



ELSEVIER

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Developmental Review

journal homepage: www.elsevier.com/locate/dr

The importance of belonging and the avoidance of social risk taking in adolescence

Livia Tomova^{a,b,*}, Jack L. Andrews^c, Sarah-Jayne Blakemore^{a,c}

^a Department of Psychology, University of Cambridge, UK

^b Hughes Hall, University of Cambridge, UK

^c Institute of Cognitive Neuroscience, University College London, UK

ARTICLE INFO

Keywords:

Social norms
Peer norms
Peer influence
Adolescence
Risk taking
Decision making
Social cognition
Social brain

ABSTRACT

Adolescents are commonly thought of as risk takers. However, adolescents often avoid social risk taking, that is, the risk of being socially excluded by their peers. Here, we review evidence showing that the negative effects of social exclusion and loneliness are particularly high during adolescence, and that adolescents actively seek peer approval and avoid being excluded by peers. Evidence suggests that social belonging is especially important during adolescence and, given that social exclusion and loneliness have negative effects on adolescents' immediate and longer-term well-being, young people tend to be especially motivated to avoid social risk. We review evidence that suggests that the motivation to avoid social risk might lead to heightened peer influence in adolescence. Heightened peer influence can lead to a range of behaviours, from increased health risk taking to prosocial and healthy behaviour, depending on peer norms, that is, the types of behaviour endorsed by the peer group. The evidence reviewed suggests that adolescents are not always risk takers, but are often motivated to avoid social risk taking.

Introduction

Adolescence, defined as the period of life from 10 to 24 years (Sawyer, Azzopardi, Wickremarathne, & Patton, 2018), is a distinct developmental stage characterised by biological, psychological and social change. In addition, adolescence is a time of heightened susceptibility to mental health problems, with approximately 75% of adult mental health disorders first appearing before the age of 24 (Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012). There are substantial changes in the social environment during adolescence (Blakemore & Mills, 2014). The amount of time spent with peers increases between childhood and adolescence, and adolescents' evaluation of their social and personal worth becomes more influenced by what their peers think about them (Foulkes & Blakemore, 2016; Lam, McHale, & Crouter, 2014). Here, we highlight the importance this has in scaffolding adolescent behaviour. When adolescents are with peers, they are more likely to take health or legal risks (when this is valued by the peer group), such as engaging in reckless behaviour and experimenting with drugs, alcohol and cigarettes, compared with when alone (Chein, Albert, O'Brien, Uckert, & Steinberg, 2011a; Gardner & Steinberg, 2005; Lundborg, 2006). Risk taking is defined here as engaging in behaviours that entail uncertainty about their outcomes in terms of costs or benefits, be they health-related, legal or social. Heightened sensitivity to peer norms is not specific to health risk behaviours: adolescents are also more likely to act prosocially when presented with evidence that their peers have been prosocial (Foulkes, Leung, Fuhrmann, Knoll, & Blakemore, 2018).

* Corresponding author.

E-mail address: lt503@cam.ac.uk (L. Tomova).

<https://doi.org/10.1016/j.dr.2021.100981>

Received 23 November 2020; Received in revised form 15 June 2021;

Available online 17 July 2021

0273-2297/© 2021 Elsevier Inc. All rights reserved.

Together, this suggests that adolescents show a tendency to align their behaviour to social norms, whether these be risk seeking, risk averse, prosocial or antisocial in nature.

Social norms

An important overarching concept for understanding conformity and peer susceptibility is social norms. Social norms are unwritten rules about appropriate behaviour in group contexts and contribute to the formation of distinct social group identities (McDonald & Crandall, 2015). Social norms are proposed to represent the foundation of culture, social interaction, prejudice and many other social phenomena. Deviations from social norms are typically viewed unfavourably by other members of the group and can lead to loss of social status or group exclusion (Schachter, 1951). Throughout this paper, we refer to the social norms of a peer group as *peer norms*.

Social norms theory (McDonald & Crandall, 2015) proposes that the types of decisions and actions promoted by peers depend on expectations about appropriate behaviour endorsed by the social group (Prinstein, Brechwald, & Cohen, 2011; Romer, Reyna, & Satterthwaite, 2017). Empirical research has supported this hypothesis by showing that adolescent risk taking can be affected differently depending on whether peers present themselves as cautious or risky (Cascio et al., 2015; Tomova & Pessoa, 2018). Indeed, a recent study showed that perceived peer norms (information about whether safe or risky choices were endorsed by peers) were the most important factor for predicting engagement in risky choices in laboratory gambling tasks in adolescents aged 10–20 years (Ciranka & van den Bos, 2021). When viewed through the framework of social norms theory, many adolescent-typical behaviours can be interpreted as conforming to peer norms. This might be because adolescents tend to be averse to taking *social risks*, that is the risk of being excluded by peers (Blakemore, 2018; Blakemore & Mills, 2014; Do, Guassi Moreira, & Telzer, 2017). In this review, we first summarise research on risk taking in adolescence and then discuss how adolescents avoid social risk taking. We suggest that the avoidance of social risk taking is due, at least partly, to the importance of belonging to a social group and can be considered rational because of the detrimental effects of social disconnectedness in adolescence. We then review literature showing the effects of peer influence on a broad range of behaviours including risk taking and prosocial behaviour. We discuss the possibility that heightened social risk aversion in adolescence can explain a variety of observed behaviours, from health risk taking to prosocial behaviour.

Health and legal risk taking in adolescence

Compared with adults, adolescents are more likely to engage more in risky sexual behaviour, criminal behaviour, experimentation with illegal substances, risky driving and show higher risk taking in controlled laboratory experiments (Burnett, Bault, Coricelli, & Blakemore, 2010; Defoe, Dubas, Figner, & Van Aken, 2015; Patton et al., 2016). The precise age at which risk taking peaks is variable between individuals and depends on the type of risk behaviour and the cultural laws and norms surrounding such behaviours (Park, McCoy, Erausquin, & Bartlett, 2018; Peeters, Oldehinkel, Veenstra, & Vollebergh, 2019). Yet, an overall higher propensity to take risks

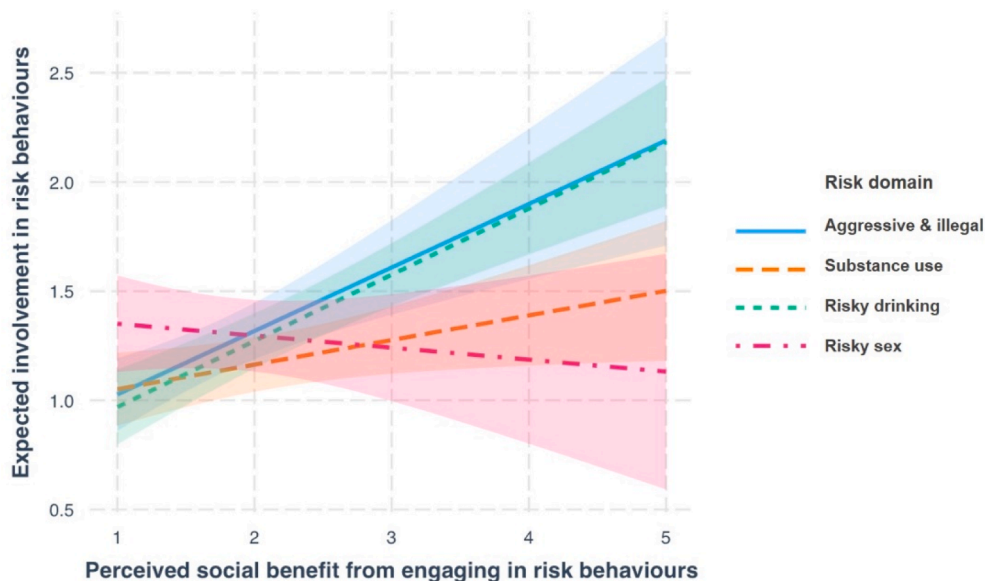


Fig. 1. The relationship between perceived social benefit (1 = they would be liked a lot less, 3 = no difference, 5 = they would be liked a lot more) and expected involvement in risk behaviour (higher scores indicate greater anticipation that participants will engage in said particular behaviour in the near future), broken down by risk domain. Increased perceived social benefit was related to increased anticipated involvement in all risk domains except risky sex (taken from Andrews, Mills, et al. (2020)). Risky sex might be associated with a different set of social evaluative concerns, which are not captured in this study. For example, the concerns of the peer group might be less important than those of the sexual partner.

in adolescence can be observed across different cultures (Duell et al., 2018; Steinberg & Monahan, 2007) and species (Spear, 2011), suggesting that increased risk taking during adolescence might, to some extent, be a universal characteristic of this period of life. However, many of these findings are not replicated in lab-based studies, perhaps partly because they lack sufficient power or because lab-based risk taking tasks measure different underlying processes compared with those that lead to real-life risk taking.

