk ratios ranged from 1.80 (past suicide attempts at baseline) to 2.15 (baseline anxiety). In order of magnitude: past suicide attempt, DSH and anxiety each emerged as significant predictors of suicidality over the follow-up period. Depression at baseline was also approaching significance (RR= 3.40,  $p=0.06$ ).

Borderline personality disorder, sexual abuse, PTSD and sexual abuse were found to significantly predict suicidality. However, these results are based on synthesis of only two studies which limits the degree to which these results can be usefully interpreted.

The results of assessments of publication bias were not possible to interpret due to inadequate numbers of included trials. It was not possible to assess funnel plots or regression based assessments.

# Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

Table 3 - Meta Analysis

Variable	N	Effect size and 95% interval			Test of null (2-Tail)		Heterogeneity
		RR/SMD	Lower limit	Upper limit	Z	p	I <sup>2</sup> (%)
Female Gender	10	1.26	0.94	1.71	1.53	.13	57
Ethnic Minority	4	1.13	0.82	1.56	0.77	.44	0
<b>Previous Suicide Attempt</b>	6	1.80	1.19	2.72	2.76	<b>.01</b>	69
Depression	5	3.40	0.96	12.00	1.90	.06	50
<b>PTSD</b>	2	1.79	1.20	2.67	2.83	<b>.01</b>	0
Substance Misuse	5	1.43	0.89	2.29	1.49	.14	53
Conduct Disorder	2	1.25	0.71	2.19	0.77	.44	56
<b>Anxiety</b>	3	2.15	1.08	4.26	2.18	<b>.03</b>	74
ADHD	3	0.92	0.67	1.25	0.56	.58	0
<b>Sexual Abuse</b>	2	1.96	1.30	2.95	3.23	<b>&gt;.01</b>	0
Family History of suicide	4	1.28	0.86	1.90	1.20	.23	42
<b>Borderline Personality Disorder</b>	2	2.04	1.17	3.56	2.52	<b>.01</b>	40
<b>DSH</b>	4	2.02	1.22	3.34	2.73	<b>.01</b>	73
Lives with both parents	2	1.19	0.61	2.36	0.51	.61	63
<b>Excessive drinking</b>	2	1.63	1.19	2.23	3.03	<b>&gt;.01</b>	0
Family History of depression	2	2.58	0.98	6.77	1.92	.05	38

## Discussion

### **Main outcomes**

This study synthesized the most up-to-date longitudinal risk factor literature in clinical samples of children and adolescents, and identified 20 unique longitudinal studies which explored the associations between baseline factors and suicidality at follow-up. The narrative synthesis identified psychological and social/demographic risk factors including stressful life events, identification with death and a number of diagnosable mental disorders.

The results of the meta-analysis found anxiety disorders doubled the likelihood of presenting with suicidality over a follow-up period compared with those without anxiety disorder.

Whilst this information may not provide clinicians with sufficient information to identify which children and adolescents are at the highest risk of suicide, it does indicate that interventions targeting symptoms of anxiety might reduce suicide risk.

Other results of this meta-analysis identified that previous suicide acts and DSH are statistically significant predictors of suicidality. However, the overall effects were weak and did not result in large increases in the risk of future suicidality. Children and adolescents that present with DSH are twice as likely to present with suicidality over a follow-up period of greater than one month. Those that have previously attempted suicide are 1.8 times as likely to present with further suicidality.

The meta-analysis also found that symptoms of PTSD, borderline personality disorder and depression (BDI/BHS scores) were significantly associated with increased risk of suicidality over the follow-up period, as was excessive drinking and past sexual abuse. However, these symptoms were included in too few studies to draw conclusions from their results. Further research focussing on these symptoms might provide clinicians with more useful data that might enable them to better tailor the interventions they provide.

### **Missing risk factors**

This study provides insight into the need for further research in this field. Many of the risk factors described in the narrative portion of this review were only investigated by single studies. Furthermore, several associated factors identified in the cross-sectional literature were not reported by any of the studies included in this review. This may be because of reporting bias (i.e. these risk factors were investigated by the authors, but they were not reported as their effects were non-significant), or it may be that longitudinal studies have not yet sought to investigate these risk factors. No studies examined the effect of bullying or education (performance, attendance, attitudes or behaviour) on the risk of developing suicidality. The investigation of the impact of relationships with family or peers was limited. Given the extensive evidence from cross-sectional studies that these factors are associated with suicidality, it is surprising that more longitudinal studies have not investigated their impact. It may be that this is indicative of a tendency in clinical settings for clinicians to primarily focus on individual rather than systemic difficulties. Further research investigating these correlates would provide more evidence that these are risk factors for suicidal ideation or attempts.

Little literature has identified protective factors that might mitigate the risk of developing suicidal thoughts and behaviours. One study identified that higher scores in the hard work and achievement domain of a coping scale are associated with reduced risk of suicidality. Further research to identify other protective factors might help clinicians to develop interventions in populations that are known to be at elevated risk of developing suicidal ideation.

## **The spectrum of suicidality – heterogeneity of outcome**

The measurement of suicidality is not straightforward. The studies included in this review varied significantly in terms of their outcome of interest, which ranged from suicidal ideation to completed suicide. In some studies, suicidal ideation and attempts were considered together (Brent et al., 2009; Burns et al., 2008; Greenfield et al., 2008; Tuisku et al., 2012), whereas in others they were treated as two separate outcomes (Berona et al., 2017; Czyz et al., 2016; Czyz & King, 2015; Czyz et al., 2012; King et al., 2014; Miller et al., 2017; Prinstein et al., 2008; Selby et al., 2013; Stone et al., 2014; Yen et al., 2015; Yen et al., 2012). Whilst most studies used normed outcome measures to assess suicidality, in some cases, suicide attempts and behaviours were assessed by asking adolescents about the number of attempts they had made in the follow-up period (Berona et al., 2017; Brabant et al., 2014; Czyz et al., 2016; Czyz & King, 2015; Czyz et al., 2012; King et al., 2014), in others clinicians were asked to report or hospital attendances were recorded (Hawton, Bergen, et al., 2012; Huth-Bocks et al., 2007). Where normed outcome measures were used, there was considerable heterogeneity in which measures were used. This field would benefit from the development of consensus around the best method for assessing current suicidality. The review presented risk factors associated with outcomes across the spectrum of suicidality. This may have led to a greater degree of clinical heterogeneity between studies.

## **Models of suicide**

The outcomes of this review can be used to evaluate existing models of suicide. Findings that diagnosable mental disorders predict suicidality are consistent with mental disorders causing symptoms which are hard to bear. Family functioning and high stress might also be experienced as unbearable. This could be understood in the context of the theory that suicide is caused by a desire to escape from unbearable situations (Baumeister, 1990). In addition, evidence that previous suicide attempts and DSH predict suicidality is consistent with the

fifth and sixth steps in this model in which individuals seek sensory experiences and make suicide attempts.

The comprehensive cognitive model (Wenzel & Beck, 2008), in part, supports the findings of this review. Cognitive biases and schemas are consistent with the finding that diagnosable mental disorders are associated with suicidality. The finding that hopelessness predicts suicidality is consistent with the non-impulsive/hopeless schema. Previous suicide attempts predicting suicidality might be consistent with the impulsive/unbearable schema. Further research might examine whether these truly are two distinct categories in adolescents.

The results of the narrative review indicate that there are psychological and social/demographic factors that increase the risk of suicidality. This is consistent with a developmental model which holds that vulnerability to suicidality is caused by early experiences and biological factors. This review did not include any genetic or other biological factors; however, family history of depression was approaching significance in the meta-analysis and it may be the case that this is an indicator that genetic risk factors exist.

Alternatively, parental depression in early childhood may have a significant impact on early childhood experience. Other identified psychological disorders might be explained by developmental models of their own, that is their cause could also be due to vulnerability and stress. Social and demographic risk factors might be explained by this model as stressors.

Whilst this model is consistent with the findings of this study, it is so simplistic that it does little to inform understanding of suicidality.

The finding that higher peer and family invalidation scores predict suicidality, may lend some support to the interpersonal theory of suicide. Miller et al. (2016) based their research on this model and found that thwarted belongingness was associated with depression, which in turn

was associated with suicidality. However, this study was conducted with a very short follow-up. Further research, over longer time periods might provide more evidence for this theory.

### **Clinical utility**

Clinicians working in the field of child and adolescent mental health may be able to make use of risk factor data. However, the small effect sizes reported in this study indicate that the presence or absence of any risk factor would not enable a clinician to identify children or adolescents who will go on to present with suicidality. However, they may be able to identify and target problem areas which are associated with high risk. For example, interventions targeting anxiety symptoms may also reduce the risk of adolescents developing suicidal ideation or behaviours. Further research is needed to establish whether interventions aimed at reducing anxiety symptoms are effective in preventing the development of suicidality.

### **Strengths and limitations**

This systematic review and meta-analysis provides a summary of evidence from a large number of studies. It provides evidence that interventions targeting anxiety may reduce suicide risk, which is relevant to healthcare providers and policy makers. Additionally, it identifies current gaps in the literature relevant to researchers. This review has drawn attention to flaws in the current evidence and has employed methods to limit bias.

Defining adolescence as people aged under-20 may have missed some clinical populations that could have usefully been included in the report. Furthermore, this requirement limited the follow-up period over which studies could collect data. Young people followed up over longer periods might have been captured by a review which also included young adults.

However, this data might have made this report less meaningful to practitioners working in child and adolescent services.



## Adolescent Suicide Risk: Longitudinal Studies of Clinical Populations

The narrative review identified a wide range of possible psychological and social/demographic risk factors for suicidality. However, only past suicide attempts were investigated by seven different studies. This indicates that there has been a lack of replication of research in this field.

Studies did not employ the same method for assessing suicidality. In some cases, clinicians reassessed suicidality using a standardised measure, in others adolescents were asked whether they had made a suicide attempt over the follow-up period. These approaches may have led to some reporting bias, (e.g. if adolescents were trying to avoid rehospitalisation). Binary coding of suicidality was used by all studies included in the meta-analysis, however, in a number of studies suicidality was measured using a continuous metric. Binary coding may have led to misclassification. It was unclear whether studies classified as suicidal all individuals who reported a single instance of suicidal ideation or thoughts about death.

The present meta-analysis examined risk factors in isolation. Many studies reported interactions too idiosyncratic to include in the analysis. This approach assumes zero correlation between exposures in the same study. This may have resulted in an increase in Type-1 error and in the probability of significant effects. Combinations of risk factors may increase their magnitude, improving their predictive power and enriching clinicians' understanding of at-risk service users. For example, adolescents with a diagnosis of depression may be more susceptible to the effects of bullying compared to those that are not clinically depressed. In their review of risk factors for suicidality Franklin et al. (2017) suggest that future research should focus on combining risk factors. The studies in this review, such as that published by Wolff et al. (2017) have performed more complex analyses. However, the complexity of the models created make them difficult to replicate, and the tendency of studies of this kind to only publish the effect size of their final model make it

hard to include them in meta-analyses. There is a need for study data to be made available to develop risk algorithms.

Bias at a study, outcome and review level may have had an effect. Due to the small number of studies included in the meta-analysis, it was not possible to assess publication bias. Many of the reported estimates may overestimate effect sizes because only published studies were included. The quality of included studies varied considerably, and only one study included a quantitative analysis of bias. All studies required that participants could give informed consent, and most studies required that adolescents did not have an intellectual disability. Furthermore, few studies examined the characteristics of drop-outs between baseline and follow-up. Upon close reading of the literature, it became clear that 10 papers were in fact based on only two unique studies. These individual papers were integrated within the analysis. However, this indicates that within-study reporting bias may have been operating. All papers published based on the same study did not include all outcomes. Although all authors were contacted, no authors responded to study data requests. As a result, it was not possible to include all studies in the meta-analysis. These limitations should be considered when interpreting the results of this review.

## Conclusion

Most research on suicidality has been cross-sectional; however, the evidence-base of longitudinal research investigating risk factors is growing. Risk factor research using clinical populations is essential to the advancement of the conceptualisation and prevention of suicide, because it allows clinicians to target interventions at preventable risk factors and test psychological theories in the field.

The narrative review identified social/demographic and psychological risk factors for suicide. However, many risk factors were only identified in a single study. Further research is needed to confirm these findings to aid clinical decision making.

Despite the paucity of research in this area, meta-analysis of twelve of the included studies provided some evidence for baseline anxiety, DSH and past suicidality as risk factors for suicidality at follow-up. Evidence for other risk factors was inconclusive and further research is required to identify other risk and protective factors for suicidality in this population.

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## Section B

### Investigating the Impact of Bullying on Suicidality in a Clinical Sample of Adolescents with Autism Spectrum Conditions

## Abstract

This retrospective cohort study investigated the impact of bullying on suicidality in a clinical population of adolescents with autism spectrum conditions. Evidence suggests that adolescents that experience bullying are at increased risk of developing suicidality.

Adolescents with ASCs are at increased risk of developing suicidality and are at increased risk of being bullied. However, the relationship between bullying and suicidality in adolescents with ASCs has not been investigated.

Electronic health records of adolescents (13-17 yrs) with a diagnosis of ASC using the services of a South London mental health trust were analysed. Natural language processing was employed to identify mentions of suicidality and bullying in the free text fields of adolescents' clinical records. Cox regression analysis was employed to investigate the longitudinal relationship between bullying and suicidality.

Bullying at baseline was associated with suicidality over the follow-up period (HR = 1.96). In addition, female gender, psychosis or affective disorder diagnosis and absence of intellectual disorder diagnosis were associated with suicidality at follow-up.

Bullying seems to predict future suicidality in adolescents with ASCs. The results of this study suggest that mental health clinicians and educators should take reports of bullying seriously.

### Key words

Suicide, Bullying, Autism, Natural Language Processing, Clinical Informatics



## Introduction

### Background

Suicide disproportionately affects people with autism spectrum conditions (ASCs). Adults with a diagnosis of an ASC are seven times more likely to end their lives by suicide compared to the general population (Hirvikoski et al., 2016). There are a number of different possible explanations for this higher prevalence of suicide in people with ASCs. People with ASCs may be more likely to be exposed to risk factors for suicide, be more affected by risk factors for suicide, have unique risk factors for suicide, or some combination of these.

