EMPIRICAL RESEARCH

Social Media Use Subgroups Differentially Predict Psychosocial Well-Being During Early Adolescence

Anna Vannucci [1] · Christine McCauley Ohannessian[1,2]

Abstract

Despite the salience of the social media context to psychosocial development, little is known about social media use patterns and how they relate to psychological and social functioning over time during early adolescence. This longitudinal study, therefore, identified subgroups of early adolescents based on their social media use and examined whether these subgroups predicted psychosocial functioning. Adolescents ($N = 1205$; 11–14 years; 51% female; 51% white) completed surveys at baseline and a six-month follow-up. There were three social media use subgroups at baseline: high overall social media use (8%); high Instagram/Snapchat use (53%); and low overall social media use (39%). The high social media use subgroup predicted higher depressive symptoms, panic disorder symptoms, delinquent behaviors, family conflict, as well as lower family and friend support, than the High-Instagram/Snapchat and low social media use subgroups. The high Instagram/Snapchat use subgroup predicted higher delinquent behaviors and school avoidance than the low social media use subgroup, but also higher close friendship competence and friend support as compared to both the high social media use and low social media use subgroups. Social media use patterns appear to differentially predict psychosocial adjustment during early adolescence, with high social media use being the most problematic and patterns of high Instagram/Snapchat use and low social media use having distinct developmental tradeoffs.

Keywords Social media · Adolescence · Internalizing problems · Externalizing problems · Social functioning

Introduction

The transition to adolescence is characterized by marked increases in developmental plasticity as a result of the considerable changes that take place within individuals and their contexts. At the individual level, pubertal onset initiates substantial hormonal shifts and alterations to brain structure and function that underlie increases in reactivity and sensitivity to environmental stimuli, particularly social stimuli, which allows for vast learning and psychosocial development to take place (Tottenham and Galván 2016). Despite advances in autonomy, identity formation, and coping skills that occur

during early adolescence (~11- to 14-years-old) (Arnett 2014; Zimmer-Gembeck and Collins 2008; Zimmer-Gembeck and Skinner 2011), executive functioning capabilities have yet to mature due to the protracted development of prefrontal cortical brain regions relative to socio-emotional salience regions (Casey 2015; Shulman et al. 2016). At the contextual level, peer relationships become increasingly important and central to self-evaluations, family relationships realign as adolescents strive for independence, the school environment becomes larger and more complex, and social media is introduced (Eccles and Roeser 2011; Gerwin et al. 2018; Nelson et al. 2016; Shifflet-Chila et al. 2016). For some early adolescents, negotiating so much change in such a short period of time is challenging, especially given the imbalance between enhanced socio-environmental sensitivity and immature executive functioning (Casey 2015; Shulman et al. 2016). As such, early adolescence is characterized by a marked increase in internalizing and externalizing problems (McLaughlin and King 2015; Miech et al. 2017; Petersen et al. 2015; Tottenham and Galván 2016).

Social media has become a salient developmental context for adolescents, who are often referred to as "screenagers"

✉ Anna Vannucci
  AVannucci@Connecticutchildrens.org

1 Center for Behavioral Health Research, Connecticut Children's Medical Center, 282 Washington Street, Hartford, CT 06106, USA

2 Department of Pediatrics and Psychiatry, University of Connecticut School of Medicine, 263 Farmington Avenue, Farmington, CT 06030, USA

(Pew Research Center 2018a). Social media refers to interactive websites or internet applications ("apps") that allow users to generate and share content with others, create personalized profiles, and develop online social networks (Obar and Wildman 2015). Social media is nearly ubiquitous among U.S. adolescents, with 97% using at least one social media platform (Pew Research Center 2018a). Adolescents also devote large amounts of time to social media (nearly 3 h per day, on average), confirming its significance (Barry et al. 2017). Social media likely plays an important role in the lives of *early* adolescents due to the salience of identity exploration, autonomy, friendships, and peer acceptance during this developmental stage (Gerwin et al. 2018). Yet, little is known about social media use patterns or the relationship between social media use and psychosocial functioning among early adolescents because prior studies largely have focused on youth in high school or college (Carvalho et al. 2015; Pew Research Center 2018a; Seabrook et al. 2016). However, social media use and its impact on development may differ across adolescence due to prolonged developmental plasticity stemming from continuous contextual shifts and biological changes (Gerwin et al. 2018). Elucidating social media use patterns and their relationship to psychosocial development during early adolescence, therefore, may have important implications for theory, practice, and policy.