There are a number of individual differences that influence the propensity of adolescents to be risk seeking or risk averse. Several studies have investigated individual variation in adolescent risk taking and have found that factors such as trait impulsivity, empathy, gender and fluid intelligence moderate risk taking behaviour (Lorenz & Kray, 2019). In addition to these individual differences, social context also plays an important role in determining risk taking in adolescence. A consistent finding is that adolescents are more likely to take health or legal risks in the presence of peers than when alone (e.g., Gardner & Steinberg, 2005). Neuroimaging studies have found that brain regions involved in reward processing, such as the ventral striatum, show increased activity in adolescents, relative to adults, when taking risks in the presence of peers (Chein, Albert, O'Brien, Uckert, & Steinberg, 2011b). If health risk behaviours (such as binge drinking or drug taking) are perceived to have a high social value among the peer group, adolescents may be especially motivated to participate in these behaviours (Blakemore & Mills, 2014; Crone & Dahl, 2012; Pfeifer & Berkman, 2018). Indeed, one study found that adolescents (aged 11–17) were more likely to anticipate engaging in certain health and legal risks in the near future if they expected this to lead to an increase in how well they are liked by others (a greater perceived social benefit) ((Andrews, Mills, et al., 2020); see Fig. 1).

Adolescents avoid social risks

During adolescence, the main source of social interaction shifts from parents and family to peers (Brown, 2013). Fitting in with the peer group is a key developmental goal in adolescence. Affiliating with peers might help facilitate the transition into independent adulthood and aid developmental steps, such as establishing a social self-identity (van der Aar, Peters, & Crone, 2018). As such, adolescence can be considered a sensitive period of social development (Blakemore & Mills, 2014). This might be partly dependent on the development of the social brain, the network of brain regions involved in social perception and social cognition, which allows us to understand and interact with other people (Frith & Frith, 2007).

One aspect of social development during adolescence is an increased motivation for peer acceptance and peer affiliation, and an increased sensitivity to the negative effects of social exclusion (Sebastian, Viding, Williams, & Blakemore, 2010). It has been proposed that, as a consequence of this hypersensitivity to social exclusion, adolescents are risk averse when it comes to taking social risks (Blakemore, 2018; Blakemore & Mills, 2014). A social risk can be defined as any action that might lead to negative evaluations or exclusion by others (Blakemore, 2018). The motivation to avoid taking social risks might result in heightened peer influence, whereby the presence of peers is particularly likely to guide adolescent decision making. Some adolescents might take health or legal risks, if this is valued by their peer group, because they weigh the risk of social exclusion more strongly than potential negative health or legal outcomes (Blakemore, 2018; Blakemore & Mills, 2014; Do et al., 2017). In a recent study, almost 1400 participants were asked how concerned they would feel about engaging in a number of hypothetical, every day, health risks (for example, crossing a street on a red light, or riding a bicycle without a helmet) and social risks (for example, defending an unpopular opinion, or standing up for someone who is being mocked by your friends) (see Fig. 2). The results showed that, whilst health risks elicited greater concern than did social

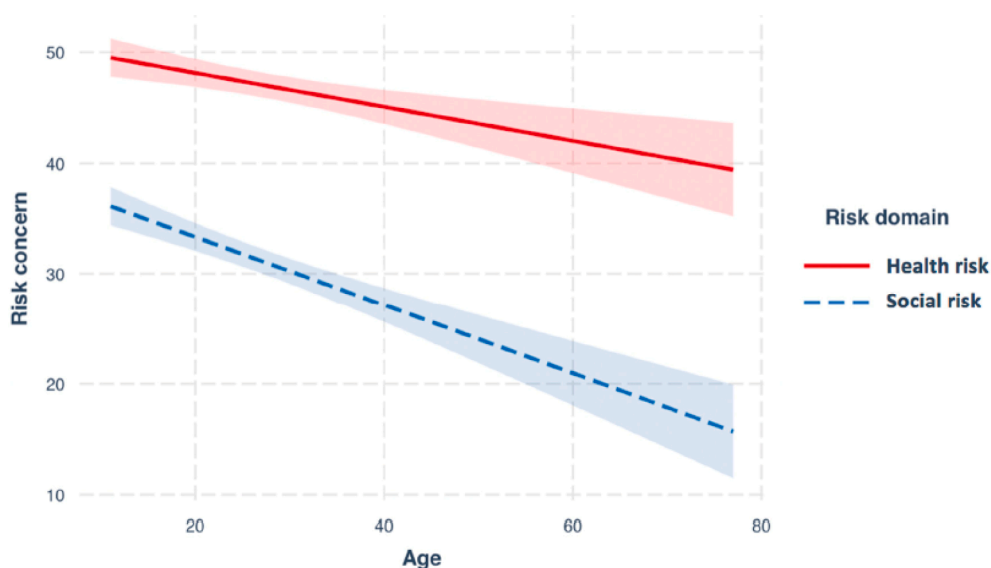


Fig. 2. The relationship between age and concern for health risk (slope: $\beta = -0.15$, $p < 0.001$) and social risk (slope: $\beta = -0.31$, $p < 0.001$). There was a significant difference between the gradient of these slopes ($t(2794) = 2.7$, $p = 0.008$), driven by a steeper decline across age in concern for social risk than in concern for health risk. Figure from Andrews, Mills, et al. (2020).

risks across all ages, compared with adults, adolescents were more concerned about engaging in social risks (Andrews, Foulkes, Bone, & Blakemore, 2020). This was not based on a general overestimation of risk during adolescence as there was a significant interaction between age and risk concern, which was driven by the age-related decrease in social risk concern being significantly steeper than the age-related decrease in health risk concern. It is worth noting that, in this study, adolescents reported being more concerned about both health and social risks compared with adults, which goes against the stereotype of adolescents being careless about taking risks. Interestingly, this is in line with previous studies that found that risk ratings for a number of risky behaviours declined with age from childhood through adulthood (Knoll, Leung, Foulkes, & Blakemore, 2017).

In practice, many decisions involve weighing up a complex combination of risk factors, including social, health, legal and financial considerations, and occur within a dynamic social milieu (Blakemore & Mills, 2014). For example, the decision to engage in health risk taking when with peers might mean that certain social risks (e.g. the risk of being excluded by peers) are avoided but other social risks (e.g. disapproval from parents, teachers or other peer groups) are generated. In this context, social and health risks should not be considered orthogonal but rather interacting constructs. This is consistent with a value-based choice account of adolescent decision making in which a single system integrates value-laden inputs (which could include social motives) to guide choices (Pfeifer & Berkman, 2018). Given that developing a positive personal and social identity, especially in the peer context, is a key goal of adolescence, it is likely that self and social-related cues are given high value. This account assumes that peer norms will be a significant driver of adolescent decision making (Blakemore & Mills, 2014).

Although health risk taking when with peers might seem irrational or reckless, we suggest that it can in fact be adaptive for adolescents to avoid social risks, as being socially disconnected during adolescence has profoundly detrimental effects.