Understanding the causes of suicide in people with ASCs is important, because it may enable health workers to reduce the suicide rate by reducing exposure to known risk factors.

Suicidal adolescents are at five times increased risk of going on to complete suicide, both during adolescence and as adults (Brière, Rohde, Seeley, Klein & Lewinsohn, 2014).

Interventions aimed at preventing adolescents from developing suicidality may ultimately prevent suicide rates across the lifespan. Not only are adults with ASCs more likely to end their lives by suicide, young people with ASCs are at 28 times higher risk of reporting suicidality compared to typically developing peers (Mayes, Gorman, Hillwig-Garcia, & Syed, 2013). Some risk factors for suicidality in typically developing children are more prevalent in children with ASC (Kim, Szatmari, Bryson, Streiner, & Wilson, 2000) and it may be the case that some risk factors have a more pronounced effect in children with ASCs. Risk factors for psychiatric outcomes have been found to have different effects in populations with diagnoses of development disorder (Jerrell, McIntyre, & Park, 2015). Research is needed with a specific focus on youth with ASCs, because suicidal ideation and behaviour may manifest itself differently in this group.

Bullying is an example of a risk factor for suicidality (Klomek et al., 2009) which is known to be more prevalent in children with ASCs (van Roekel, Scholte, & Didden, 2010). In Maye's et al.'s (2013) study, 57% of children aged 1-16 with autism had been teased and those that had been teased were three times more likely to report suicidality. Further research is needed to understand the relationship between bullying and suicidality in adolescents with ASCs.

## **Definitions**

### **Suicidality**

There is no nationally or internationally agreed terminology or classification system for suicidality (Silverman & Leo, 2016). The World Health Organization (2002) has recommended that a set of uniform definitions be agreed upon and regularly reviewed. However, consensus has not yet been achieved. The ICD-10 (World Health Organization, 1992) defines suicide as death as a result of intentional self-harm, or injury or poisoning of undetermined intent. Suicidal ideation and suicidal behaviours are strongly predictive of death by suicide (Nock, Holmberg, Photos, & Michel, 2007). Suicidal ideation is any form of thinking about, considering or planning one's own death. Suicidal behaviour is any form of preparation for one's death at one's own hands (e.g. writing notes or stockpiling medication) and any self-injurious acts with the intent to die. This kind of broad definition has been criticised as being over inclusive. The construct of suicide attempts has been criticised due to the difficulty that exists in determining intent to die (Haw, Casey, Holmes, & Hawton, 2015). Furthermore, some researchers have argued that many completed suicides are the result of an unplanned, impulsive act, and as such, deaths due to suicide may be very different from suicidal behaviours (Lim, Lee, & Park, 2016). However, to date, there is no clear evidence that differences exist between impulsive suicide and other forms (Rimkeviciene, O'Gorman,

& De Leo, 2015). Van Orden et al. (2010) argue that even if suicides appear impulsive, some degree of planning must have preceded the event.

## Bullying

There is no agreed-upon definition of bullying (Thornberg, 2015). Olweus' (1994) definition is frequently used by researchers in this field. This definition consists of three features: intentional aggression, repetition, and a power imbalance between the bullies and the bullied. This definition positions bullying as a form of aggression existing in the context of a power imbalance. Volk, Dane, and Marini (2014) provide a recent update to this definition which defines bullying as goal-directed behaviour, rather than intentional. Research suggests that young people's perception of bullying is not consistent with academic definitions (Cole, Cornell, & Sheras, 2006). Volk, Veenstra, and Espelage (2017) recommend providing young people with a definition of bullying before asking them about it. In addition, this paper suggests that peer reports of bullying are the most reliable source of information about bullying. Whilst this approach may provide a valid means of assessing bullying, it seems less clinically useful. Clinicians working in the field of adolescent mental health will rarely have the opportunity to meet with their patients' peers. The impact of perceived bullying may be important to understand regardless of whether the three criteria above are met. Researchers have taken significantly different methodological approaches to measuring bullying. Researchers differ in both who they ask about bullying (peer, teacher, victim or parent) and in their approach to its measurement, with some classifying any mentions of peer victimisation as bullying and others only including instances which are moderate or severe (Burk, Edmondson, Whitehead, & Smith, 2014; Hicks, Jennings, Jennings, Berry, & Green, 2018).

## ASCs

ASCs refer to a spectrum of conditions related to autism. Within the ICD-10, ASCs are referred to as pervasive developmental disorders (PDDs). PDDs are characterised by abnormal social interactions and restricted, repetitive interests and activities (Y. S. Kim et al., 2014). This classification is very similar to the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-V) term Autism Spectrum Disorders which are characterised by deficits in social communication/interaction and restrictive repetitive behaviours across multiple contexts (American Psychiatric Association, 2013). Asperger Syndrome is included in ICD-10 as a form of PDD characterised by an absence of delay in language or cognitive development (World Health Organization, 1992). However, the DSM-V does not refer to Asperger syndrome, instead this would be classified as an autism spectrum disorder. ASC is used within this paper instead of PDD or ASD, because the term ‘disorder’ could be considered pejorative. Whilst there are aspects of ASCs which are disabling, there are others which are simply differences, some of which may be areas of strength (Autism Research Centre, ND).

## Adolescence

The WHO defines adolescence as the years of life between 10-19 years (World Health Organization, 2005). This second decade of life is a time of rapid change and transition for young people (Jaworska & MacQueen, 2015). Half of all psychiatric disorders start before age 14 (Kessler et al., 2007). The WHO also include a wider category termed “young people” which covers the ages of 10 to 24, this is to acknowledge the continued mental and physical development which continues into the early 20s (World Health Organization, 2014). Bullying is at its most prevalent in early adolescence, however, in adolescents with special educational needs this decline with age is not seen (Chatzitheochari, Parsons, & Platt, 2014).

Whilst adolescent suicidal ideation and attempts predict adult suicide attempt (Horwitz, Czyz, & King, 2015), research suggests that different risk factors are associated with suicidality in adolescence compared to adulthood (Shain, 2016). Parellada et al. (2008) compared adolescent and adult suicide, they found that adults who attempted suicide were more likely to have been diagnosed with an affective disorder, whereas adolescents were more likely to have a diagnosis of adjustment of anxiety disorder. Rates of completed suicide are lower in adolescence than in adulthood, however, suicidal ideation and attempts which are rare in childhood, increase rapidly during early adolescence and reach their lifetime peak in mid to late adolescence (Miranda, Ortin, Polanco-Roman, & Valderrama, 2017).

Adolescents with ASCs face the same developmental challenges as their typically developing peers, whilst managing pervasive social skills deficits. Research suggests that adaptive functioning deficits can become more pronounced in adolescence (Pugliese et al., 2015).

Picci and Scherf (2014) have suggested that adolescence is a particularly vulnerable period of development in the lives of people with ASCs. During adolescence, a typically developing youth undergoes a period of rapid development of social skills (Picci & Scherf, 2014).

Regions of the caudate and amygdala which show increased sensitivity to peer-related information in typically developing adolescents, show disrupted growth in adolescents with ASCs (Picci & Scherf, 2014). Evidence suggests that adolescents with ASCs struggle to form friendships (Mazurek & Kanne, 2010), and are more likely to be socially excluded or bullied (Cappadocia, Weiss, & Pepler, 2012). In addition, adolescence is a period of heightened risk taking compared to adulthood or childhood (Chein, Albert, O'Brien, Uckert, & Steinberg, 2011). Adolescents with ASCs show similar levels of risk taking when compared to their typically developing peers (South, Dana, White, & Crowley, 2011). However, adolescents with ASC have less ability to inhibit responses compared to typically developing peers (Geurts, van den Bergh, & Ruzzano, 2014). Adolescents with ASCs may be less socially

motivated to take risks (Chevallier, Kohls, Troiani, Brodtkin, & Schultz, 2012), however, they may be at increased risk of self-motivated impulsive acts like self-harm (Richards, Davies, & Oliver, 2017).

### **Bullying, ASCs and Suicidality**

There is evidence that children and adolescents with ASCs are more likely to experience suicidal ideation or make suicide attempts compared with their typically developing peers.

There is evidence that children and adolescents that are involved in bullying are more likely to present with suicidality. Children and adolescents with ASCs are more likely to experience bullying than their typically developing peers. There is some evidence that young people with ASCs that are involved in bullying are more likely to present with suicidal ideation or attempts, however, this research has been cross-sectional and has used samples of limited size.

The prevalence of involvement in bullying in school-aged children is approximately 30% (Bradshaw, Sawyer, & O'Brennan, 2007). Children and adolescents with ASCs may be at increased risk of bullying, because they have social skills deficits which lead to lower social status and more frequent peer rejection (Greenham, 1999). Vermeulen (2014) suggests that young people with ASC's tendency to interpret jokes and expressions at face value, and hypersensitivity to ridicule due to stigmatisation in other contexts, may lead young people with ASC to overidentify cases of bullying. Zablotsky, Bradshaw, Anderson, and Law (2013) found that the prevalence of involvement in bullying in school-aged children with a diagnosis of ASC was 63%. Their study found that young people with ASCs educated in mainstream settings were more likely to be involved in bullying than those in a specialist environment. Bullying was most prevalent in children aged 10-14 years. Published studies providing estimates of prevalence vary substantially. Little's (2002) survey found that 94% of mothers

of children (4-17yrs) with Asperger syndrome reported their child had been bullied in the past year, whereas Sterzing, Shattuck, Narendorf, Wagner, and Cooper (2012) classified 46% of adolescents (13-16yrs) with ASCs as having been bullied. Methodological and age differences may explain the wide variation in prevalence estimates (Hebron & Humphrey, 2014). Nonetheless, all studies of prevalence indicate that the prevalence of involvement in bullying is significantly higher in populations of children with ASCs compared with general populations of adolescents (Hebron & Humphrey, 2014). Studies have identified an association between involvement in bullying, either as a bully, a victim or a bully-victim, and suicidality (Cui, Cheng, Xu, Chen, & Wang, 2010; Y. S. Kim, Leventhal, Koh, & Boyce, 2009). Shtayermman (2007) also investigated the relationship between suicidal ideation and bullying. This study only included 10 participants and as a result was underpowered. However, it identified a non-significant correlation between suicidal ideation and bullying in adolescents with ASCs.

### **Potential confounders**

In the general population a wide range of biological, psychological and social/demographic associations with suicidality have been identified. Depression, eating disorder, anxiety disorder, behavioural disorder and sleep disorder diagnoses have all been found to be associated with increased suicidality (Beautrais, 2000; Evans, Hawton, & Rodham, 2004; Hannon & Taylor, 2013; Steele & Doey, 2007). In addition, age, gender, ethnicity, substance misuse, smoking, sexuality, socio-economic status, abuse, suicide in family/peers, suicide in media, parental separation, family discord, family mental disorder, family substance misuse, academic problems, peer discord, gang involvement, obesity, physical disability, and physical health problems have all been identified as associated with adolescent suicidality (Beautrais, 2000; Evans et al., 2004; Holt et al., 2015; Steele & Doey, 2007). These associations may interact with ASCs, for example adolescents with ASCs may be differently affected by

academic problems and adolescents with ASCs are more likely to have academic difficulties (Department for Education & Department of Health, 2015).

## **Models of suicide**

Joiner's (2005) Interpersonal Theory of Suicide distinguishes between suicidal thoughts and suicide attempts. This theory posits that thwarted belongingness, and perceived burdensomeness on others leads to suicidal ideation. An additional feature, known as acquired capability for suicide, is hypothesised to be necessary for suicide attempt. Capability for suicide refers to reductions in fear and pain sensitivity necessary to overcome the will to live. Lai, Rhee, and Nicholas (2017) suggest that subtypes of ASC are more likely to experience thwarted belongingness and perceived burdensomeness. Thwarted belongingness and perceived burdensomeness both require some degree of theory of mind, which may exclude some individuals with ASC. However, for individuals with ASCs who can experience thwarted belongingness and perceived burdensomeness, external factors such as stigma and peer victimisation may increase their risk. Thwarted belongingness, the absence of reciprocal social relations, may be increased in people with ASCs as autistic traits are associated with reduced reciprocity and increased loneliness (Pelton & Cassidy, 2017). Autistic traits are also associated with low self-esteem and parental burden, which may lead to increased perceived burdensomeness.

Acquired capability for suicide may be increased in individuals with ASC because of the increased incidence of self-injurious behaviour, sensory differences and restrictive interests which may include a specific fixation on death and dying (Lai et al., 2017). Pelton and Cassidy (2017) found that perceived burdensomeness and thwarted belonging were found to significantly mediate the relationship between ASCs and suicidal behaviour. One might also



assume that bullying victimisation might lead to feelings of burdensomeness and thwarted belonging.

## **Rationale**

This study aims to examine longitudinally the effect of bullying on suicidality in a clinical sample of adolescents with a diagnosis of ASCs. This study takes the position that it is likely a causal pathway exists between thoughts of suicide, suicidal behaviours and suicide; understanding the common risk factors for all forms of suicidality remains a worthwhile approach which can enhance clinicians' understanding.

Electronic Health Records (EHRs) provide an opportunity to conduct research using longitudinal data from large populations of children with ASC. Data of this kind have the potential to be used to analyse risk factors for suicidality in children with ASC.

By studying a clinical population, it is possible to provide clinically relevant data. In addition, despite collecting data on a smaller cohort, populations referred to adolescent mental health services are more likely to report suicidality than the general population, leading to a study with greater predictive power.

This study focuses on a narrower age range within adolescence from 13-17 years of age. The rationale for this narrower focus is twofold. First, the data available to this study came from CAMHS services in South London; because of CAMHS's service provision, this meant data for adolescents aged eighteen or older was not available. In addition, a decision was made to only include older adolescents (thirteen and over) as this is understood to be a period of higher risk for developing suicidality (Miranda et al., 2017).