Social Media Use Patterns During Adolescence

Social media platforms have a wide range of purposes and usage options, ranging from text-based platforms that focus on the exchange of information (e.g., Twitter) and image-centric platforms that focus on sharing videos and photos (e.g., Instagram, Snapchat) to platforms that encompass a wide variety of usage capabilities (e.g., Facebook; McFarland and Ployhart 2015). Uses and gratifications theories (Katz et al. 1973; Sundar and Limperos 2013) propose that individuals are driven to use different social media platforms to satisfy their diverse needs. For adolescents, such needs may include identity expression, social connection, surveillance, social status pursuits, information seeking or sharing, escape, and entertainment (Sundar and Limperos 2013). Early adolescents' varied needs coupled with the increasing number of social media platforms may have contributed to changes in social media use in recent years. Facebook use has declined as only about half of 13- to 17-year olds use the platform according to a recent U.S. survey (Pew Research Center 2018a). Adolescents report waning enthusiasm for Facebook because of the high number of adults that use Facebook and frequent "drama" (Pew Research Center 2018a). In contrast, the proportion of adolescents using Twitter has remained stable (32%), and Instagram and Snapchat use has increased to 72 and 69% of

13- to 17-year olds, respectively (Pew Research Center 2018a). Consistent with uses and gratification theories (Katz et al. 1973; Sundar and Limperos 2013), adolescents report gravitating towards Twitter, Instagram, Snapchat, Tumblr, and discussion boards because these platforms better fill their needs for self-expression, social support, and privacy from adults (Gerwin et al. 2018). These trends may be amplified among early adolescents.

Adolescents typically compartmentalize various social media platforms for specific purposes and maintain multiple social media accounts (Gerwin et al. 2018), which also aligns with uses and gratifications theories (Katz et al. 1973; Sundar and Limperos 2013). On average, adolescents report using three different social media platforms, with some using as many as eight different platforms daily (Barry et al. 2017). There likely is significant inter-individual variability in social media use patterns among early adolescents based on the extent to which they use multiple different social media platforms. However, research has been dominated by descriptions of overall social media use across an entire sample, as described previously (Barry et al. 2017; Pew Research Center 2018a), rather than examinations focused on adolescent subgroups that differ based on their social media use patterns.

Only three known studies have investigated subgroups of collective social media patterns based on differences in social media use frequency, specific platforms, and/or the number of platforms used among emerging adults (Hargittai and Hsieh 2010; Scott et al. 2017; Yang and Lee 2018). Two similar subgroups were found in studies identifying subgroups based solely on social media use frequency and the number of platforms used (Hargittai and Hsieh 2010; Scott et al. 2017), including "samplers" who occasionally used a couple of platforms and "omnivores" who often used most social media platforms. In addition, one study identified subgroups of "dabblers" who occasionally used only one social media platform and "devotees" who often used only one platform (Hargittai and Hsieh 2010). These subgroups did not differ on academic achievement (Hargittai and Hsieh 2010). Finally, four social media use subgroups were identified in a small sample of undergraduate social media users, including: (1) "browsers" who were distinguished by their frequent passive viewing of content across Facebook, Twitter, and Instagram; (2) high Facebook and Instagram, but low Twitter, users; (3) low Instagram posters who frequently engaged in all other forms of social media activity; and (4) a "platform differentiated" group of users who were highly engaged in Instagram, followed by Twitter and then Facebook the least frequently (Yang and Lee 2018). The two social media use patterns distinguished by high Instagram use had the highest levels of social adjustment, whereas the "omnivores" (frequent engagement across all three social media platforms) had the poorest

social adjustment (Yang and Lee 2018). These findings suggest that it is useful to characterize social media use patterns by identifying differences in time spent using social media, number of social media platforms used, and type of platform used among subgroups of individuals. The lack of consistency in study findings likely stems from several sources, such as the social media use assessment and statistical method of identifying subgroups. Furthermore, it seems unlikely that the subgroups would be fully replicated in early adolescents due to their different developmental tasks and priorities from emerging adults (Gerwin et al. 2018; Sundar and Limperos 2013). Critically, it remains unknown as to how subgroups of youth may differ in their social media use patterns according to frequency, platform number(s), and platform type. Such information would provide greater understanding of how early adolescents use social media and what platforms are embedded in early adolescents' daily lives.

Social Media Use and Psychosocial Functioning

Considerable debate and disagreement exist regarding whether social media use has a beneficial or harmful impact on psychosocial functioning during adolescence. Existing theories and literature suggest a complex relationship (Gerwin et al. 2018). Adolescents also acknowledge the mixed effects of social media. According to a recent survey in 13- to 17- year olds (Pew Research Center 2018a), 31% perceived that social media had a mostly positive impact, 24% thought that social media had a mostly negative impact, and 45% believed that social media had neither a positive nor negative impact on their lives.