Social disconnectedness and avoiding social risks in adolescence

Social exclusion in adolescence. In this section we discuss the effects of social exclusion on behaviour, the brain and mental health in adolescence. Studies have investigated the cumulative effects of chronic exclusion by peers over time. Young people who have been excluded adopt different strategies in response to exclusion (Smart Richman & Leary, 2009). For example, they might engage in attempts to gain acceptance (Dewall & Richman, 2011; Maner, DeWall, Baumeister, & Schaller, 2007), or harm others (Ayduk, Gyurak, & Luerksen, 2008; Twenge & Baumeister, 2004) or withdraw from the excluding situation (Molden, Lucas, Gardner, Dean, & Knowles, 2009). Studies have also shown that young people's responses to exclusion vary according to how the excluded individual perceives the intentions of the excluder (in 17–22-year olds (Molden et al., 2009)), and by their estimate of whether reaffiliating with the excluding individual is possible (in undergraduates (Maner et al., 2007)).

However, due to their correlational nature, studies on chronic exclusion typically cannot disentangle the different contributing factors or direction of causality. Research investigating the causal effects of social exclusion often use Cyberball, an online ball throwing game in which participants are excluded from the game (Leary, 2005). Many of these studies have demonstrated decreases in mood, increases in anxiety (Fuhrmann, Casey, Speekenbrink, & Blakemore, 2019) and a decline in cognitive processing, such as working memory performance (Fuhrmann et al., 2019) and self-regulation (Baumeister, DeWall, Ciarocco, & Twenge, 2005), following single episodes of social exclusion (using Cyberball) in adolescence (see (Hartgerink, van Beest, Wicherts, & Williams, 2015) for a meta-analysis).

Social exclusion can also lead to increased risk taking. For example, a series of studies demonstrated that young people (18–19 years on average) show increased risky and costly choices following social exclusion (Twenge, Catanese, & Baumeister, 2002). While seemingly irrational, it has been suggested that these behaviours represent increased engagement in pleasurable activities as a compensatory strategy to deal with the exclusion, while neglecting potential consequences to health (Twenge et al., 2002). Additionally, experiencing social exclusion might lead to an increase in the value placed on peer interactions (the social augmentation hypothesis (Dishion, Piehler, & Myers, 2008)), motivating adolescents to take health or legal risks if they expect these to be endorsed by their peer group.

The regions of the brain activated during social exclusion overlap with neural signals of pain processing: both are associated with activation in the 'pain network,' including the dorsal anterior cingulate cortex and anterior insula. This has led to the proposal that social exclusion has similar properties to real physical pain (Eisenberger, 2012a; Eisenberger, 2012b; Eisenberger, Lieberman, & Williams, 2003). However, two meta-analyses failed to find evidence for consistent involvement of these regions (Cacioppo et al., 2013; Vijayakumar, Cheng, & Pfeifer, 2017), one including developmental samples (7 years to late 20's) (Vijayakumar et al., 2017). Rather, more recent studies suggest that activity in these regions monitor a discrepancy between the expected and experienced amount of social inclusion. For example, in one study using a novel social feedback paradigm with 17–21 year olds, activation in the dorsal anterior cingulate cortex and anterior insula tracked information relevant to both inclusion and exclusion (Dalgleish et al., 2017). A different study including 11–17-year olds (Cheng et al., 2020) investigated whether activity in these regions might represent surprise rather than social pain by comparing social exclusion and over-inclusion, as both conditions violate fairness expectations but only exclusion should result in a painful experience. This study showed partially overlapping regions within the pain network, including the anterior insula and dorsal anterior cingulate cortex, for both types of violations (exclusion and over-inclusion), suggesting that the neural responses to exclusion might not be associated with pain processing and instead might be due to violation of expectation.

A different line of research has investigated the effects of social exclusion on pain processing in adolescents (Fales & Noel, 2020). This study found that, while perceived pain intensity (in a cold pressor task that used cold water to induce pain) was unaffected by exclusion, adolescents who were previously excluded by two of their peers recalled their pain experience as being less intense than adolescents who were not excluded. This might suggest that the experience of social pain inhibited later memory for physical pain. One speculative explanation could be that social exclusion was more salient than physical pain for these adolescents. Another form of social

disconnectedness is loneliness, which we turn to in the next section.

Loneliness. Loneliness is defined as the difference between one's desired and actual social relationships (Hawkley & Cacioppo, 2010). While loneliness can result from social exclusion, the two differ in that social exclusion is characterised by an ostracising act from others. Loneliness is a highly subjective experience that can be unrelated to objective social isolation: for example, two people might have the same amount of social interactions and social contacts but show different experiential loneliness (Cacioppo, Hawkley, Norman, & Berntson, 2011). A recent large-scale survey showed that, contrary to common belief, self-reported loneliness is not highest in older age but rather in late adolescence (16–24 years) (Hammond, 2019). This might be partly due to the changes that occur to social relationships, social expectations and social identities during adolescence. Key triggers for strong feelings of loneliness during adolescence are transition points such as moving from primary to secondary school or going to university (Siva, 2020). Some have argued that loneliness in adolescence may be a normative experience (Sippola & Bukowski, 1999). However, while some experience of loneliness during adolescence might be expected, persistent and strong feelings of loneliness are problematic as they are associated with mental health and behavioural problems (Doane & Thurston, 2014; Drake, Sladek, & Doane, 2016; Dyal & Valente, 2015; Essau, de la Torre-Luque, Lewinsohn, & Rohde, 2020; McKay, Konowalczyk, Andretta, & Cole, 2017; Zheleznyakova, 2020).

Adolescent loneliness has been associated with behavioural problems such as low self-esteem (Heinrich & Gullone, 2006) and poor academic performance (Benner, 2011), as well as addictive behaviour (Zheleznyakova, 2020) and substance use such as smoking (DeWall & Pond, 2011; Dyal & Valente, 2015) and alcohol use (McKay et al., 2017). It has been suggested that increased substance use might serve as a form of self-medication to cope with loneliness (Heinrich & Gullone, 2006), or as a way to affiliate with others if substance use is known to be endorsed by the peer group (DeWall & Pond, 2011). In adults, substance use was predicted by feelings of loneliness and especially so in environments in which substance use was endorsed by others. This suggests that people who are lonely are more prone to using substances in order to reconnect with others. Thus, engaging in a risky behaviours, such as increased substance use, might be a way in which adolescents try to decrease loneliness.

Loneliness induced by short-term social isolation led to decreased happiness and increased craving for social contact in young adults between 18 and 40 years (Tomova et al., 2020). In addition, the substantia nigra, a core component of the reward circuitry, showed similar patterns of activation in response to social cues following social isolation and to food cues following fasting, suggesting that craving social contact is represented in the brain in similar ways as craving food (Tomova et al., 2020). While it is unknown how adolescents respond to experimentally induced periods of social isolation, a large body of research in adolescent animals (mice and rats) has shown that social isolation has unique effects on brain and behavioural development and mental health in adolescence (Burke, McCormick, Pellis, & Lukkes, 2017; Orben, Tomova, & Blakemore, 2020).

Cross-sectional studies have shown that changes in stress responsiveness (Doane & Thurston, 2014; Drake et al., 2016), depression (Essau, de la Torre-Luque, Lewinsohn, & Rohde, 2020; Heinrich & Gullone, 2006) and suicide (Lasgaard, Goossens, & Elklit, 2011; Schinka, VanDulmen, Bossarte, & Swahn, 2012), are linked to loneliness in adolescence. Furthermore, longitudinal studies have shown that loneliness in adolescence also predicts mental health problems, such as depression, later in life (Goosby, Bellatorre, Walsemann, & Cheadle, 2013). In addition, structural MRI studies have shown that chronic loneliness in late adolescence/early adulthood is associated with altered brain structure (Nakagawa et al., 2015; Tian et al., 2014). One study found that, compared to non-lonely young people, lonely young people aged 18–27 years show variations in the white matter integrity of several regions of the cortex associated with social functioning, including the inferior parietal lobe, anterior insula, posterior temporoparietal junction, posterior superior temporal sulcus and prefrontal cortex (Nakagawa et al., 2015) and in the fibre tracts connecting the regions among the inferior frontal gyrus, temporoparietal junction, and anterior insula (Tian et al., 2014). It is important to note that most studies in this field, including studies on brain differences, are cross-sectional and correlational and cannot determine the direction of causality. Overall, these studies suggest that loneliness and social exclusion both interact with risk taking behaviour in that engaging in risky behaviours that are endorsed by peers (such as binge drinking or substance use) is a strategy that some adolescents use to try to overcome loneliness and exclusion.