This study relied on natural language processing in the clinical records of young people to identify mentions of them being bullied. These mentions may be self-reported, teacher

reported, or parent reported. Whilst this approach may sacrifice scientific validity, it is possible that it provides information of greater clinical significance.

Past suicide attempts and suicidal ideation are the best predictors of completed suicide (Horwitz et al., 2015). By studying suicidality as a broad category, it is possible to identify adolescents experiencing significant distress who are at increased risk of going on to complete suicide. Clinicians working with adolescents with ASCs in a mental health context can make use of an understanding of the risk factors for young people going on to develop suicidality, in developing treatment plans which target risk factors, or increasing their monitoring of high risk groups.

## **Hypotheses**

### **Primary hypothesis:**

In a clinical sample of adolescents with ASCs, bullying will be a significant predictor of suicidality after controlling for depression, anxiety, personality disorder symptoms, PTSD, substance misuse, functional impairment, self-harm, aggression, older age, black race, lower family income, poor family function, past sexual abuse and stressful life events.

### **Secondary hypothesis:**

Other risk factors identified by previous research in clinical samples of adolescents will significantly predict suicidality in this population. Risk factors found to predict suicidality in clinical samples of adolescents include: depression, anxiety, personality disorder symptoms, PTSD, substance misuse, functional impairment, self-harm, aggression, older age, black race, lower family income, poor family function, past sexual abuse and stressful life events.

## Method

### Design

#### Data

This study used data from the clinical records of children aged under 18 between 01/01/2008-31/12/13 who had used the services of South London and Maudsley NHS Foundation Trust (SLaM) during this period. Electronic clinical records data had been anonymised prior to analysis. SLaM provides all aspects of specialist mental health care to approximately 300,000 children who live in Lambeth, Southwark, Lewisham and Croydon (four London boroughs). SLaM Community CAMHS (Child and Adolescent Mental Health Services) specialist ASC services accept referrals from 4-18-year-olds registered with a GP in the borough with suspected or diagnosed ASC who are displaying difficulties emotionally or behaviourally. SLaM is also a specialist provider of inpatient and outpatient services to children nationally, this includes national specialist ASC assessment and treatment services. These services routinely record socio-demographic characteristics and clinical information, including routine outcome measures, on patients' electronic records.

SLaM has developed the Clinical Record Interactive Search (CRIS) in 2007; CRIS provides a pseudonymised, electronic mental health records database. This database can be used to search structured data and free text fields of patients referred to SLaM services. The CRIS database is an example of an Electronic Health Record (EHR). EHRs are increasingly used for observational research, their popularity is due to their ability to provide sufficient data to answer complex research questions. SLaM adopted EHRs in 2006 and imported legacy data from older systems at this time. The CRIS system's data is derived from the SLaM Patient Journey System (ePJS), this locally developed EHR was developed to capture clinical activity conducted by SLaM employees. All clinical information relating to CAMHS is held within

EPJS. This includes proforma assessments (both risk and clinical), structured fields for recording medication, diagnosis and demographic information and unstructured fields in which clinical correspondence and progress notes are included as free text.

Natural Language Processing (NLP) is used to process large quantities of unstructured, free-text and return quantitative information about its meaning. NLP has been widely used in clinical records research, however, the focus of research has tended to be upon physical rather than mental health. The CRIS-CODE project has been developed in SLaM with the long-term aim to develop NLP programmes for mental health records. The focus of this project was to develop applications which could identify suicidality and bullying within free-text sections of clinical records to allow automatic extraction. These applications will support future research projects focussing on similar constructs.

TextHunter, and NLP information extraction suite, was used to develop the bullying application. It is able to find instances of terms within a database of documents, allow human annotators to annotate the terms (positive, negative, unknown) within their context to provide a gold-standard and training set, then develop a model of the concept based upon the training set which can be tested against the gold-standard set. To develop the bullying app a terms list: \$bull\* was generated. This search was run over all health records for patients included in this analysis. Then 200 documents containing the term were annotated either as positive (evidence that the patient has been bullied: e.g. “their teacher is concerned that they are being bullied”), negative (evidence that the patient has not been bullied: e.g. “they reported getting on well with peers and never having been bullied”) or uncertain (a mention of the term which neither confirms nor disconfirms bullying: e.g. “her twin sister has been bullied”). The TextHunter programme used 100 annotations to learn the model, and then tested whether its annotations based upon the model corresponded with the annotations made to the training set. The first iteration of this application identified all positive instances of bullying that had been

identified by the human annotator, however it had a 28% false positive rate. In order to improve the accuracy of the application additional rules were created for surrounding words: “thought\*bully”, “worry\*bully” automatically were coded as unknown and a number of forms commonly uploaded as free-text were automatically coded as unknown. A further 100 documents were annotated as a gold-standard set. This improved the false positive rate to 14%. This analysis used V.3.0.6 of TextHunter (Jackson et al., 2014). The specification for this application is included as an appendix (Appendix F).

The suicidality application was developed by a team of researchers using the clinical sample included in this study. The development of this application is fully described in Downs et al. (2017). The development of the application involved three phases. First, classification rules were designed by two qualified psychiatrists to identify suicidality related information in EHR documents. Second, these rules were applied in a manual review of documents which were used to develop an NLP application to screen for mentions of suicidality in documents. The author of this study was one of two trainee clinical psychologists involved in the third phase of the project. In this phase, both trainee psychologists performed a manual review of documents identified as containing mentions of suicidality. These documents were coded as positive for suicidality, negative for suicidality or uncertain. The NLP application was then further developed to classify mentions of suicidality as positive, negative or unknown.

As one of two manual coders, the author was randomly assigned 50% of patients whose records contained mentions of suicidality. Every explicit mention of suicidality in their clinical records was coded as positive, negative or uncertain. In addition, a sample of 100 randomly extracted documents were assigned to both coders to calculate interrater reliability. All mentions of suicidality within each document were coded. A document was classified as positive for suicidality if most mentions of suicidality within it were positive, and negative if most were negative. The first document classified as positive for suicidality within a patient’s

clinical record was recorded as a positive suicidality outcome and the date of this document was recorded. These annotations were used to evaluate the effectiveness of the NLP application.

Additionally, gender, ethnicity and DOB were extracted from young people's electronic record. Age at first recorded face-to-face contact was calculated. Children's Global Assessment Scale (CGAS) score (Shaffer, Gould, Brasic, Bird, & Aluwahlia, 1983), risk of violence rating, risk of abuse rating, parental substance misuse, parental mental health problems, and diagnosis within 28 days of first contact were extracted from young people's electronic record.

### Defining suicidality

Suicidality was defined as any mention by the patient or carer of suicidal ideation or attempt. This included passive thoughts of suicide (e.g. I wish I was dead) as well as active thoughts of suicide (e.g. I'm going to jump off a bridge). Concerns about suicide risk expressed by caregivers were coded as positive for suicidality, as was treatment or risk management provided in response to suicide risk (e.g. hospitalisation due to suicide risk). Self-harming behaviours were coded as positive if subsequent assessed intent was established, or if the young person clearly stated that they believed the act to be lethal. In addition, highly lethal behaviours (e.g. hanging) were classed as suicidality even if intent could not be clearly established within the extract. More unclear mentions of suicidality were discussed with a CAMHS psychiatrist before a decision was made. Appendix G shows the agreed upon classification agreed by the coders.

### Ethics

Patient consent was not required for this retrospective study. In 2008 CRIS was approved by the Oxfordshire Research Ethics Committee C (reference 08/H0606/71+5) to perform

secondary data analysis of pseudonymised clinical information searched for and retrieved from its database. (Appendix H)

## **Participants**

To perform the longitudinal analysis, only adolescents with a recorded first face to face contact were included in the study. At first contact adolescents had to be at least 13 years and have no record of suicidality on their electronic record from first referral until 28 days after their first referral.

All adolescents aged between 13-18 years, who had at least one contact with CAMHS between 01.01.08-01.06.16, and who had a diagnosis of ASC recorded between 01.01.08-31.12.13 were included in the study.

Psychiatric disorders were diagnosed by CAMHS clinicians using the ICD-10 (World Health Organization, 1992). The Autism Diagnostic Observation Scale (ADOS) (Gotham, Pickles, & Lord, 2009) was used to diagnose ASC in cases where it could not be diagnosed at initial assessment. Demographic and clinical information were recorded using assessment proforma.

## **Materials**

Bullying and Suicidality were extracted from text based fields using NLP as described above.

Date of birth and date of first contact with services were extracted from the database, from these variables age at baseline was calculated. Ethnicity was extracted from a fixed field in the database. This was then coded according to ONS categories (Office for National Statistics, 2011). Gender was extracted from a fixed field in the database. Index of neighbourhood deprivation for the main address was extracted, patients were divided into tertials and classified as either most, 2nd most or least deprived.

Children's adaptive functioning was recorded as CGAS scores. Higher scores (range 0-100) are associated with better functioning. CGAS scores at baseline were extracted from the database, as were ICD-10 codes entered within the baseline period (up to 28 days after first contact). ICD-10 codes were then classified as ADHD, intellectual disability, psychosis, mood disorder or anxiety disorder – any other diagnoses were not included in the final analysis. Most adolescents only had a diagnosis of ASC recorded. This may be because there is only a requirement to record one diagnosis on EPJS. Although it is possible to include multiple diagnoses, most adolescents did not have multiple diagnoses recorded. Other diagnoses were not included in the final analysis because there were so few recorded cases. Selective serotonin reuptake inhibitors (SSRIs) and antipsychotic prescriptions within the baseline period were extracted from structured medication fields. These are two commonly prescribed psychiatric medications in adolescents with ASCs (Coury et al., 2012).

Data from the SLAM CAMHS basic risk assessment was extracted from fixed fields; this included recorded risk of violence, risk of abuse, parent/carer substance misuse and parent/carer mental health problems. Once extracted, risk or abuse and risk of violence were recoded as either no risk/low risk or moderate/high risk.

## **Procedure**

All data analysis was conducted in STATA (Version 14) (StataCorp., 2015). The prospective association between reported bullying in the baseline window, and demographic characteristics, baseline diagnosis, baseline medication, baseline risk, and baseline parent/carer substance misuse and mental health problems were analysed. A Cox regression model was used to analyse the association between baseline bullying and suicidality over a follow-up period of five years from first presentation or before discharge from CAMHS. First, the crude effect of bullying on suicidality was modelled. Additional models of



increasing complexity were constructed adding additional potential confounders. As not every participant had baseline CGAS scores and deprivation data, these variables were the last to be added to the overall model.

### Justification of sample size

Power calculations were based on estimated differences in suicide prevalence between bullied and non-bullied groups. The total sample of 680 would have 80% power to detect a difference, between groups exposed and unexposed to bullying with a hazard ratio of at least 1.66. The study will have adequate power (preliminary work estimates 28% prevalence of suicidality post-bullying).

## Results

### Characteristics of the sample

Characteristics of the sample are displayed in tables 4 and 5.

In total, 680 adolescents met the inclusion criteria for this study. Thirty-six percent of the overall sample reported bullying. The overall sample was mostly male (75%) and white (55%) with an average age of 15 years. Five percent of the sample at baseline had a parent or carer with a substance misuse difficulty. Sixteen percent of the sample had a parent or carer with a mental health problem recorded at baseline. Twenty-two percent of the sample were rated as at moderate or high risk of abuse. Thirty five percent of the sample were rated as at moderate to high risk of violence to others. Two percent of the sample had an anxiety diagnosis, 5% a depression diagnosis, 5% a psychosis diagnosis, 22% an ADHD diagnosis and 29% had a diagnosis of intellectual disability. Seven percent of the sample were prescribed an anti-depressant during the baseline period and 15% were prescribed an antipsychotic. Six hundred and forty-eight (95%) adolescents had address data which allowed deprivation to be calculated. Five hundred and eighty-three (86%) adolescents had baseline CGAS scores with a mean score of 45.29. The average follow-up time for the sample was 699 days or 2 years.

Table 4 - Characteristics of baseline sample by suicidality over follow-up

<b>Baseline characteristics</b>	<b>Total (% of overall sample)</b>	<b>Suicidality over follow-up</b>	<b>No suicidality over follow-up</b>
Overall Sample	680 (100%)	128 (19%)	552 (81%)
Bullied	246 (36%)	68 (28%)	178 (72%)
Female	172 (25%)	48 (28%)	124 (7%)
<b>Age</b>	680 (100%) $M = 15.20$ ( $SD = 1.42$ )	$M = 14.82$ ( $SD = 1.34$ )	$M = 15.28$ ( $SD = 1.43$ )
<b>Ethnicity</b>			
White	377 (55%)	78 (21%)	299 (79%)
Black	163 (24%)	29 (18%)	134 (82%)
Asian	37 (5%)	6 (16%)	31 (84%)
Mixed	12 (10%)	12 (18%)	56 (82%)
Other/Not stated	35 (5%)	3 (7%)	32 (91%)
<b>Local Deprivation</b>			
Deprivation least deprived 1 <sup>st</sup>	230 (35%)	52 (23%)	178 (77%)
Deprivation 2 <sup>nd</sup>	210 (32%)	36 (17%)	174 (83%)
Deprivation most deprived 3 <sup>rd</sup>	208 (32%)	37 (18%)	171 (82%)
Caregiver substance	37 (5%)	8 (22%)	29 (78%)
Caregiver MH	108 (16%)	29 (27%)	79 (73%)
Risk of abuse (Rated Moderate or High)	150 (22%)	35 (23%)	115 (77%)
Risk of violence to others (Rated Moderate or High)	235 (35%)	44 (19%)	191 (81%)
Anxiety diagnosed	13 (2%)	4 (31%)	9 (69%)
Depression diagnosed	33 (5%)	21 (64%)	12 (36%)
Psychosis diagnosed	35 (5%)	13 (37%)	22 (63%)
ADHD	147 (22%)	34 (23%)	113 (77%)
ID	200 (29%)	20 (16%)	180 (33%)
SSRI prescribed	46 (7%)	13 (28%)	33 (72%)
Antipsychotic prescribed	102 (15%)	19 (19%)	83 (81%)
CGAS score	583 (86%) $M = 45.29$ ( $SD = 15.74$ )	$M = 46.48$ ( $SD=13.21$ )	$M = 45.01$ ( $SD = 16.28$ )
Length of follow-up window	$M = 699.55$ ( $SD = 447.22$ )	$M = 772.92$ ( $SD= 446.32$ )	$M = 682.54$ ( $SD = 446.10$ )

There were some significant differences between participants that reported bullying in the baseline period compared to those that did not. The bullied sample was significantly younger (14 years) than the not bullied sample (15 years). The bullied sample also had a significantly larger proportion of reported parent/carer substance misuse, moderate to high risk of abuse and SSRI prescriptions. The bullied sample had significantly fewer adolescents with parents with mental health problems, intellectual disabilities and antipsychotic prescriptions. Adolescents reporting bullying had significantly longer follow-up windows (2 years on average) and significantly higher CGAS scores.