Importance of belonging in adolescence

We have described evidence that social exclusion and loneliness are associated with negative outcomes in adolescence. At the same time, being socially included confers benefits when coping with life stressors. Young people who adapt well to these changes by gaining a stable social position have better physical and psychological health outcomes later in life (Almquist, 2009; Van Harmelen et al., 2017). When measuring social connectedness, many studies focus on family and school connectedness. Family connectedness refers to self-reported enjoyment and feelings of closeness and caring by family members. School connectedness refers to self-reported enjoyment of school and experiencing a sense of belonging and connectedness to school (independent of academic performance) (Resnick, Harris, & Blum, 1993). Family and school connectedness show the highest influence on adolescents' well-being, even above demographic factors such as two-parent versus single parent family structure (Resnick et al., 1993) and serve a protective function against health risk behaviours such as excessive drinking, smoking, cannabis use and risky sexual behaviour (Brooks, Magnusson, Spencer, & Morgan, 2012).

Evidence from large-scale studies indicates that supportive peer environments can act as a protective factor against a number of mental health problems in adolescence. Adolescent friendship quality predicts later resilience in terms of psychiatric symptoms, personality traits and mental well-being (Van Harmelen et al., 2017). In addition, school connectedness buffers the negative effects of emotional distress on school achievement (Pate, Maras, Whitney, & Bradshaw, 2017) and friendship and family support are associated with reduced subsequent depressive symptoms in at-risk adolescents (van Harmelen, Blakemore, Goodyer, & Kievit, 2021; van Harmelen et al., 2016) and lower incidence of self-harm (Klemera, Brooks, Chester, Magnusson, & Spencer, 2017). Similarly, social

support and belonging can buffer negative effects in adolescents who experience discrimination or exclusion (Arslan, 2018; Huynh & Gillen-O'Neel, 2016) and school connectedness mitigates the transmission of violence from home to school in adolescents who experience family violence (Valido et al., 2020).

Of course, not all peer environments are equally beneficial. Belonging to a peer group that engages in anti-social or illegal behaviour is a risk factor for engagement in a number of negative health risk behaviours, such as smoking and substance use (Fergusson, Swain-Campbell, & Horwood, 2002). By the same token, peer groups that adopt positive peer norms can lead to reduced engagement in health risk behaviours (Maxwell, 2002) and an increase in prosocial behaviour (van Hoorn, van Dijk, Meuwese, Rieffe, & Crone, 2016). This suggests that adolescents are highly sensitive to the values and norms of their social group. In the following section, we describe evidence that adolescents are particularly susceptible to influence from their peers.

Peer influence in adolescence

A large body of evidence has demonstrated that adolescents are particularly susceptible to peer influence. In a study investigating the role of social influence on risk perception, participants aged 8–59 years were asked to rate the riskiness of a series of everyday scenarios before being shown an average risk rating purportedly from groups of teenagers or adults, and then rating the scenario again. While all age groups showed significant social influence in that their risk ratings changed in the direction of the provided rating, social influence was highest in late childhood/early adolescence and gradually decreased with age. Furthermore, young adolescents (12–14 years) showed higher influence from other teenagers than from adults, and mid-adolescents (15–18 years) were highly influenced by both teenagers and adults. In contrast, children (8–11 years) and adults (over 18 years) were more influenced by adults than by teenagers (Knoll, Magis-Weinberg, Speekenbrink, & Blakemore, 2015). In a second study, we replicated the finding that young adolescents were more influenced by teenagers than by adults, and found that this was especially true when the provided rating from teenagers was *more risky* than the participants' initial rating (Knoll et al., 2017). We interpreted this as being due to stereotypes about adolescents as 'risk takers,' which generates expectations about the social norm of risk taking in this group. If an adolescent participant is presented with a risk rating from teenagers, who purportedly perceive a situation as higher risk than does the adolescent participant, then the participant might be more likely to modify their risk perception as this is not in line with their expectation of how someone from this group would have rated that scenario, compared with if teenagers had rated the risk lower than did the participant. If, on the contrary, the participant was presented with a rating from a group that they expect to be risk averse, they might not modify their behaviour when learning that this group rated the risk higher as they did (as this would be in line with their expectations). This fits with evidence that perceived peer norms are the most important factor predicting engagement in risky behaviours, and that adolescents perceived risk taking to be more normative than children or adults (Ciranka & van den Bos, 2021).

One task frequently used to assess risk taking tendencies in a laboratory setting is the Balloon Analogue Risk Task (BART) in which participants inflate a virtual balloon, with each pump translating to a monetary reward. However, with each pump the chance that the balloon will explode (and all money is lost) increases. The propensity to take risks on the BART, measured by the number of pumps made, is associated with a number of real-world adolescent risk behaviours, such as smoking and substance use (Lejuez et al., 2007; Lejuez, Aclin, Zvolensky, & Pedulla, 2003; Lejuez et al., 2002). In a social adaptation of the BART, information about peer choices impacted the number of risks taken by older adolescents (18–25 years), such that when other participants were perceived to be making high and low risky choices, individuals took more or fewer risks, respectively (Tomova & Pessoa, 2018). These findings corroborate other evidence suggesting that, when observing peers making safe, risk averse and prosocial decisions, adolescents are more likely to do so themselves (Braams, Davidow, & Somerville, 2019; Ciranka & van den Bos, 2019; Foulkes et al., 2018; van Hoorn et al., 2016).

Individual variation in neural sensitivity to social exclusion has also been implicated in peer influence on risk behaviours. For example, one study showed that adolescents (16–17 years) who show higher activity in the anterior cingulate cortex and anterior insula following social exclusion in the Cyberball task showed more risky behaviour in a subsequent driving simulator task when a peer was present (Falk et al., 2014). This suggests that adolescents who show higher activity in these regions when being excluded are more susceptible to peer influence. This is consistent with the finding that adolescents with higher rejection sensitivity report greater concern about taking social risks (Andrews, Foulkes, et al., 2020). It is important to note, that in other driving simulator studies (without social exclusion), increases in risk taking when peers were present were only observed when the peer was thought to endorse risk taking. When participants were explicitly told that the peer was risk-averse, the increase in risk taking was not observed (Bingham et al., 2016; Simons-Morton et al., 2014). Another fMRI study showed that 14–17-year-olds who had high resistance to peer influence (measured by the Resistance to Peer Influence scale (Steinberg & Monahan, 2007)) showed less engagement in risky behaviours after social exclusion and increased activity in lateral prefrontal cortex, a brain region related to self-regulation, when experiencing negative outcomes (crashes during the car driving task) in the presence of peers (Peake, Dishion, Stormshak, Moore, & Pfeifer, 2013). In contrast, participants with low resistance to peer influence engaged more in risky behaviours after social exclusion and showed increased activity in regions associated with social cognition (such as the right temporoparietal junction) while engaging in risky behaviours (Peake et al., 2013).

In sum, these data suggest that social connectedness is vital for healthy adolescent development and that disruptions in social connectedness (such as via peer exclusion) can increase avoidance of social risk taking, which in turn increases susceptibility to peer influence.

Prosocial influence in adolescence

Prosocial behaviour refers to decisions that are costly to oneself but beneficial to others. There is evidence showing that peers

influence prosocial decisions and positive behaviour in adolescence in similar ways as they influence risk taking. For example, the presence of peers was associated with increased monetary contributions by adolescents in a public goods game in which participants are able to decide whether they want to keep tokens for themselves or contribute them in a public pot (Van Hoorn, Crone, & Van Leijenhorst, 2017). Similarly, whether adolescents volunteer is influenced by whether their peers also volunteer (Choukas-Bradley, Giletta, Cohen, & Prinstein, 2015; Van Goethem, Van Hoof, Orobio de Castro, Van Aken, & Hart, 2014).

A study involving 755 participants aged 8–59 years showed that, compared with adults, adolescents were more likely to be influenced by others towards (hypothetical) prosocial behaviours, such as helping a neighbor (Foulkes et al., 2018). In a further study, we investigated antisocial and prosocial influence in 520 adolescent participants (Ahmed et al., 2020). We found that both prosocial influence (influence of others on prosocial behaviour, such as “helping a classmate with their work”) and antisocial influence (influence of others on antisocial behaviour, such as “making fun of a classmate”) decreased with age. Compared with older adolescents, younger adolescents were more influenced by other teenagers’ ratings when they were more prosocial and less antisocial than their own initial rating. This supports the notion that susceptibility to social influence does not temporarily peak in adolescence but gradually declines across this period of life. The results also suggest that younger adolescents are likely to be influenced in a positive way by their friends, not just in a negative way.

Adolescents who observed peers being generous are also more likely to be generous themselves, as found in incentivised charitable donation tasks (van Hoorn et al., 2016). In a recent study, we used an incentivised charitable donations task to investigate how decisions are revised after learning about the donations of others in 220 participants aged 11–35 years (Chierchia, Pi-Sunyer, & Blakemore, in press). Similar to the findings from studies on hypothetical prosocial influence, the probability of social influence decreased with age, with young adolescents being more socially influenced than adults. In addition, while previous research has suggested that adults are more likely to conform to selfish others than to prosocial others (‘opportunistic conformity’ (Charness, Naef, & Sontuoso, 2019; Croson & Shang, 2008; Dimant, 2019)), we observed no evidence of such an asymmetry in social influence in young to mid-adolescents. This suggests that the tendency to be selfish after seeing others acting in selfish ways might develop after early adolescence.

Conclusion

Adolescents are commonly viewed as risk takers. Here, we have reviewed evidence that adolescents tend to avoid risk taking when it comes to social risks, that is, the risk of being socially excluded by peers. Evidence suggests that social belonging is especially important during adolescence and that social exclusion and loneliness present tangible threats to mental health. Thus, avoiding social risks might be a sensible strategy for avoiding these threats. Indeed, many decisions adolescents make can be explained within the framework of peer norms. Adolescents are highly motivated to conform with the social norms of their peer group. For example, if they perceive their peer group norm to be one that endorses taking health risks, many adolescents become more prone to taking health risks when with their peers. However, peer susceptibility can also influence adolescents to become more prosocial if prosocial behaviour is perceived as the norm of their peer group. In sum, we suggest that adolescent behaviour is often motivated by the desire to avoid deviations from perceived peer group norms in order to avoid the risk of being social excluded. There is large individual variation in these effects and further research is needed to provide a deeper understanding of the factors underlying individual differences in the effects of peer susceptibility in adolescence.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

SJB is funded by Wellcome (grant number WT107496/Z/15/Z), the Jacobs Foundation, the Wellspring Foundation, the MRC and the University of Cambridge. LT is funded by the Cambridge Philosophical Society, University of Cambridge. JLA is funded by the MRC doctoral training programme at UCL. We thank E. Towner for comments and feedback on the manuscript.

References

- Ahmed, S., Foulkes, L., Leung, J. T., Griffin, C., Sakhardande, A., Bennett, M., ... Blakemore, S. J. (2020). Susceptibility to prosocial and antisocial influence in adolescence. *Journal of Adolescence*, *84*, 56–68. <https://doi.org/10.1016/j.adolescence.2020.07.012>
- Almqvist, Y. (2009). Peer status in school and adult disease risk: A 30-year follow-up study of disease-specific morbidity in a Stockholm cohort. *Journal of Epidemiology and Community Health*, *63*(12), 1028–1034.
- Andrews, J. L., Foulkes, L. E., Bone, J. K., & Blakemore, S.-J. (2020). Amplified concern for social risk in adolescence: Development and validation of a new measure. *Brain Sciences*, *10*(6), 397.
- Andrews, J. L., Mills, K. L., Flournoy, J. C., Flannery, J. E., Mobasser, A., Ross, G., ... Pfeifer, J. H. (2020). Expectations of social consequences impact anticipated involvement in health-risk behavior during adolescence. *Journal of Research on Adolescence*, *jora.12576*. <https://doi.org/10.1111/jora.12576>
- Arslan, G. (2018). Social exclusion, social support and psychological wellbeing at school: A study of mediation and moderation effect. *Child Indicators Research*, *11*(3), 897–918. <https://doi.org/10.1007/s12187-017-9451-1>
- Ayduk, O., Gyurak, A., & Luerssen, A. (2008). Individual differences in the rejection-aggression link in the hot sauce paradigm: The case of Rejection Sensitivity. *Journal of Experimental Social Psychology*, *44*(3), 775–782. <https://doi.org/10.1016/j.jesp.2007.07.004>