### **Missing data and excluded participants**

Additional analysis of excluded participants (i.e. under 13s, suicidality at baseline or no recorded first contact with services) and analysis of participants with partially missing data (i.e. missing CGAS) is included in appendix I. There were no significant differences between participants missing deprivation scores and the remaining sample.

Table 5 - Characteristics of baseline sample by bullying

Baseline Characteristics	Total (% of overall sample)	Bullied at baseline	Not bullied at baseline	Statistic
Total	680 (100%)	246 (36%)	434 (64%)	
Female	172 (25%)	70 (41%)	102 (59%)	$X^2 = 2.04, p = .15$
Age	680 (100%) $M = 15.20$ $(SD = 1.42)$	14.85 ( $SD = 1.33$ )	15.38 ( $SD = 1.44$ )	$t(678) = 4.78, p < .001$
<b>Ethnicity</b>				
White	377 (55%)	127 (34%)	250 (66%)	$X^2(4) = 4.85, p = .30$
Black	163 (24%)	67 (41%)	96 (59%)	
Asian	37 (5%)	13 (35%)	24 (65%)	
Mixed	12 (10%)	29 (43%)	39 (57%)	
Other/Not stated	35 (5%)	10 (29%)	25 (71%)	
<b>Local Deprivation</b>				
Deprivation least deprived 1 <sup>st</sup>	230 (36%)	71 (31%)	159 (69%)	$X^2(2) = 5.33, p = .07$
Deprivation 2 <sup>nd</sup>	210 (32%)	87 (41%)	123 (59%)	
Deprivation most deprived 3 <sup>rd</sup>	208 (32%)	76 (37%)	132 (63%)	
<b>Caregiver substance</b>	37 (5%)	19 (51%)	18 (48%)	$X^2(1) = 3.90, p = .05$
<b>Caregiver MH</b>	108 (16%)	50 (46%)	58 (54%)	$X^2(2) = 5.69, p = .02$
<b>Risk of abuse (Rated Moderate or High)</b>	150 (22%)	82 (55%)	68 (45%)	$X^2(1) = 28.50, p < .001$
<b>Risk of violence to others (Rated Moderate or High)</b>	246 (36%)	82 (55%)	68 (45%)	$X^2(1) = 28.49, p < .001$
Anxiety diagnosed	13 (2%)	7 (54%)	6 (46%)	$X^2(1) = 1.79, p = .18$
Depression diagnosed	33 (5%)	17 (52%)	16 (49%)	$X^2(1) = 3.53, p = .06$
Psychosis diagnosed	35 (5%)	14 (40%)	21 (60%)	$X^2 = 0.23, p = .63$
ADHD	147 (22%)	47 (32%)	100 (68%)	$X^2(1) = 1.44, p = .23$
<b>ID</b>	200 (29%)	41 (21%)	159 (79%)	$X^2(1) = 30.16, p < .001$
<b>SSRI prescribed</b>	46 (7%)	24 (52%)	22 (48%)	$X^2 = 5.47, p < .02$
<b>Antipsychotic prescribed</b>	102 (15%)	22 (22%)	80 (78%)	$X^2 = 11.09, p = .001$
<b>CGAS score</b>	583 (86%) $M = 45.29$ $(SD = 15.74)$	$M = 48.00 (SD = 16.96)$	$M = 43.71 (SD = 13.01)$	$t(581) = -3.21, p < .001$
<b>Follow-up time</b>	$M = 699.55$ $(SD = 447.22)$	$M = 792.82 (SD = 448.79)$	$M = 646.68 (SD = 438.09)$	$t(678) = -4.14, p < .001$

## **Cox regression**

Table 6 shows the full results of the regression analysis. Consistent with the primary hypothesis, when the full sample was included in the analysis, bullying was associated with a significantly higher rate of follow-up suicidality. Female gender, psychosis, and the absence of an intellectual disability diagnosis were also associated with a higher rate of follow-up suicidality. After adjusting for deprivation, using a smaller sample of 648 adolescents, affective disorder was also found to significantly predict suicidality. There was no significant difference between participants missing deprivation scores and the remainder of the cohort.

There was no significant association between bullying and suicidality after controlling for CGAS scores with a reduced sample size of 583. There were significant differences between participants missing CGAS scores and the remainder of the cohort. Participants missing CGAS scores were more likely to come from areas of higher deprivation, they were less likely to have a recorded diagnosis of depression, they were less likely to be at moderate to high risk of violence to others or abuse, and they were less likely to have care givers recorded as having mental health problems or substance misuse difficulties. After controlling for CGAS score, psychosis diagnosis, depression diagnosis, the absence of intellectual disability and female gender continued to significantly predict suicidality rate over the follow up period. However, the effect of bullying did not remain significant.

Table 6 - Suicidality regression analysis

Variables	Hazard Ratio (CI)
<i>Unadjusted model</i>	
<b>Bullying</b>	1.96 (1.38-2.78), $p < .001$
<i>Adjusted for demographic characteristics</i>	
<b>Bullying</b>	1.96 (1.38-2.80), $p < .001$
Age	1.06 (0.91-1.23), $p = .47$
<b>Female</b>	1.97 (1.37-2.83), $p < .001$
<i>Ethnicity:</i>	
Black	0.81 (0.53-1.24), $p = .33$
Asian	0.65 (0.28-1.51), $p = .32$
Mixed	0.81 (0.43-1.49), $p = .50$
Other/Not stated	0.40 (0.13-1.26), $p = .12$
<i>Adjusted for demographic characteristics + diagnosis and medication</i>	
<b>Bullying</b>	1.62 (1.12-2.35), $p = .01$
Age	1.05 (0.90-1.22), $p = .52$
<b>Female</b>	2.00 (1.39-2.89), $p < .001$
<i>Ethnicity:</i>	
Black	0.96 (0.61-1.50), $p = .85$
Asian	0.67 (0.29-1.56), $p = .35$
Mixed	0.86 (0.46-1.61), $p = .64$
Other/Not stated	0.44 (0.14-1.39), $p = .16$
<b>Psychosis</b>	2.11 (1.11-4.00), $p = .02$
Affective Disorder	1.67 (0.89-3.16), $p = .11$
Anxiety Disorder	1.31 (0.48-3.60), $p = .60$
<b>Intellectual Disability</b>	0.40 (0.24-0.68), $p = .001$
ADHD	1.33 (0.87-2.03), $p = .19$
Anti-psychotics prescribed	1.10 (0.64-1.88), $p = .73$
SSRI prescribed	1.17 (0.63-2.16), $p = .62$
<i>Adjusted for demographic characteristics, diagnosis, medication + risk/carer characteristics</i>	
<b>Bullying</b>	1.60 (1.10 – 2.34), $p = .01$
Age	1.05 (0.90 – 1.22), $p = .55$
<b>Female</b>	2.00 (1.38-2.91), $p < .001$
<i>Ethnicity:</i>	
Black	0.96 (0.61-1.51), $p = .85$
Asian	0.65 (0.28-1.51), $p = .31$
Mixed	0.83 (0.44-1.56), $p = .56$
Other/Not stated	0.45 (0.14-1.43), $p = .18$
<b>Psychosis</b>	2.22 (1.16-4.22), $p = .02$
Affective Disorder	1.67 (1.88-3.17), $p = .12$
Anxiety Disorder	1.23 (0.44-3.43), $p = .65$
<b>Intellectual Disability</b>	0.40 (0.24-0.67), $p = .001$
ADHD	1.24 (0.80-1.91), $p = .34$

Anti-psychotics prescribed	1.09 (0.63-1.88), $p = .77$
SSRI prescribed	1.21 (0.65-2.26), $p = .55$
Risk of abuse	1.05 (0.67-1.66), $p = .83$
Risk of violence	1.11 (0.74-1.69), $p = .61$
Carer mental health	1.32 (0.83-2.09), $p = .25$
Carer substance misuse	0.63 (0.28-1.41), $p = .27$
<i>Adjusted for deprivation (N=648)</i>	
<b>Bullying</b>	1.69 (1.15-2.48), $p = .008$
Age	1.00 (0.85-1.17), $p = .97$
<b>Female</b>	2.00 (1.37-2.91), $p < .001$
<i>Ethnicity:</i>	
Black	0.95 (0.58-1.54), $p = .83$
Asian	0.70 (0.30-1.68), $p = .43$
Mixed	0.80 (0.42-1.51), $p = .49$
Other/Not stated	0.39 (0.12-1.24), $p = .11$
<b>Psychosis</b>	2.34 (1.22-4.47), $p = .01$
<b>Affective Disorder</b>	2.03 (1.06-3.90), $p = .03$
Anxiety Disorder	1.30 (0.47-3.62), $p = .62$
<b>Intellectual Disability</b>	0.40 (0.24-0.67), $p < .001$
ADHD	1.26 (0.82-1.94), $p = .30$
Anti-psychotics prescribed	1.16 (0.67-2.02), $p = .59$
SSRI prescribed	1.06 (0.55-2.01), $p = .87$
Risk of abuse	1.07 (0.67-1.71), $p = .78$
Risk of violence	1.05 (0.69-1.61), $p = .83$
Carer mental health	1.28 (0.80-2.04), $p = .30$
Carer substance misuse	0.64 (0.28-1.46), $p = .83$
Deprivation	0.83 (0.65-1.05), $p = .12$
<i>Adjusted for deprivation and CGAS score (N=559)</i>	
Bullying	1.45 (0.96-2.20), $p = .08$
Age	1.02 (0.86-1.21), $p = .81$
<b>Female</b>	2.08 (1.38-3.12), $p < .001$
<i>Ethnicity:</i>	
Black	1.02 (0.61-1.73), $p = .93$
Asian	0.82 (0.34-1.97), $p = .65$
Mixed	0.90 (0.46-1.76), $p = .75$
Other/Not stated	0.48 (0.15-1.60), $p = .24$
<b>Psychosis</b>	2.87 (1.39-5.90), $p = .004$
<b>Affective Disorder</b>	2.03 (1.05 – 3.93), $p = .04$
Anxiety Disorder	1.64 (0.58-4.65), $p = .35$
<b>Intellectual Disability</b>	0.33 (0.18-0.60), $p < .001$
ADHD	1.33 (0.84-2.13), $p = .23$
Anti-psychotics prescribed	1.03 (0.56-1.89), $p = .92$
SSRI prescribed	0.83 (0.40-1.70), $p = .61$
Risk of abuse	1.20 (0.74-1.95), $p = .46$



Risk of violence	1.05 (0.66-1.66), $p = .84$
Carer mental health	1.14 (0.69-1.89), $p = .46$
Carer substance misuse	0.66 (0.29-1.52), $p = .33$
Deprivation	0.85 (0.97-1.01), $p = .24$
CGAS	0.85 (0.66-1.10), $p = .44$

## Discussion

### Hypotheses

This study found that bullying recorded during the baseline assessment period of adolescents with ASCs significantly predicted suicidality over the follow-up period. This finding is consistent with previous research which has identified that bullying is associated with suicidality in populations of typically developing adolescents (Holt et al., 2015). This is the first study to use EHRs to identify bullying. It demonstrates the wide-ranging applications of electronic health records in child and adolescent mental health research.

When the study controlled for functional ability, reducing the overall sample size, the effect of bullying was no longer significant. CGAS scores were significantly higher in adolescents who reported bullying. Research suggests that adolescents with ASCs are less likely to experience bullying if they are more impaired (Rowley et al., 2012). This result indicates that an interaction may exist between functioning, bullying and suicidality. This possible overfitting along with the loss in power associated with removing 100 participants may have led to bullying no longer significantly predicting suicidality.

After controlling for deprivation, depression was associated with increased risk of developing suicidality. However, anxiety, functional impairment, aggression, age, ethnicity and deprivation were not associated with increased risk of developing suicidality. This result contrasts with research on other clinical populations of adolescents and suggests risk factors for suicidality in adolescents with ASCs may differ from those of adolescents in the general population.

Female adolescents with ASCs were at significantly increased risk of going on to develop suicidality. This is consistent with the results of some existing studies which have identified female gender as a risk factor for suicidality (Goldstein et al., 2012; Greenfield et al., 2008).

Women are at higher risk of suicidal ideation and attempt in the general population, but men are at increased risk of completed suicide (Hawton, 2000). Research is needed to establish whether this is also the case in individuals with ASCs. Typically, high functioning women with ASCs are diagnosed later than men (Giarelli et al., 2010). This may lead to an increased burden, requiring female children to cope without support for longer. Evidence suggests that early intervention in ASCs leads to better outcomes (Pickles et al., 2016). Research investigating the impact of late diagnosis on suicidality would be a useful extension to this research.