- Baumeister, R. F., DeWall, C. N., Ciarocco, N. J., & Twenge, J. M. (2005). Social exclusion impairs self-regulation. *Journal of Personality and Social Psychology*, 88(4), 589–604. <https://doi.org/10.1037/0022-3514.88.4.589>
- Benner, A. D. (2011). Latino adolescents' loneliness, academic performance, and the buffering nature of friendships. *Journal of Youth and Adolescence*, 40(5), 556–567.
- Bingham, C. R., Simons-Morton, B. G., Pradhan, A. K., Li, K., Almani, F., Falk, E. B., ... Albert, P. S. (2016). Peer passenger norms and pressure: Experimental effects on simulated driving among teenage males. *Transportation Research Part F: Traffic Psychology and Behaviour*, 41, 124–137. <https://doi.org/10.1016/j.trf.2016.06.007>
- Blakemore, S.-J. (2018). Avoiding social risk in adolescence. *Current Directions in Psychological Science*, 27(2), 116–122.
- Blakemore, S.-J., & Mills, K. L. (2014). Is adolescence a sensitive period for sociocultural processing? *Annual Review of Psychology*, 65(1), 187–207. <https://doi.org/10.1146/annurev-psych-010213-115202>
- Braams, B. R., Davidow, J. Y., & Somerville, L. H. (2019). Developmental patterns of change in the influence of safe and risky peer choices on risky decision-making. *Developmental Science*, 22(1), Article e12717. <https://doi.org/10.1111/desc.12717>
- Brooks, F. M., Magnusson, J., Spencer, N., & Morgan, A. (2012). Adolescent multiple risk behaviour: An asset approach to the role of family, school and community. *Journal of Public Health*, 34(SUPPL. 1), i48–i56. <https://doi.org/10.1093/pubmed/dfs001>
- Brown, B. B. (2013). Adolescents' relationships with peers. In R. M. Lerner & L. Steinberg (Eds.), *Handbook of Adolescent Psychology* (pp. 363–394).
- Burke, A. R., McCormick, C. M., Pellis, S. M., & Lukkes, J. L. (2017). Impact of adolescent social experiences on behavior and neural circuits implicated in mental illnesses. *Neuroscience and Biobehavioral Reviews*, 76(Pt B), 280–300. <https://doi.org/10.1016/j.neubiorev.2017.01.018>
- Burnett, S., Bault, N., Coricelli, G., & Blakemore, S.-J. (2010). Adolescents' heightened risk-seeking in a probabilistic gambling task. *Cognitive Development*, 25(2), 183–196. <https://doi.org/10.1016/j.cogdev.2009.11.003>
- Cacioppo, J. T., Hawkley, L. C., Norman, G. J., & Berntson, G. G. (2011). Social isolation. *Annals of the New York Academy of Sciences*, 1231(1), 17–22. <https://doi.org/10.1111/j.1749-6632.2011.06028.x>
- Cacioppo, S., Frum, C., Asp, E., Weiss, R. M., Lewis, J. W., & Cacioppo, J. T. (2013). A quantitative meta-analysis of functional imaging studies of social rejection. *Scientific Reports*, 3, 2027. <https://doi.org/10.1038/srep02027>
- Cascio, C. N., Carp, J., O'Donnell, M. B., Tinney, F. J., Jr., Bingham, C. R., Shope, J. T., ... Falk, E. B. (2015). Buffering social influence: Neural correlates of response inhibition predict driving safety in the presence of a peer. *Journal of Cognitive Neuroscience*, 27(1), 83–95. https://doi.org/10.1162/jocn_a_00693
- Charness, G., Naef, M., & Soutoouo, A. (2019). Opportunistic conformism. *Journal of Economic Theory*, 180, 100–134.
- Chein, J., Albert, D., O'Brien, L., Uckert, K., & Steinberg, L. (2011a). Peers increase adolescent risk taking by enhancing activity in the brain's reward circuitry. *Developmental Science*, 14(2), F1–F10.
- Chein, J., Albert, D., O'Brien, L., Uckert, K., & Steinberg, L. (2011b). Peers increase adolescent risk taking by enhancing activity in the brain's reward circuitry: Peer influence on risk taking. *Developmental Science*, 14(2), F1–F10. <https://doi.org/10.1111/j.1467-7687.2010.01035.x>
- Cheng, T. W., Vijayakumar, N., Flournoy, J. C., de Macks, Z. O., Peake, S. J., Flannery, J. E., ... Pfeifer, J. H. (2020). Feeling left out or just surprised? Neural correlates of social exclusion and overinclusion in adolescence. *Cognitive, Affective, & Behavioral Neuroscience*, 1–16.
- Chierchia, G., Pi-Sunyer, B. P., & Blakemore, S. J. (in press). Prosocial influence and opportunistic conformity in adolescents and young adults. *Psychological Science*.
- Choukas-Bradley, S., Giletta, M., Cohen, G. L., & Prinstein, M. J. (2015). Peer influence, peer status, and prosocial behavior: An experimental investigation of peer socialization of adolescents' intentions to volunteer. *Journal of Youth and Adolescence*, 44(12), 2197–2210. <https://doi.org/10.1007/s10964-015-0373-2>
- Ciranka, S., & van den Bos, W. (2019). Social influence in adolescent decision-making: A formal framework. *Frontiers in Psychology*, 10, 1915. <https://doi.org/10.3389/fpsyg.2019.01915>
- Ciranka, S., & van den Bos, W. (2021). Social norms in adolescent risk engagement and recommendation. *British Journal of Developmental Psychology*. <https://doi.org/10.1111/bjdp.12369>
- Crone, E. A., & Dahl, R. E. (2012). Understanding adolescence as a period of social-affective engagement and goal flexibility. *Nature Reviews Neuroscience*, 13(9), 636–650. <https://doi.org/10.1038/nrn3313>
- Crosen, R., & Shang, J. Y. (2008). The impact of downward social information on contribution decisions. *Experimental Economics*, 11(3), 221–233.
- Dalgleish, T., Walsh, N. D., Mobbs, D., Schweizer, S., van Harmelen, A.-L., Dunn, B., ... Stretton, J. (2017). Social pain and social gain in the adolescent brain: A common neural circuitry underlying both positive and negative social evaluation. *Scientific Reports*, 7(1), 42010. <https://doi.org/10.1038/srep42010>
- Defoe, I. N., Dubas, J. S., Figner, B., & Van Aken, M. A. (2015). A meta-analysis on age differences in risky decision making: Adolescents versus children and adults. *Psychological Bulletin*, 141(1), 48.
- DeWall, C. N., & Pond, R. S., Jr (2011). Loneliness and smoking: The costs of the desire to reconnect. *Self and Identity*, 10(3), 375–385. <https://doi.org/10.1080/15298868.2010.524404>
- Dewall, C. N., & Richman, S. B. (2011). Social exclusion and the desire to reconnect. *Social and Personality Psychology Compass*, 5(11), 919–932. <https://doi.org/10.1111/j.1751-9004.2011.00383.x>
- Dimant, E. (2019). Contagion of pro-and anti-social behavior among peers and the role of social proximity. *Journal of Economic Psychology*, 73, 66–88.
- Dishion, T. J., Pielhler, T. F., & Myers, M. W. (2008). Dynamics and ecology of adolescent peer influence. In *Understanding peer influence in children and adolescents* (pp. 72–93). New York, NY, US: The Guilford Press.
- Do, K. T., Guassi Moreira, J. F., & Telzer, E. H. (2017). But is helping you worth the risk? Defining Prosocial Risk Taking in adolescence. *Developmental Cognitive Neuroscience*, 25, 260–271. <https://doi.org/10.1016/j.dcn.2016.11.008>
- Doane, L. D., & Thurston, E. C. (2014). Associations among sleep, daily experiences, and loneliness in adolescence: Evidence of moderating and bidirectional pathways. *Journal of Adolescence*, 37(2), 145–154.
- Drake, E. C., Sladek, M. R., & Doane, L. D. (2016). Daily cortisol activity, loneliness, and coping efficacy in late adolescence: A longitudinal study of the transition to college. *International Journal of Behavioral Development*, 40(4), 334–345. <https://doi.org/10.1177/0165025415581914>
- Duell, N., Steinberg, L., Icenogle, G., Chein, J., Chaudhary, N., Di Giunta, L., ... Chang, L. (2018). Age patterns in risk taking across the world. *Journal of Youth and Adolescence*, 47(5), 1052–1072. <https://doi.org/10.1007/s10964-017-0752-y>
- Dyal, S. R., & Valente, T. W. (2015). A systematic review of loneliness and smoking: Small effects, big implications. *Substance Use and Misuse*, 50(13), 1697–1716. <https://doi.org/10.3109/10826084.2015.1027933>
- Eisenberger, N. I. (2012a). The neural bases of social pain: Evidence for shared representations with physical pain. *Psychosomatic Medicine*, 74(2), 126–135. <https://doi.org/10.1097/PSY.0b013e3182464dd1>
- Eisenberger, N. I. (2012b). The pain of social disconnection: Examining the shared neural underpinnings of physical and social pain. *Nature Reviews: Neuroscience*, 13(6), 421–434. <https://doi.org/10.1038/nrn3231>
- Eisenberger, N. I., Lieberman, M. D., & Williams, K. D. (2003). Does rejection hurt? An fMRI study of social exclusion. *Science*, 302(5643), 290–292. <https://doi.org/10.1126/science.1089134>
- Essau, C. A., de la Torre-Luque, A., Lewinsohn, P. M., & Rohde, P. (2020). Patterns, predictors, and outcome of the trajectories of depressive symptoms from adolescence to adulthood. *Depression and Anxiety*.
- Fales, J. L., & Noel, M. (2020). The effects of brief social exclusion on pain perception and pain memory in adolescents. *Journal of Adolescent Health*, 66(5), 623–625. <https://doi.org/10.1016/j.jadohealth.2020.01.018>
- Falk, E. B., Cascio, C. N., Brook O'Donnell, M., Carp, J., Tinney, F. J., Jr, Bingham, C. R., ... Simons-Morton, B. G. (2014). Neural responses to exclusion predict susceptibility to social influence. *Journal of Adolescent Health*, 54(5 SUPPL.), S22–S31. <https://doi.org/10.1016/j.jadohealth.2013.12.035>
- Fergusson, D. M., Swain-Campbell, N. R., & Horwood, L. J. (2002). Deviant peer affiliations, crime and substance use: A fixed effects regression analysis. *Journal of Abnormal Child Psychology*, 30(4), 419–430.
- Foulkes, L., & Blakemore, S. J. (2016). Is there heightened sensitivity to social reward in adolescence? *Current Opinion in Neurobiology*, 40, 81–85. <https://doi.org/10.1016/j.conb.2016.06.016>
- Foulkes, L., Leung, J. T., Fuhrmann, D., Knoll, L. J., & Blakemore, S.-J. (2018). Age differences in the prosocial influence effect. *Developmental Science*, 21(6). <https://doi.org/10.1111/desc.12666>. e12666-e12666.