Adolescents with dual diagnoses of ASCs and psychosis at baseline were at significantly increased risk of going on to develop suicidality. ASC is a known risk factor for psychosis (Sullivan, Rai, Golding, Zammit & Steer, 2013). Additionally, in the wider population psychotic experiences are a known predictor of suicidality (Bromet et al., 2017). Whilst only 5% of adolescents with ASCs were given a diagnosis of psychosis, 15% were prescribed anti-psychotics. It may be the case that many of these prescriptions were given for the management of aggression (Downs et al., 2016). However, it is also possible that psychosis is being under recorded on the clinical records of young people with ASCs within the trust. Further investigation into the differences between young people with ASCs that go on to develop psychosis, compared to those that do not, might enhance service provision for youth with ASCs. Research suggests that psychotic illness in children with ASCs differs from psychotic illness in non-ASC samples. It may be beneficial to conduct further research into whether there are differences between ASC and non-ASC samples of youth with psychosis in terms of their risk of developing suicidality.

Adolescents with an intellectual disability diagnosis were at significantly reduced risk of going on to develop suicidality. Intellectual disability (ID) has a high prevalence rate (40%) in people with ASCs (La Malfa, Lassi, Bertelli, Salvini, & Placidi, 2004). Research into the

prevalence of suicidality in this population is limited, existing evidence suggests that it is similar to that of the general population, however this population is less likely to be screened for risk of suicide (Dodd, Doherty, & Guerin, 2016). The prevalence of bullying in young people with intellectual disabilities is higher than their typically developing peers both in special and mainstream schools (Knox & Conti-Ramsden, 2010). Ludi et al. (2012) argue that assessments of suicidality used for typically developing populations are inappropriate for youth with intellectual disabilities, and consequentially suicidality is consistently underestimated in young people with intellectual disability. It may be the case that young people with intellectual disabilities and ASCs are less likely to report suicidality to clinicians, or that clinicians are not effectively asking this population about suicidality. Further research into the assessment of suicidality in youth with intellectual disability might provide greater insight into whether intellectual disability is truly a protective factor against the development of suicidality.

### **Further research**

More than a third of the sample (36.8%) reported bullying within the baseline period. This is a smaller percentage than that reported by anonymous surveys of the general population of adolescents in the United Kingdom (Ditch the Label, 2017). Ditch the Label (2017) reported the results of a survey study that 54% of adolescents reported bullying and 75% of adolescents with ASCs reported bullying. It may be the case that young people with ASCs in this sample were experiencing less bullying than the general population. It is also possible that the sample were not being asked about bullying or not reporting bullying during this period. CAMHS clinicians may not have been asking about bullying or not reporting in clinical notes young people's reports of bullying. Further research examining CAMHS clinicians' attitudes to bullying might shed more light on this result. This inconsistency may make it more likely that bullying was only recorded by young people seeing some clinicians,

meaning that their outcomes may have been affected by which clinician they saw.

Furthermore, it may be the case that only reports of bullying above a certain threshold were recorded by some clinicians. Additional research to make sense of underreporting in this sample is needed.

It was beyond the scope of this study to compare the outcomes of clinical populations of adolescents with ASCs to the outcomes of other adolescents in contact with CAMHS.

However, this study provides a clear rationale for doing so. It would be useful to understand whether adolescents with ASCs are particularly vulnerable to certain risk factors, as well as being potentially resilient to others. Furthermore, the developed bullying app did not assess whether bullying was past or current. Further research to assess whether interventions to stop bullying (i.e. bullying being absent at follow-up) were effective in reducing suicidality would be a useful avenue for further research.

Cyberbullying is a growing problem for adolescents in the UK (Ditch the Label, 2017). This study included cyberbullying as a form of bullying searched for in adolescents' clinical records. Hase, Goldberg, Smith, Stuck, and Campain (2015) found that the negative mental health outcomes associated with conventional bullying were not associated with cyberbullying. However, research suggests that children and adolescents with ASCs spend more time online than their typically developing peers (Mazurek & Wenstrup, 2013). As a result, their lives may be more impacted by cyberbullying. Further research distinguishing between conventional bullying and cyberbullying in populations of adolescents with ASCs would be a useful avenue for further research.

## **Strengths and limitations**

## Clinical records

Electronic health records offer low cost access to large data sets. NLP offers an opportunity to extract quantitative data from the text-based electronic health records of mental health patients. This includes all uploaded documents and all clinical notes. An advantage of this approach is that all records are included in studies and as a consequence possible selection bias is reduced. As the sample represents the whole clinical population of four south London trusts, it provides real world data which gives a true clinical picture. Using longitudinally-collected clinician records avoids the response and recall bias that may arise in conventional survey research. Using a large sample size permitted the study to have sufficient statistical power to conduct analyses which remained robust after controlling for confounders. This addressed the sample size limitations of previous literature in the field.

It was not assumed that clinical terms used in typically developing children would generalise to ASC populations. The suicidality search app was validated by two clinicians with experience of working with children with ASC. Using an NLP approach tailored to this population acknowledges the differences in presentation between adolescents with ASC and their typically developing peers.

Whilst this approach offers tremendous potential for researchers to explore complex interactions using large datasets, there are drawbacks to this methodology. First, some may contend that this approach is unethical, because patients have not given permission for their data to be used in this way. Whilst there is the option for patients to opt-out, only three have done so to date, and this may indicate a lack of awareness of how patient data are being used. The NHS health record scheme was withdrawn due to public concern that this data would be mishandled (Greenhalgh, Hinder, Stramer, Bratan, & Russell, 2010). Whilst this project does have ethical approval, with patient data rigorously protected and entirely pseudonymised,

questions about the ethics of this approach may remain. A further potential disadvantage is that this study is limited to clinical records collected in SLaM services. Results from this urban population may not be generalisable to the wider population. Due to available data being limited to that which could be extracted from historic clinical records it was not possible to include all risk factors which have been found to predict suicidality in clinical samples of adolescents.

### Longitudinal research

The longitudinal nature of this study is an advantage because it is possible to establish that certain risk factors predict the future risk of developing suicidality. Correlational studies cannot establish whether dynamic correlates like bullying are risk factors. Drop-outs are frequently a drawback of longitudinal studies, but the nature of this research avoids such a difficulty. However, the longitudinal nature of this study did lead all children that were suicidal at baseline to be excluded from the study; this group may have had unique characteristics that are not captured by the cohort. In addition, excluding young people whose first contact with CAMHS occurred before the age of 13 may have also excluded a group of young people with ASC with unique characteristics.

### The bullying and suicidality search strategy

The approach to assessing the presence or absence of suicidality in young people with ASCs by having a clinician review the mention of suicidality within free-text fields identified as containing a mention of suicidality is a reliable method. However, given the controversy surrounding the definition of suicidality, it is possible that the recording of suicidality by CAMHS clinicians varied significantly. Furthermore, the screening of clinical records coded suicidality merely as positive or negative, it did not indicate whether it was past or current. This study makes the assumption that if no mention of suicidality was made in the 28-day

baseline period the adolescent was not experiencing suicidality at or before that time, however subsequent suicidal mentions in their record may have been referring to suicidality events during or preceding the baseline window.

The bullying application relied more heavily upon TextHunter software, than the suicidality application, to establish cases of bullying. This application also did not establish whether bullying was current or past. Consequentially, bullying reported in the baseline period may have been historic. The bullying search application was developed using common terms for bullying and some exclusion rules (e.g. not “worry bully” a term used in OCD treatment). However, neither the precision, nor the recall of this application was 100%, as a result, some instances of bullying may have been missed, and some false positives for bullying will have been generated. Whilst this problem will affect the validity of the results of this study, the validity and reliability of this application are similar to that achieved by many validated outcome measures widely used in mental health research (e.g. Beck Depression Inventory has an alpha coefficient of 0.88 (Beck, Steer, & Brown, 1996)).

### The problem of intent

This study assumes that certain behaviours can be classified as suicide attempts and others can be classified as non-suicidal self-harm. This is widely contested; Mars et al. (2014) argues that it is difficult to establish whether or not suicidal intent was present in any instance of self-harm. The severity of self-harm, or the risk associated with it are not good indicators of intent, because adolescents may not be aware of the lethality of their behaviour (DeJong, Overholser, & Stockmeier, 2010). Due to the high levels of non-suicidal self-injury in adolescents, this study excluded young people thought not to have intent to die based upon inclusion/exclusion criteria. This approach may have led to some cases of non-suicidal self-injury being classified as suicidality and some cases of suicidality being classified as non-



suicidal self-injury. This may have affected the validity of the results of this study. One way in which intent may have been captured by the study was through negation rules on a document level. If there were more negative mentions of suicidality (e.g. he did not want to die) at a document level than positive mentions (e.g. he tied a ligature to the door handle and around his neck) then the overall document was classified as negative for suicidality.

## **Applications**

Interventions aimed at preventing bullying in schools might reduce the severity of psychiatric symptoms in young people with ASCs. A recent study by Carrington et al. (2017) described the recommendations that young people with ASCs and their caregivers made for bullying prevention and intervention. They found that adolescents and their parents recommended improved communication between school staff, parents and pupils. Adolescents reported that they did not feel teachers were doing enough. Evidence suggests that school-based bullying interventions can reduce bullying (Vreeman & Carroll, 2007). Vreeman and Carroll (2007) found that interventions work best when they are multidisciplinary. CAMHS clinicians, experienced in delivering systemic interventions, may be well placed to improve schools' communication and facilitate multidisciplinary working within schools. Ultimately, these school based interventions may reduce the degree of distress young people with ASCs presenting to CAMHS have to overcome.

Having established that an NLP application can be used to identify bullying within the clinical records of children and young people, there are many possibilities for further research. It may also be possible in future for NLP applications to be used to identify individuals in need of specific interventions.

At a policy level, all schools in the UK must have an anti-bullying policy and bullying is surveyed during Ofsted inspections (Education and Inspections Act, 2006). However, the

prevalence of bullying in the UK remains high (Ditch the Label, 2017). Given the significant impact bullying has on the wellbeing of adolescents, additional funding and stricter targets are justified (Wolke, Copeland, Angold, & Costello, 2013). A recent report suggests that national investment in anti-bullying interventions is an economically sound investment with the cost of anti-bullying programmes being outweighed by reductions in mental health service use and absenteeism (McDaid et al., 2017).

## Conclusion

This study demonstrates how researchers can conduct epidemiological research using the electronic clinical notes made by clinicians. Both the main outcome and the main predictor in this study were generated using NLP from the free text fields of adolescents' clinical records. The study found, consistent with the primary hypothesis, that bullying at baseline predicted the development of suicidality. Research of this kind uses data that were not originally generated for research purposes; this makes the data more naturalistic and reduces selection bias, however, it means that standardised procedures for data collections were not in place. Consequently, the results of this study may be less reliable than those generated by studies under experimental conditions or using validated outcome measures. However, the results of this study make a compelling case for better controlled research into the impact of bullying on adolescents with ASCs and highlight the need for clinicians to work together with educators in order to improve mental health outcomes in the UK.

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## Appendix A – Letter to Authors

Dear Dr X,

I am currently conducting a meta-analysis examining risk factors for adolescent suicide. I am interested in including your study in this analysis. I was hoping that you could provide me with access to your study data for the paper “xxx”

Kind Regards

xxxxx

Trainee clinical psychologist

Salomons Centre for Applied Psychology

Canterbury Christ Church University

1 Meadow Road

Tunbridge Wells, Kent TN1 2YG

Please note that emails are not a secure source of communication and confidentiality cannot be assured. For sustainability reasons, please consider the need to print this email or attachments.

**Appendix B – Meta Analysis data extraction form**

Name of study	data source	country	Time to follow-up	age range	N	suicide event N	no suicide event N	group 1 suicide event N	Group 1 no suicide event N	Group 2 suicide event N	Group 2 no suicide event N