- Frith, C. D., & Frith, U. (2007). Social cognition in humans. *Current Biology*, 17(16), R724–R732. <https://doi.org/10.1016/j.cub.2007.05.068>
- Fuhrmann, D., Casey, C. S., Speekenbrink, M., & Blakemore, S.-J. (2019). Social exclusion affects working memory performance in young adolescent girls. *Developmental Cognitive Neuroscience*, 40, Article 100718.
- Gardner, M., & Steinberg, L. (2005). Peer influence on risk taking, risk preference, and risky decision making in adolescence and adulthood: An experimental study. *Developmental Psychology*, 41(4), 625–635. <https://doi.org/10.1037/0012-1649.41.4.625>
- Goosby, B. J., Bellatorre, A., Walsemann, K. M., & Cheadle, J. E. (2013). Adolescent loneliness and health in early adulthood. *Sociological Inquiry*, 83(4). <https://doi.org/10.1111/soin.12018>
- Hammond, C. (2019). Who feels lonely? The results of the world's largest loneliness study. Retrieved from <https://www.bbc.co.uk/programmes/articles/2yzhfv4DvqVp5nZyxBD8G23/who-feels-lonely-the-results-of-the-world-s-largest-loneliness-study>.
- Hartgerink, C. H. J., van Beest, I., Wicherts, J. M., & Williams, K. D. (2015). The ordinal effects of ostracism: A meta-analysis of 120 cyberball studies. *PLoS One*, 10(5), Article e0127002. <https://doi.org/10.1371/journal.pone.0127002>
- Hawley, L. C., & Cacioppo, J. T. (2010). Loneliness matters: A theoretical and empirical review of consequences and mechanisms. *Annals of Behavioral Medicine*, 40(2), 218–227. <https://doi.org/10.1007/s12160-010-9210-8>
- Heinrich, L. M., & Gullone, E. (2006). The clinical significance of loneliness: A literature review. *Clinical Psychology Review*, 26(6), 695–718.
- Huynh, V. W., & Gillen-O'Neil, C. (2016). Discrimination and sleep: The protective role of school belonging. *Youth and Society*, 48(5), 649–672. <https://doi.org/10.1177/0044118X13506720>
- Kessler, R. C., Petukhova, M., Sampson, N. A., Zaslavsky, A. M., & Wittchen, H.-U. (2012). Twelve-month and lifetime prevalence and lifetime morbid risk of anxiety and mood disorders in the United States. *International Journal of Methods in Psychiatric Research*, 21(3), 169–184. <https://doi.org/10.1002/mpr.1359>
- Klemera, E., Brooks, F. M., Chester, K. L., Magnusson, J., & Spencer, N. (2017). Self-harm in adolescence: Protective health assets in the family, school and community. *International Journal of Public Health*, 62(6), 631–638. <https://doi.org/10.1007/s00038-016-0900-2>
- Knoll, L. J., Leung, J. T., Foulkes, L., & Blakemore, S.-J. (2017). Age-related differences in social influence on risk perception depend on the direction of influence. *Journal of Adolescence*, 60, 53–63. <https://doi.org/10.1016/j.jad.2017.07.002>
- Knoll, L. J., Magis-Weinberg, L., Speekenbrink, M., & Blakemore, S.-J. (2015). Social influence on risk perception during adolescence. *Psychological Science*, 26(5), 583–592. <https://doi.org/10.1177/0956797615569578>
- Lam, C. B., McHale, S. M., & Crouter, A. C. (2014). Time with peers from middle childhood to late adolescence: Developmental course and adjustment correlates. *Child Development*, 85(4), 1677–1693.
- Lasgaard, M., Goossens, L., & Elklit, A. (2011). Loneliness, depressive symptomatology, and suicide ideation in adolescence: Cross-sectional and longitudinal analyses. *Journal of Abnormal Child Psychology*, 39(1), 137–150.
- Leary, M. R. (2005). Varieties of interpersonal rejection. In *The social outcast: Ostracism, social exclusion, rejection, and bullying* (pp. 35–51). New York, NY, US: Psychology Press.
- Lejuez, C. W., Aklin, W., Daughters, S., Zvolensky, M., Kahler, C., & Gwadz, M. (2007). Reliability and validity of the youth version of the Balloon Analogue Risk Task (BART-Y) in the assessment of risk-taking behavior among inner-city adolescents. *Journal of Clinical Child and Adolescent Psychology*, 36(1), 106–111. <https://doi.org/10.1080/15374410709336573>
- Lejuez, C. W., Aklin, W. M., Zvolensky, M. J., & Pedulla, C. M. (2003). Evaluation of the Balloon Analogue Risk Task (BART) as a predictor of adolescent real-world risk-taking behaviours. *Journal of Adolescence*, 26(4), 475–479.
- Lejuez, C. W., Read, J. P., Kahler, C. W., Richards, J. B., Ramsey, S. E., Stuart, G. L., ... Brown, R. A. (2002). Evaluation of a behavioral measure of risk taking: The Balloon Analogue Risk Task (BART). *Journal of Experimental Psychology: Applied*, 8(2), 75–84.
- Lorenz, C., & Kray, J. (2019). Are mid-adolescents prone to risky decisions? The influence of task setting and individual differences in temperament. *Frontiers in Psychology*, 10(1497). <https://doi.org/10.3389/fpsyg.2019.01497>
- Lundborg, P. (2006). Having the wrong friends? Peer effects in adolescent substance use. *Journal of Health Economics*, 25(2), 214–233.
- Maner, J. K., DeWall, C. N., Baumeister, R. F., & Schaller, M. (2007). Does social exclusion motivate interpersonal reconnection? *Journal of Personality and Social Psychology*, 92(1), 42–55. <https://doi.org/10.1037/0022-3514.92.1.42>
- Maxwell, K. A. (2002). Friends: The role of peer influence across adolescent risk behaviors. *Journal of Youth and Adolescence*, 31(4), 267–277. <https://doi.org/10.1023/A:1015493316865>
- McDonald, R. I., & Crandall, C. S. (2015). Social norms and social influence. *Current Opinion in Behavioral Sciences*, 3, 147–151. <https://doi.org/10.1016/j.cobeha.2015.04.006>
- McKay, M. T., Konowalczyk, S., Andretta, J. R., & Cole, J. C. (2017). The direct and indirect effect of loneliness on the development of adolescent alcohol use in the United Kingdom. *Addictive Behaviors Reports*, 6, 65–70. <https://doi.org/10.1016/j.abrep.2017.07.003>
- Molden, D. C., Lucas, G. M., Gardner, W. L., Dean, K., & Knowles, M. L. (2009). Motivations for prevention or promotion following social exclusion: Being rejected versus being ignored. *Journal of Personality and Social Psychology*, 96(2), 415–431. <https://doi.org/10.1037/a0012958>
- Nakagawa, S., Takeuchi, H., Taki, Y., Nouchi, R., Sekiguchi, A., Kotozaki, Y., ... Kawashima, R. (2015). White matter structures associated with loneliness in young adults. *Scientific Reports*, 5(1), 17001. <https://doi.org/10.1038/srep17001>
- Orben, A., Tomova, L., & Blakemore, S.-J. (2020). The effects of social deprivation on adolescent development and mental health. *The Lancet Child & Adolescent Health*, 4(8), 634–640. [https://doi.org/10.1016/S2352-4642\(20\)30186-3](https://doi.org/10.1016/S2352-4642(20)30186-3)
- Park, E., McCoy, T. P., Erausquin, J. T., & Bartlett, R. (2018). Trajectories of risk behaviors across adolescence and young adulthood: The role of race and ethnicity. *Addictive Behaviors*, 76, 1–7. <https://doi.org/10.1016/j.addbeh.2017.07.014>
- Pate, C. M., Maras, M. A., Whitney, S. D., & Bradshaw, C. P. (2017). Exploring psychosocial mechanisms and interactions: Links between adolescent emotional distress, school connectedness, and educational achievement. *School Mental Health*, 9(1), 28–43. <https://doi.org/10.1007/s12310-016-9202-3>
- Patton, G. C., Sawyer, S. M., Santelli, J. S., Ross, D. A., Afifi, R., Allen, N. B., ... Viner, R. M. (2016). Our future: A Lancet commission on adolescent health and well-being. *The Lancet*, 387(10036), 2423–2478. [https://doi.org/10.1016/S0140-6736\(16\)00579-1](https://doi.org/10.1016/S0140-6736(16)00579-1)
- Peake, S. J., Dishion, T. J., Stormshak, E. A., Moore, W. E., & Pfeifer, J. H. (2013). Risk-taking and social exclusion in adolescence: Neural mechanisms underlying peer influences on decision-making. *NeuroImage*, 82, 23–34. <https://doi.org/10.1016/j.neuroimage.2013.05.061>
- Peeters, M., Oldehinkel, A., Veenstra, R., & Vollebergh, W. (2019). Unique developmental trajectories of risk behaviors in adolescence and associated outcomes in young adulthood. *PLoS One*, 14(11). <https://doi.org/10.1371/journal.pone.0225088>. e0225088–e0225088.
- Pfeifer, J. H., & Berkman, E. T. (2018). The development of self and identity in adolescence: Neural evidence and implications for a value-based choice perspective on motivated behavior. *Child Development Perspectives*, 12(3), 158–164. <https://doi.org/10.1111/cdep.12279>
- Prinstein, M. J., Brechwald, W. A., & Cohen, G. L. (2011). Susceptibility to peer influence: Using a performance-based measure to identify adolescent males at heightened risk for deviant peer socialization. *Developmental Psychology*, 47(4), 1167–1172. <https://doi.org/10.1037/a0023274>
- Resnick, M. D., Harris, L. J., & Blum, R. W. (1993). The impact of caring and connectedness on adolescent health and well-being. *Journal of Paediatrics and Child Health*, 29, S3–S9. <https://doi.org/10.1111/j.1440-1754.1993.tb02257.x>
- Romer, D., Reyna, V. F., & Satterthwaite, T. D. (2017). Beyond stereotypes of adolescent risk taking: Placing the adolescent brain in developmental context. *Developmental Cognitive Neuroscience*, 27, 19–34. <https://doi.org/10.1016/j.dcn.2017.07.007>
- Sawyer, S. M., Azzopardi, P. S., Wickremarathne, D., & Patton, G. C. (2018). The age of adolescence. *The Lancet Child & Adolescent Health*, 2(3), 223–228. [https://doi.org/10.1016/S2352-4642\(18\)30022-1](https://doi.org/10.1016/S2352-4642(18)30022-1)
- Schachter, S. (1951). Deviation, rejection, and communication. *Journal of Abnormal Psychology*, 46(2), 190–207. <https://doi.org/10.1037/h0062326>
- Schinka, K. C., VanDulmen, M. H., Bossarte, R., & Swahn, M. (2012). Association between loneliness and suicidality during middle childhood and adolescence: Longitudinal effects and the role of demographic characteristics. *The Journal of Psychology*, 146(1–2), 105–118.
- Sebastian, C., Viding, E., Williams, K. D., & Blakemore, S.-J. (2010). Social brain development and the affective consequences of ostracism in adolescence. *Brain and Cognition*, 72(1), 134–145. <https://doi.org/10.1016/j.bandc.2009.06.008>