## Appendix C – Quality Assessment

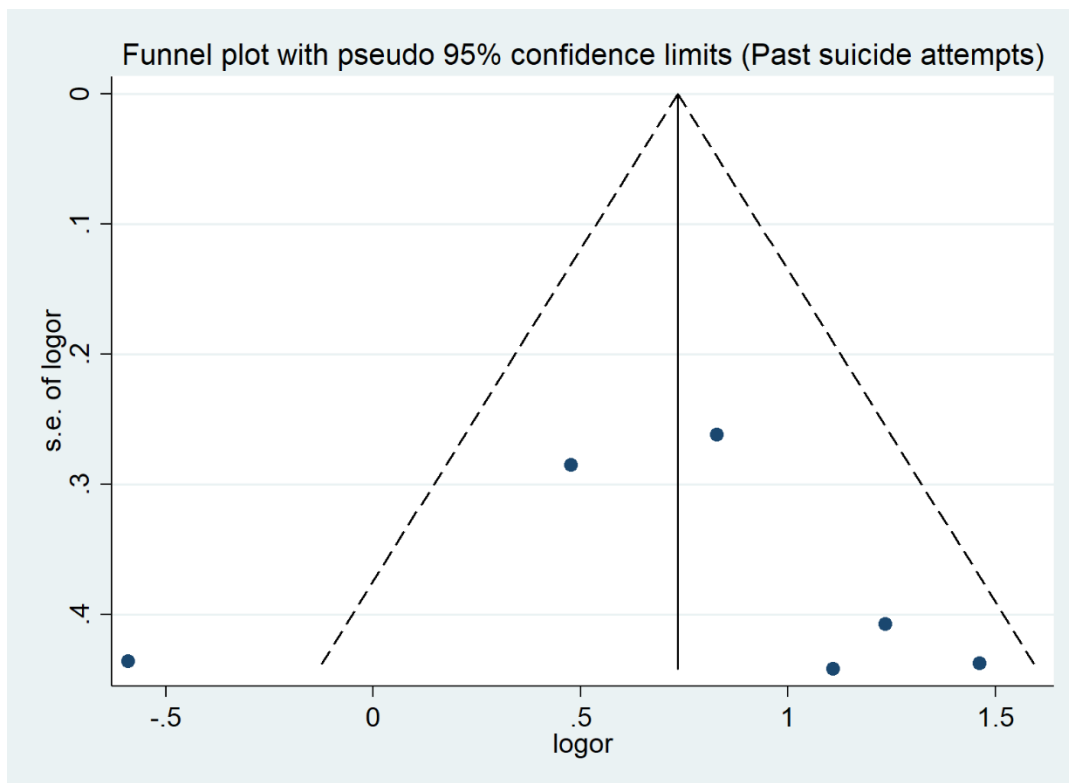
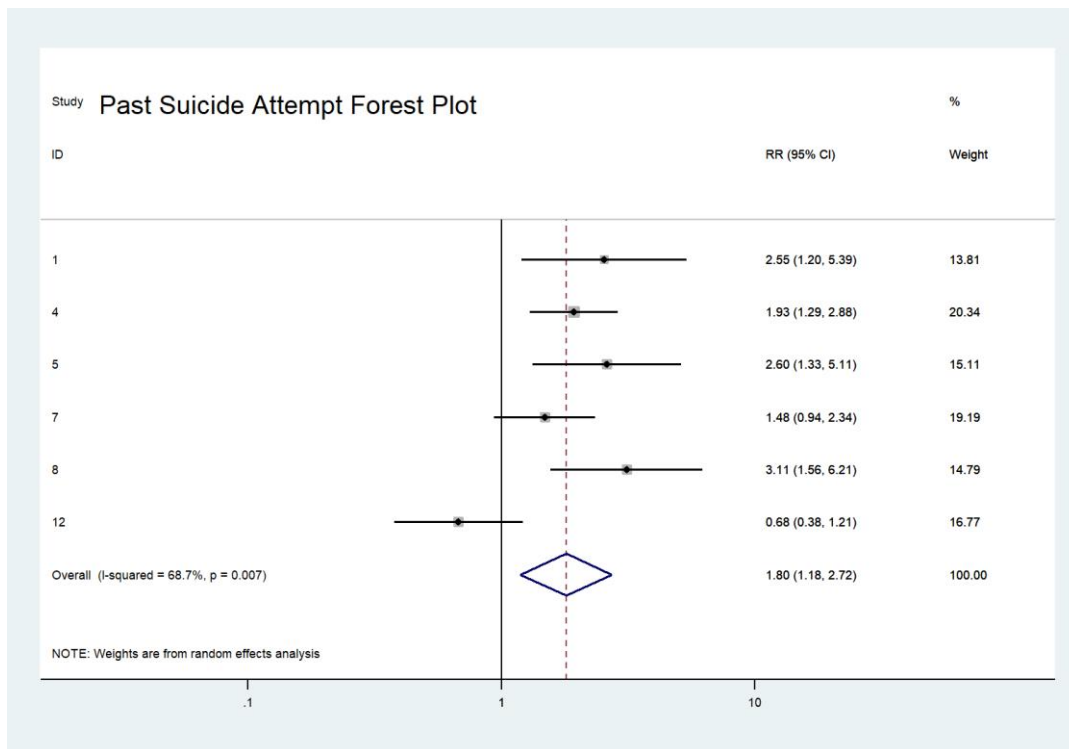
Criterion/Study	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Objectives stated	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
Target population defined	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
Sampling frame defined	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
Study population defined	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
Study setting + geographical location stated	y	y	y	n	y	y	y	y	y	y	y	y	y	y	y	y	y	y	n	y
Dates of study stated	y	y	n	n	n	y	n	y	y	y	y	y	y	y	n	y	n	n	n	n
Eligibility criteria stated	y	y	y	y	n	y	y	y	y	y	y	y	y	y	y	y	n	y	y	y
Issues of selection in to the study stated	n	y	n	y	n	n	y	n	n	n	y	y	y	n	y	y	n	n	n	n
Number of participants justified	n	y	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Proportion meeting eligibility criteria stated	n	y	n	y	n	n	n	y	n	y	n	y	n	n	y	y	n	n	n	n
Reasons for ineligibility stated	n	y	n	n	n	n	n	y	n	y	n	y	n	n	y	y	n	n	n	n
Numbers consenting to participate stated	n	y	n	y	n	y	y	n	n	n	n	y	y	y	y	y	n	n	y	n
Refusal reasons stated	n	y	n	n	n	n	n	n	n	n	n	n	n	y	y	n	n	n	n	n
Comparison of consenters/non-consenters	n	y	n	n	n	y	n	n	n	n	n	n	n	n	y	n	n	n	n	n
Number of participants at baseline stated	y	y	n	y	n	y	y	y	n	y	y	y	y	y	y	y	n	y	y	y
Methods of data collection stated	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
Reliability of measurement methods stated	y	y	y	n	y	n	y	n	n	n	n	y	y	y	y	n	n	n	y	y
Validity of measurement methods stated	n	y	y	n	y	n	y	n	n	n	n	n	y	y	y	n	n	n	y	y
Confounders mentioned	n	y	n	n	n	y	n	y	n	n	n	n	y	n	y	n	n	n	n	n

Number of participants at each wave stated	n	y	n	n	y	y	n	n	n	n	n	y	y	y	y	y	n	y	n	y
Reasons for loss to follow-up stated	n	y	n	n	n	n	n	n	n	n	n	y	n	y	y	n	n	y	n	y
Missing data items at each wave mentioned	n	y	n	n	y	n	n	y	n	n	y	y	y	y	y	n	n	n	n	y
Type of analysis conducted stated	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
Longitudinal analysis methods stated	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
Absolute effect sizes reported	n	y	n	y	n	y	n	y	y	y	n	y	n	n	y	y	y	y	n	n
Relative effect sizes reported	y	y	y	y	n	y	y	y	y	n	y	y	y	y	y	y	y	n	y	y
Loss to follow-up accounted for in analysis	n	y	n	n	n	n	n	n	n	n	n	y	y	n	y	n	n	n	n	y
Confounders accounted for in analysis	n	y	n	n	y	n	n	y	n	n	n	n	n	n	n	y	n	n	n	n
Missing data accounted for in analysis	n	y	n	n	y	n	n	n	n	n	y	y	y	n	y	n	n	n	n	y
Impact of biases assessed qualitatively	n	y	n	n	y	y	y	y	n	y	y	y	y	y	y	y	y	n	n	y
Impact of biases assesses quantitatively	n	n	n	n	n	n	n	n	n	n	n	n	n	n	y	n	n	n	n	n
Results related to target population	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
Any other discussion of generalizability	y	y	y	n	y	n	y	n	n	y	n	y	n	y	y	n	y	y	n	y

## Appendix D – Meta-analysis – publication bias

Variable name	Orwin's N	Egger's intercept			Duval and Tweedie		
		Intercept	95% CI	p	N	Estimate	CI
Previous Suicide Attempt	17	0.55	-9.23 to 10.33	0.88	1	1.86	1.13 to 3.07
Anxiety	6	2.45	-0.64 to 5.53	0.063	2	1.51	1.07 to 2.13
DSH	15	1.17	-18.81 to 21.15	0.82	0	2.53	1.79 to 3.58

## Appendix E – Graphs



# Forest Plot PTSD

Study %

ID RR (95% CI) Weight

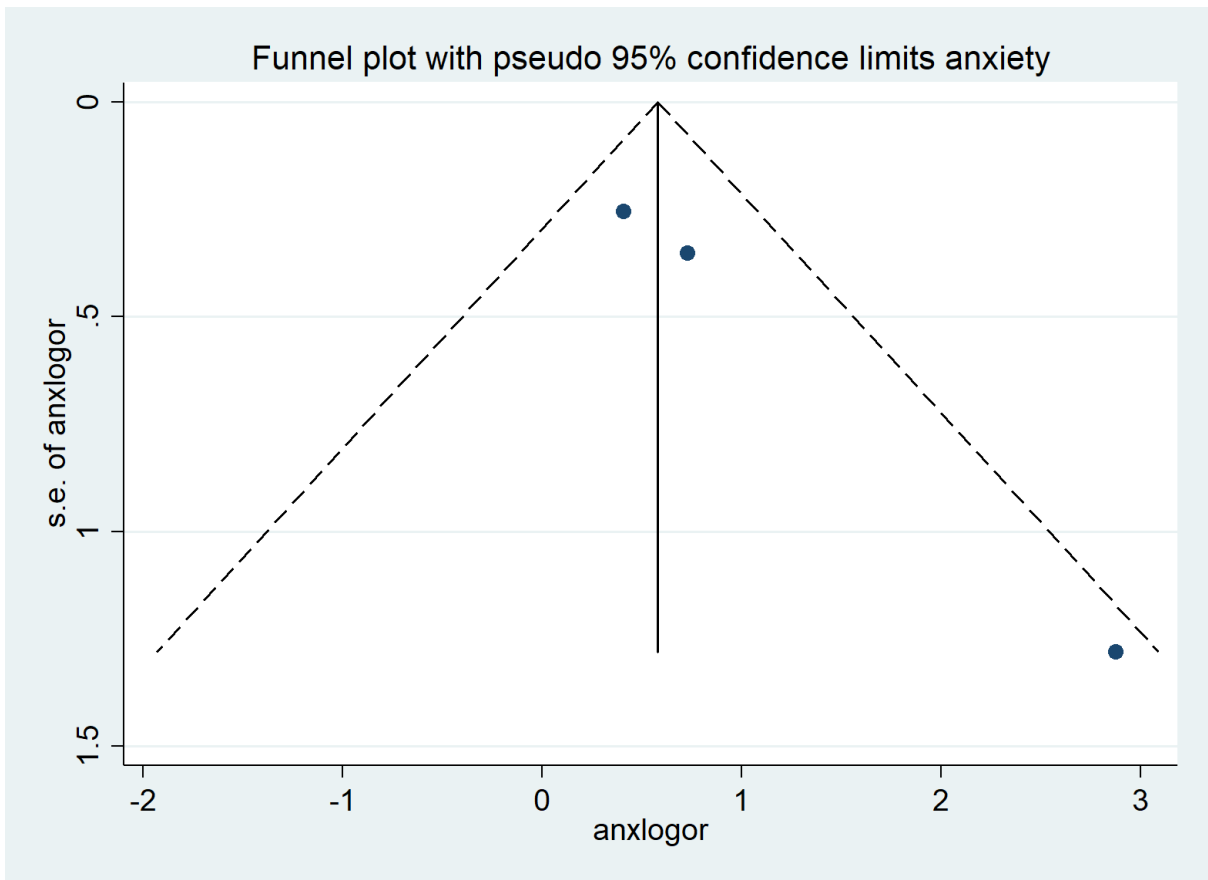
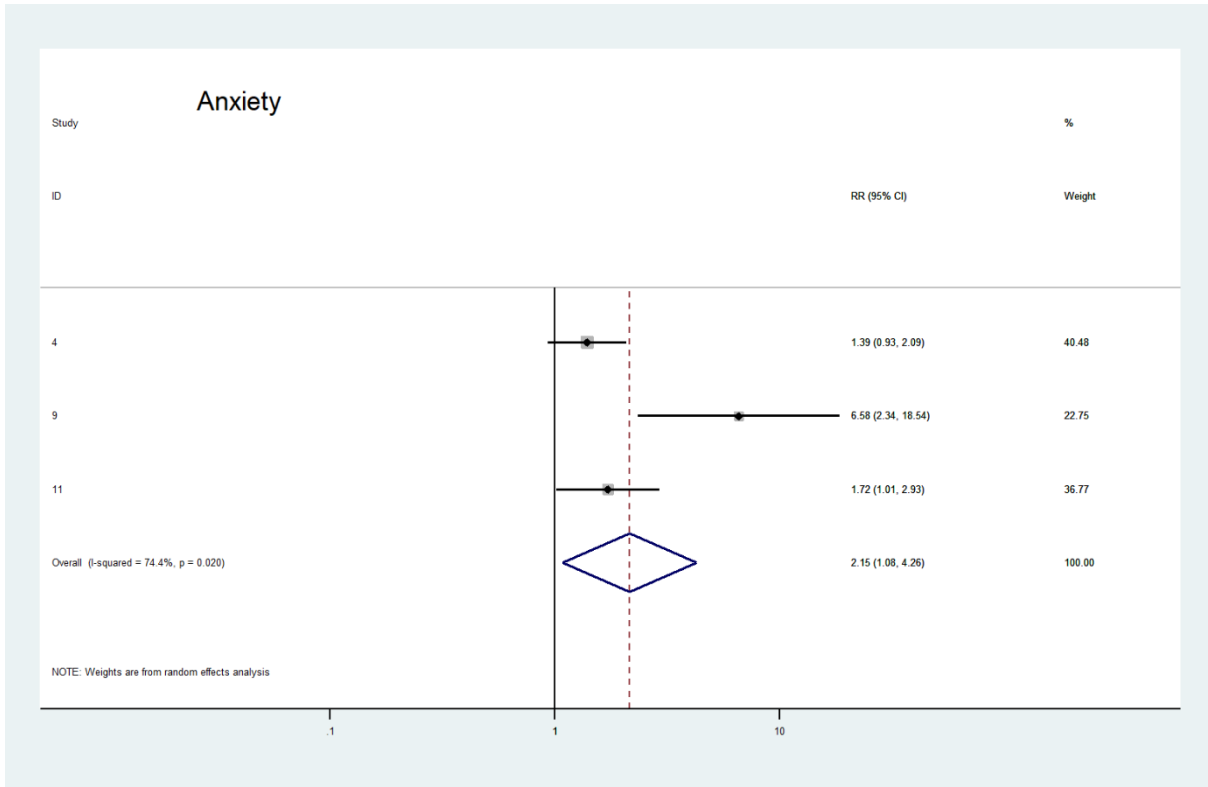
1 1.88 (0.96, 3.69) 35.32