- Simons-Morton, B. G., Bingham, C. R., Falk, E. B., Li, K., Pradhan, A. K., Ouimet, M. C., ... Shope, J. T. (2014). Experimental effects of injunctive norms on simulated risky driving among teenage males. *Health Psychology, 33*(7), 616.
- Sippola, L., & Bukowski, W. (1999). Self, other, and loneliness from a developmental perspective. In D. K. J. Rotenberg, & S. Hymel (Eds.), *Loneliness in childhood and adolescence* (pp. 280–295). New York: Cambridge University Press.
- Siva, N. (2020). Loneliness in children and young people in the UK. *The Lancet. Child & Adolescent Health, 4*(8), 567.
- Smart Richman, L., & Leary, M. R. (2009). Reactions to discrimination, stigmatization, ostracism, and other forms of interpersonal rejection: A multimotive model. *Psychological Review, 116*(2), 365.
- Spear, L. P. (2011). Rewards, aversions and affect in adolescence: Emerging convergences across laboratory animal and human data. *Developmental Cognitive Neuroscience, 1*(4), 390–403. <https://doi.org/10.1016/j.dcn.2011.08.001>
- Steinberg, L., & Monahan, K. C. (2007). Age differences in resistance to peer influence. *Developmental Psychology, 43*(6), 1531–1543. <https://doi.org/10.1037/0012-1649.43.6.1531>
- Tian, Y., Liang, S., Yuan, Z., Chen, S., Xu, P., & Yao, D. (2014). White matter structure in loneliness: Preliminary findings from diffusion tensor imaging. *Neuroreport, 25*(11), 843–847. <https://doi.org/10.1097/WNR.0000000000000197>
- Tomova, L., & Pessoa, L. (2018). Information about peer choices shapes human risky decision-making. *Scientific Reports, 8*(1), 5129. <https://doi.org/10.1038/s41598-018-23455-7>
- Tomova, L., Wang, K., Thompson, T., Matthews, G., Takahashi, A., Tye, K., & Saxe, R. (2020). Acute social isolation causes midbrain craving responses similar to hunger. *Nature Neuroscience, 23*, 1597–1605.
- Twenge, J. M., & Baumeister, R. F. (2004). Social exclusion increases aggression and self-defeating behavior while reducing intelligent thought and prosocial behaviour. In *Social psychology of inclusion and exclusion* (pp. 45–64). Psychology Press.
- Twenge, J. M., Catanese, K. R., & Baumeister, R. F. (2002). Social exclusion causes self-defeating behavior. *Journal of Personality and Social Psychology, 83*(3), 606–615. <https://doi.org/10.1037/0022-3514.83.3.606>
- Valido, A., Ingram, K., Espelage, D. L., Torgal, C., Merrin, G. J., & Davis, J. P. (2020). Intra-familial violence and peer aggression among early adolescents: Moderating role of school sense of belonging. *Journal of Family Violence, 35*(1), 1–12. <https://doi.org/10.1007/s10896-020-00142-8>
- van der Aar, L. P. E., Peters, S., & Crone, E. A. (2018). The development of self-views across adolescence: Investigating self-descriptions with and without social comparison using a novel experimental paradigm. *Cognitive Development, 48*, 256–270. <https://doi.org/10.1016/j.cogdev.2018.10.001>
- Van Goethem, A., Van Hoof, A., Orobio de Castro, B., Van Aken, M., & Hart, D. (2014). The role of reflection in the effects of community service on adolescent development: A meta-analysis. *Child Development, 85*(6), 2114–2130.
- van Harmelen, A. L., Blakemore, S. J., Goodyer, I. M., & Kievit, R. A. (2021). The interplay between adolescent friendship quality and resilient functioning following childhood and adolescent adversity. *Adversity and Resilience Science, 2*(1), 37–50. <https://doi.org/10.1007/s42844-020-00027-1>
- van Harmelen, A. L., Gibson, J. L., St Clair, M. C., Owens, M., Brodbeck, J., Dunn, V., ... Goodyer, I. M. (2016). Friendships and family support reduce subsequent depressive symptoms in at-risk adolescents. *PLoS One, 11*(5). <https://doi.org/10.1371/journal.pone.0153715>
- Van Harmelen, A. L., Kievit, R. A., Ioannidis, K., Neufeld, S., Jones, P. B., Bullmore, E., ... Goodyer, I. (2017). Adolescent friendships predict later resilient functioning across psychosocial domains in a healthy community cohort. *Psychological Medicine, 47*(13), 2312–2322. <https://doi.org/10.1017/S0033291717000836>
- Van Hoorn, J., Crone, E. A., & Van Leijenhorst, L. (2017). Hanging out with the right crowd: Peer influence on risk-taking behavior in adolescence. *Journal of Research on Adolescence, 27*(1), 189–200. <https://doi.org/10.1111/jora.12265>
- van Hoorn, J., van Dijk, E., Meuwese, R., Rieffe, C., & Crone, E. A. (2016). Peer influence on prosocial behavior in adolescence. *Journal of Research on Adolescence, 26*(1), 90–100.
- Vijayakumar, N., Cheng, T. W., & Pfeifer, J. H. (2017). Neural correlates of social exclusion across ages: A coordinate-based meta-analysis of functional MRI studies. *Neuroimage, 153*, 359–368.
- Zheleznyakova, Y. (2020). Psychological factors of adolescents disposition towards addictive behavior. *International Journal of Psychosocial Rehabilitation, 24*(8), 11014–11024. <https://doi.org/10.37200/IJPR/V24I8/PR281088>