12 1.74 (1.05, 2.86) 64.68

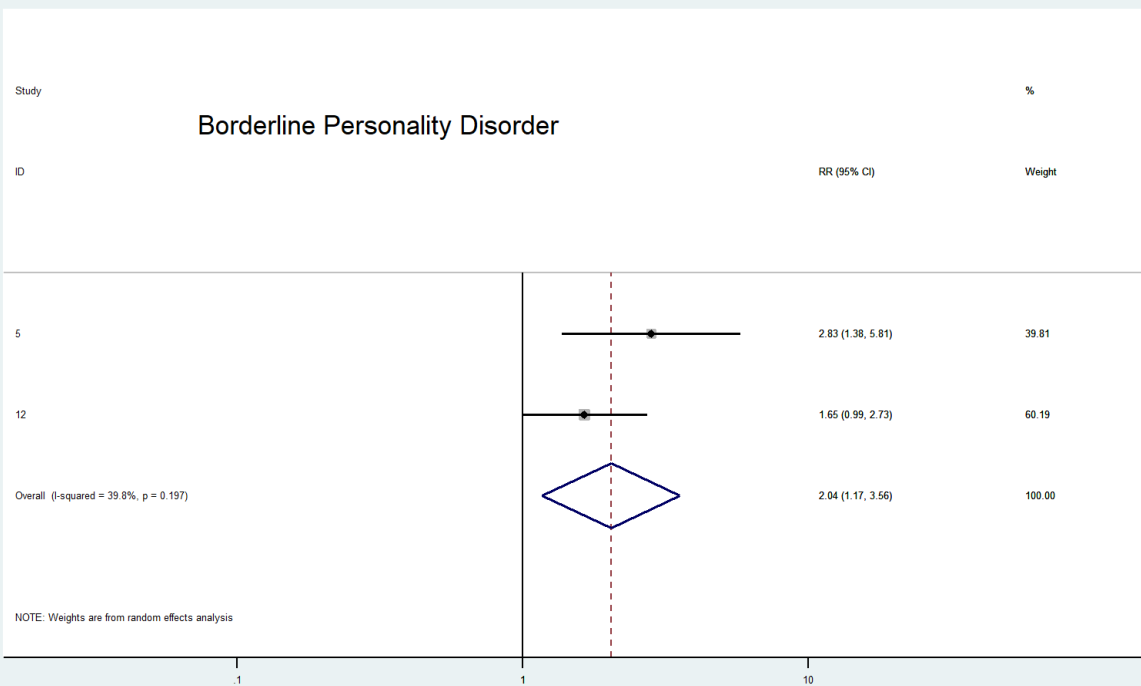
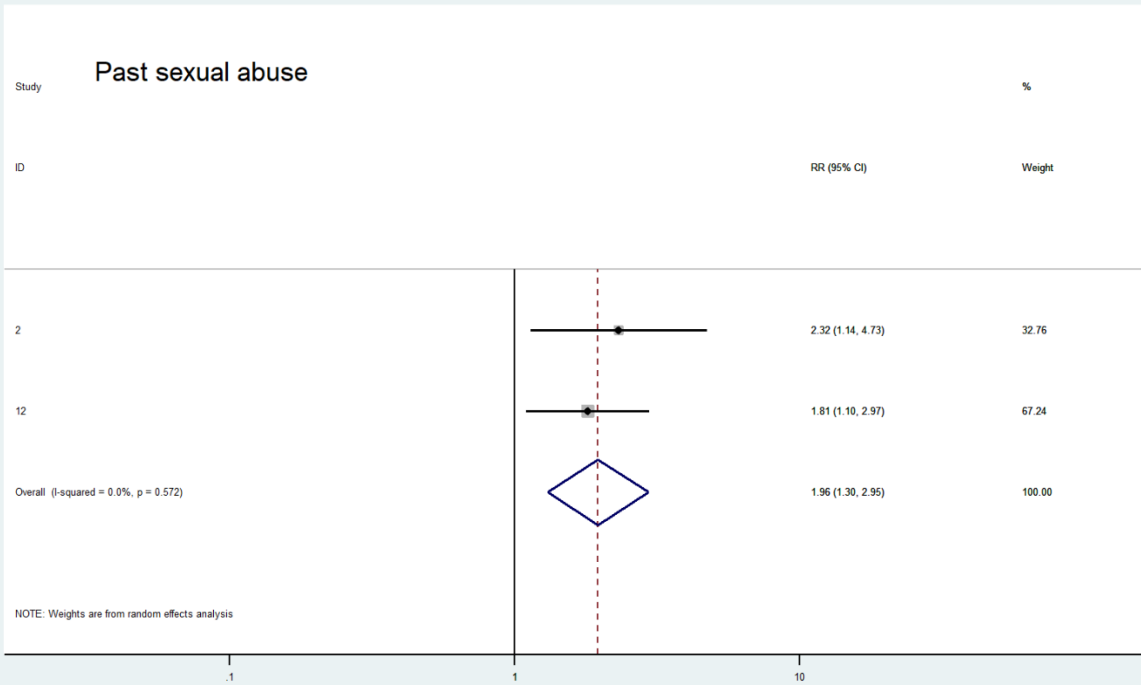
Overall (I-squared = 0.0%, p = 0.847) 1.79 (1.19, 2.67) 100.00

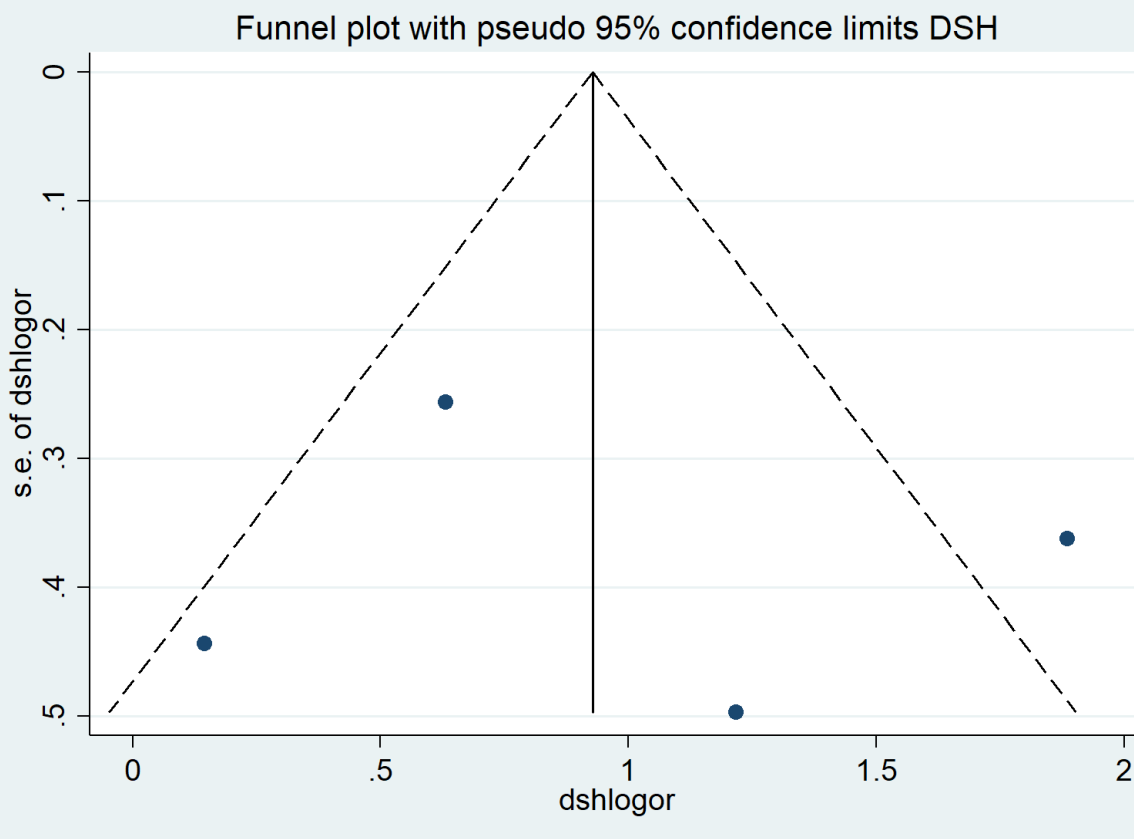
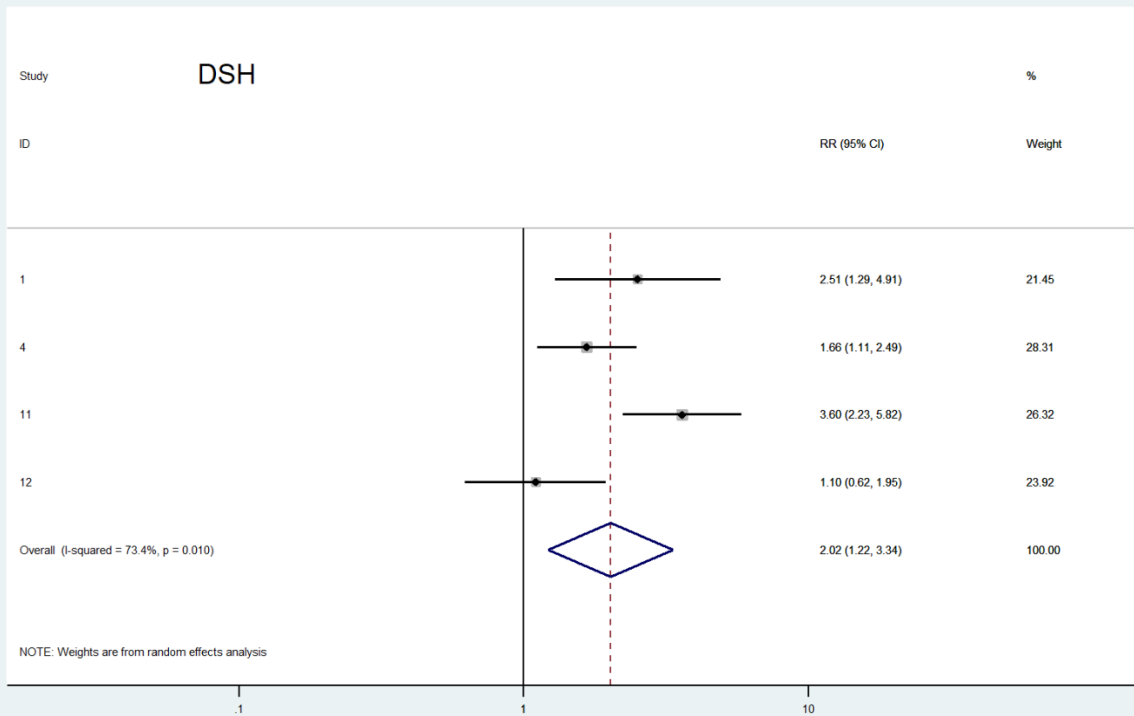
NOTE: Weights are from random effects analysis

.1 1 10

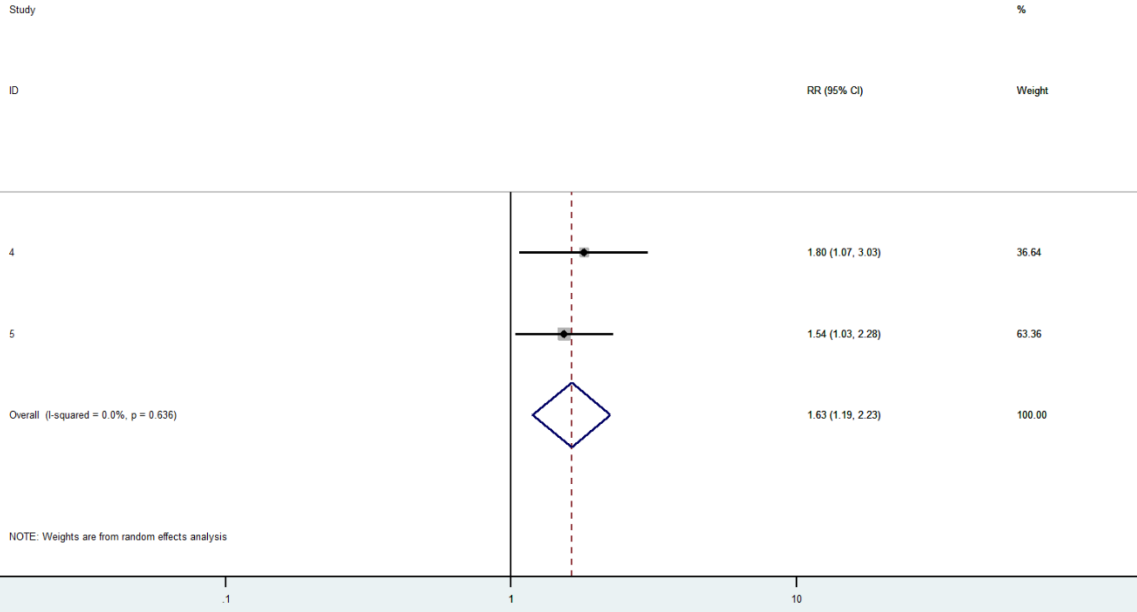








# Excessive Drinking



## **Appendix F – Bullying Application Specification**

### **Definition:**

Bullying is defined as unwanted aggressive behaviour (verbal, social, cyber or physical) between school aged children outside of the family home (i.e. not between siblings). This application relies upon reported bullying. Young people or their families or schools will have reported involvement in bullying (either as bully, victim or bully/victim) to mental health services so that it forms part of their clinical record.

### **Annotation rules:**

#### *Positive:*

Evidence of having been bullied

e.g.

“X has been bullied by a group of peers”

“In primary school X experienced extensive bullying”

#### *Negative:*

Evidence of not having experienced bullying

e.g.

“No bullying reported”

“X has not been involved in bullying”

#### *Unknown:*

Text is irrelevant and does not indicate a positive or a negative result

e.g.

“X’s twin is being bullied in school”

“He signed the school’s anti-bullying policy”

### **Search terms:**

[space]bully\*

Or

[space]bulli\*

### **Excluded terms:**

Skills for life: 'Cyberbullying'

consequences of bullying behaviour on the ward will be a deprivation of privileges  
will be supported to make any formal complaint if being bullied according to the trust  
policy

staff are aware that bullying has been occurring on the unit and will remind young  
people of the unit rules

Bullying is defined as

No form of bullying of a service user from any source will be condoned by any staff

Examples of bullying behavior include

eliminate any of its service users from being bullied in line with its general  
safeguarding from abuse/harm policies and procedures

Bullying can also be a common experience for these youngsters who stand out from their peers.

AS Anti Bullying group

Coping with bullying

handling stressful situations including teasing/bullying

what is bullying?

Bully-Guard Body Armour'

bully body armour

Precision is 0.86 and Recall is 0.98

## **Appendix G – Manual for Suicidality Coding**

Open page:

Brat > OK > ASD\_REST

Login username –

Password –

As you highlight a popup will appear – select positive, negative or uncertain

Do this for all references to suicidality in the document.

If uncertain ensure that a reason is included in the comments section

### **Uncertain terms list:**

Medication – relates to explanation of possible medication side effects

Family – relates to family member suicidality

crisis plan - relates to crisis plan should they become suicidal

friend – relates to friend/acquaintance suicidality

concerns/concern – relates to concerns about suicidality from friend/family member (see criteria below)

Overdose – see criteria below

Form – contents of form/assessment

TX goal – see criteria below

Contextual – Statement not positive/negative in isolation but confirms/negates in context

FAQs

**Overdoses:** If no mention that overdose was NOT a suicidal act code as positive.

**Hanging:** If no mention that hanging/ligature tying was NOT a suicidal act code as positive.

**Low Suicidal risk:** code as Negative

**Concerns:** code as positive unless there is clear uncertainty in the statement

**Researching and looking at websites:** positive

**Cutting:** Only positive if intent is clear otherwise uncertain

**TX goal:** if absence of suicidality mentioned but not explicitly saying reduction then code as uncertain with TX goal as term. If “to stop feeling suicidal” code as positive.

## **Appendix H – Ethical Approval**

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## Appendix I – Analysis of missing data

Table 1 – Missing first contact

Characteristics	Total (% of overall sample)	Missing first contact	Has first contact date	Statistic
Total	1950	396 (20%)	1554 (30%)	
<b>Ever Bullied</b>	862 (44%)	149 (38%)	939 (60%)	$X^2(1) = 66.51$ , $p < .001$
<b>Ever suicidal</b>	607 (31%)	73 (18%)	534 (34%)	$X^2(1) = 37.35$ , $p < .001$
<b>Female</b>	515 (26%)	89 (23%)	426 (27%)	$X^2(1) = 3.96$ , $p = .047$
<b>White</b>	1134 (58%)	238 (60%)	896 (58%)	$X^2(4) = 111.19$ , $p < .001$
<b>Black</b>	386 (20%)	48 (12%)	338 (22%)	
<b>Asian</b>	91 (5%)	12 (3%)	79 (5%)	
<b>Mixed race</b>	210 (11%)	29 (7%)	181 (12%)	
<b>Other/Not stated</b>	129 (7%)	69 (17%)	60 (4%)	
<b>Deprivation least deprived 1<sup>st</sup></b>	646 (36%)	174 (49%)	472 (32%)	$X^2(2) = 34.16$ , $p < .001$
<b>Deprivation 2<sup>nd</sup></b>	582 (32%)	90 (25%)	492 (34%)	
<b>Deprivation most deprived 3<sup>rd</sup></b>	582 (32%)	91 (26%)	491 (34%)	
Caregiver substance	122 (7%)	20 (8%)	102 (7%)	$X^2(1) = 0.24$ , $p = .63$
Caregiver MH	403 (24%)	55 (22%)	348 (24%)	$X^2(1) = 0.64$ , $p = .42$
Risk of abuse (Rated Moderate or High)	484 (48%)	70 (43%)	414 (49%)	$X^2(1) = 1.71$ , $p = .19$
Risk of violence to others (Rated Moderate or High)	748 (46%)	123 (50%)	625 (44%)	$X^2(1) = 3.31$ , $p = .07$
<b>Anxiety diagnosed</b>	51 (3%)	3 (0.8%)	48 (3%)	$X^2(1) = 6.73$ , $p = .009$
<b>Depression diagnosed</b>	161 (8%)	6 (2%)	155 (10%)	$X^2(1) = 29.81$ , $p < .001$
Psychosis diagnosed	138 (7%)	20 (5%)	118 (8%)	$X^2(1) = 3.10$ , $p = .08$
<b>ADHD</b>	500 (26%)	85 (22%)	415 (27%)	$X^2(1) = 4.55$ , $p = .03$
ID	420 (22%)	75 (19%)	345 (22%)	$X^2(1) = 1.99$ , $p = .16$
<b>SSRI prescribed</b>	249 (13%)	23 (6%)	226 (15%)	$X^2(1) = 21.62$ , $p < .001$
<b>Antipsychotic prescribed</b>	402 (21%)	42 (11%)	360 (23%)	$X^2(1) = 30.42$ , $p < .001$
CGAS score	N=1786 $M = 47.24$ $SD = 14.59$	$M = 46.98$ $SD = 15.73$	$M = 47.30$ $SD = 14.37$	$t(1784) = 0.34$ , $p = .73$

Table 2 – Suicidality recorded at baseline

Characteristics	Total (% of overall sample)	Suicidal at baseline	Not suicidal at baseline	Statistic
Total	1950	314 (16%)	1636 (84%)	
<b>Ever Bullied</b>	862 (44%)	232 (74%)	856 (52%)	$X^2 (1) = 49.66, p < .001$
<b>Bullied at baseline</b>	630 (32%)	155 (49%)	475 (29%)	$X^2 (1) = 49.78, p < .001$
<b>Female</b>	515 (26%)	120 (38%)	395 (24%)	$X^2 (1) = 26.84, p < .001$
<b>Age</b> <i>Suicidality only searched for in 13+ population</i>	N=1554 $M = 13.43, SD=2.72$	$M = 15.44, SD = 1.27$	$M = 13.06, SD = 2.72$	$t (1552) = -13.34, p < .001$
<b>White</b>	1134 (58%)	211(67%)	923 (56%)	$X^2 (4) = 16.42, p = .003$
<b>Black</b>	386 (20%)	39 (12%)	347 (21%)	
<b>Asian</b>	91 (5%)	14 (5%)	77 (5%)	
<b>Mixed</b>	210 (11%)	33 (11%)	177 (12%)	
<b>Other/Not stated</b>	129 (7%)	17 (5%)	112 (7%)	
<b>Deprivation least deprived 1<sup>st</sup></b>	646 (36%)	128 (43%)	518 (34%)	$X^2 (2) = 9.42, p = .009$
<b>Deprivation 2<sup>nd</sup></b>	582 (32%)	89 (30%)	493 (33%)	
<b>Deprivation most deprived 3<sup>rd</sup></b>	582 (32%)	79 (27%)	503 (33%)	
Caregiver substance	122 (7%)	21 (8%)	101 (7%)	$X^2 (1) = 0.05, p = .82$
<b>Caregiver MH</b>	403 (24%)	91 (32%)	312 (22%)	$X^2 (1) = 14.34, p < .001$
<b>Risk of abuse (Rated Moderate or High)</b>	484 (48%)	110 (55%)	374 (46%)	$X^2 (1) = 5.79, p = .016$
Risk of violence to others (Rated Moderate or High)	748 (46%)	125 (46%)	623 (45%)	$X^2 (1) = 0.11, p = .75$
Anxiety diagnosed	51 (3%)	8 (3%)	43 (3%)	$X^2 (1) = 0.11, p = .75$
<b>Depression diagnosed</b>	161 (8%)	64 (20%)	97 (6%)	$X^2 (1) = 72.65, p < .001$
<b>Psychosis diagnosed</b>	138 (7%)	44 (14%)	94(6%)	$X^2 (1) = 27.38, p < .001$
<b>ADHD</b>	500 (26%)	56 (18%)	444 (27%)	$X^2 (1) = 11.96, p = .001$
<b>ID</b>	420 (22%)	32 (10%)	388 (24%)	$X^2 (1) = 28.52, p < .001$
<b>SSRI prescribed</b>	249 (13%)	77 (25%)	172 (11%)	$X^2 (1) = 46.41, p < .001$
<b>Antipsychotic prescribed</b>	402 (21%)	89 (23%)	313 (19%)	$X^2 (1) = 13.66, p < .001$

Table 3 – Under 13 at baseline

Characteristics	Total (% of overall sample)	Under 13	13 +	Statistic
Total	1950	636 (32%)	1314 (67%)	
<b>Ever Bullied</b>	862 (44%)	415 (65%)	673 (51%)	$X^2 (1) = 34.22, p < .001$
<b>Bullied at baseline</b>	630 (32%)	231 (36%)	399 (31%)	$X^2 (1) = 6.95, p = .008$
<b>Ever Suicidal</b>	607 (31%)	168 (26%)	439 (33%)	$X^2 (1) = 9.78, p = .002$
Female	515 (26%)	159 (25%)	356 (27%)	$X^2 (1) = 0.97, p = .33$
<b>White</b>	1134 (58%)	354(56%)	780 (59%)	$X^2 (4) = 35.94, p < .001$
<b>Black</b>	386 (20%)	147 (23%)	239 (18%)	
<b>Asian</b>	91 (5%)	31 (5%)	60 (5%)	
<b>Mixed</b>	210 (11%)	87 (14%)	123 (9%)	
<b>Other/Not stated</b>	129 (7%)	17 (5%)	112 (7%)	
<b>Deprivation least deprived 1<sup>st</sup></b>	646 (36%)	147 (25%)	499 (41%)	$X^2 (2) = 40.26, p < .001$
<b>Deprivation 2<sup>nd</sup></b>	582 (32%)	218 (38%)	364 (30%)	
<b>Deprivation most deprived 3<sup>rd</sup></b>	582 (32%)	216 (37%)	366 (30%)	
Caregiver substance	122 (7%)	45 (7%)	77 (7%)	$X^2 (1) = 0.12, p = .73$
Caregiver MH	403 (24%)	150 (25%)	253 (23%)	$X^2 (1) = 0.73, p = .39$
Risk of abuse (Rated Moderate or High)	484 (48%)	162 (47%)	322 (48%)	$X^2 (1) = 0.06, p = .80$
Risk of violence to others (Rated Moderate or High)	748 (46%)	254(43%)	494 (46%)	$X^2 (1) = 1.38, p = .24$
Anxiety diagnosed	51 (3%)	20 (3%)	31 (2%)	$X^2 (1) = 1.04, p = .31$
<b>Depression diagnosed</b>	161 (8%)	38 (6%)	123 (9%)	$X^2 (1) = 6.49, p = .01$
<b>Psychosis diagnosed</b>	138 (7%)	28 (4%)	110 (8%)	$X^2 (1) = 10.27, p = .001$
<b>ADHD</b>	500 (26%)	229 (6%)	271 (21%)	$X^2 (1) = 53.18, p < .001$
<b>ID</b>	420 (22%)	119 (19%)	301 (23%)	$X^2 (1) = 4.47, p = .035$
<b>SSRI prescribed</b>	249 (13%)	61 (10%)	188(14%)	$X^2 (1) = 8.56, p = .003$
Antipsychotic prescribed	402 (20%)	279 (21%)	123 (19%)	$X^2 (1) = 0.94, p = .33$
<b>CGAS score</b>	N=1786	$M = 48.57$	$M = 46.55$	$t(1784) = -2.77, p = .005$

Table 4 – Missing CGAS score

Characteristics	Total (% of overall sample)	Missing CGAS	Has CGAS score	Statistic
Total	680	97 (14%)	583 (86%)	
Bullied at baseline	97 (14%)	31 (13%)	66 (15%)	$X^2 (1) = 0.87, p = .35$
Suicidal at follow-up	97 (14%)	17 (13%)	80 (15%)	$X^2 (1) = 0.12, p = .72$
Female	172 (25%)	24 (25%)	148 (25%)	$X^2 (1) = 0.02, p = .89$
White	377 (55%)	50 (52%)	327 (56%)	$X^2 (4) = 0.92, p = .92$
Black	163 (24%)	25 (26%)	138 (24%)	
Asian	37 (5%)	5 (5%)	32 (6%)	
Mixed	68 (10%)	11 (11%)	57 (10%)	
Other/Not stated	35 (5%)	6 (6%)	29 (5%)	
<b>Deprivation least deprived 1<sup>st</sup></b>	230 (36%)	22 (25%)	208 (37%)	$X^2 (2) = 6.99, p = .03$
<b>Deprivation 2<sup>nd</sup></b>	181 (32%)	29 (33%)	181 (32%)	
<b>Deprivation most deprived 3<sup>rd</sup></b>	170 (30%)	38 (43%)	170 (30%)	
<b>Caregiver substance</b>	37 (5%)	0	37 (6%)	$X^2 (1) = 6.51, p = .01$
<b>Caregiver MH</b>	108 (16%)	8(8%)	100(17%)	$X^2 (1) = 4.93, p = .03$
<b>Risk of abuse (Rated Moderate or High)</b>	150 (22%)	11 (11%)	139 (24%)	$X^2 (1) = 7.56, p = .006$
<b>Risk of violence to others (Rated Moderate or High)</b>	150 (22%)	11(11%)	139 (24%)	$X^2 (1) = 7.56, p = .006$
Anxiety diagnosed	13 (2%)	2 (2%)	11 (2%)	$X^2 (1) = 0.01, p = .91$
<b>Depression diagnosed</b>	33 (5%)	0	33 (6%)	$X^2 (1) = 5.77, p = .02$
Psychosis diagnosed	35 (5%)	6 (6%)	29 (5%)	$X^2 (1) = 0.62, p = .25$
ADHD	147 (22%)	18 (19%)	129 (22%)	$X^2 (1) = 0.63, p = .43$
ID	200 (29%)	21 (22%)	179 (31%)	$X^2 (1) = 3.3, p = .07$
SSRI prescribed	46 (7%)	5 (5%)	41 (7%)	$X^2 (1) = 0.46, p = .50$
Antipsychotic prescribed	102 (15%)	9 (9%)	93 (16%)	$X^2 (1) = 2.91, p = .09$
Age	N=680 M = 15.19 SD= 1.42	M = 15.07 SD = 1.44	M = 15.22 SD = 1.42	$t (678) = 0.94, p = .35$