Internalizing problems

A variety of mechanisms have been proposed to account for why social media use may increase risk for internalizing problems, including anxiety and depressive symptoms. According to the displacement hypothesis (Kraut et al. 1998), frequent social media use degrades emotional well-being because this sedentary activity replaces time that could otherwise be spent on protective, health-promoting behaviors such as physical activity, educational and extra-curricular activities, and in-person social interactions. Social media creates a context of public social commentary and selective self-presentations of idealized selves, which is proposed by the hyperpersonal model of online communication to cause rapid shifts in self-evaluations in response to frequent social media feedback that intensify adolescents' self-focus and concerns with identity formation and peer acceptance (Shapiro and Margolin 2014). Building upon the hyperpersonal model (Shapiro and Margolin 2014) and interpersonal theories of depression (Rudolph et al. 2008),

the transformation framework (Nesi et al. 2018b) proposes that features of the social media context, such as the public social commentary and quantifiable nature of the social feedback, facilitate maladaptive interpersonal behaviors and coping strategies among adolescents with these intensified identity and peer acceptance concerns that contribute to negative self-evaluations and worsening negative mood, including excessive interpersonal feedback seeking, upward social comparisons, rumination, and co-rumination (Nesi and Prinstein 2015). Consistent with stress exposure and generation models (Hankin et al. 2007; Hammen 2006), internalizing problems also may be elicited by social media use as a result of increased fears related to negative evaluations and missing out on activities with others, negative social interactions (e.g., public online drama, cyberbullying), and exposure to the stressors of others (Glover and Fritsch 2017). Systematic reviews of adolescent and adult studies suggest mixed support for the relationship between social media use and internalizing symptoms (Seabrook et al. 2016). These equivocal findings may stem from assessing overall social media use rather than comparing subgroups of adolescents that have common social media use patterns across different platforms. It is also possible that the relationship between social media use and internalizing problems is more robust among early adolescents, for whom identity development and peer acceptance issues are of utmost importance (Gerwin et al. 2018). Indeed, recent studies that include early adolescents (in addition to middle-to-late adolescents) have found that more time spent using social media was associated with elevated internalizing problems (Nesi et al. 2017).

Externalizing problems

Several models stemming from social learning (Bandura 1977) and social contagion (Wheeler 1966) theories have been put forth to propose mechanisms that link social media use to risk for externalizing problems, including delinquent behaviors. In general, these models hypothesize that the social media context amplifies peer influence processes that affect adolescents' cognitions and behaviors. Social network contagion theory (Scherer and Cho 2003) proposes that interactions among individuals and the resulting social networks influence individual perceptions and construct communities who share and develop similar risk perceptions, who then imitate behaviors perceived as being valued or rewarded. Social media use and the resulting online communities, therefore, are theorized to expose adolescents to pro-externalizing behavior attitudes via positive portrayals of delinquent acts in content posted by peers and other valued persons. Although adolescents primarily post positive, non-deviant content on social media (Pew Research Center 2018b), delinquent acts posted by a

minority of social media influencers and popular peers is proposed by the transformation framework to have greater reach, desirability, and influence in the social media context due to the publicness, widespread availability, and quantifiable reinforcement of this content (Nesi et al. 2018b). This social media-driven exposure, in turn, is hypothesized to influence adolescents' favorable attitudes toward externalizing behaviors and perceptions that these behaviors are normative and desirable by valued others. Adolescents then engage in externalizing behaviors purportedly to imitate or conform to the social norms of valued or high-status individuals, receive social reinforcement, and foster a positive social identity. According to "super peer" theory (Strasburger 2007), media (vs. in person interactions) acts as a "super peer" by exerting an especially profound influence and inordinate pressure on adolescents to engage in risky behaviors that are depicted as normative. Furthermore, according to the transformation framework (Nesi et al. 2018b), the social media context, in particular, has been proposed to amplify these peer influence mechanisms relative to traditional media or offline contexts as a result of an increased volume of content portraying externalizing behaviors, the quantifiable reinforcement for externalizing behaviors in the form of peer "likes" and comments, and exposure to a wider network of individuals outside of immediate peer groups. There is a paucity of social media literature focused on delinquent behaviors. Initial studies suggest that more time spent using social media was associated with higher levels of antisocial personality disorder symptoms in emerging adults (Galica et al. 2017). Research is needed in this area during early adolescence.

Social functioning

Opposing theories have been put forth to describe the consequences of social media use on social functioning, as the social media context transforms relationship processes in complex ways. According to the stimulation hypothesis (Valkenburg and Peter 2011), social media use enhances the quality of adolescents' relationships by encouraging self-disclosure and maintaining connections with existing friends and family. Conversely, the displacement hypothesis (Kraut et al. 1998) suggests that social media use hinders relationships because it displaces meaningful, in-person connections in lieu of more superficial, low quality communication and ultimately leads to social isolation and a breakdown in social support. According to one online communication framework attempting to reconcile these contrasting hypotheses (Subrahmanyam and Greenfield 2008), the impact of social media use may depend on the relationship type, such that social media use enhances adolescents' friendships at the expense of interfering with family relationships. The extant literature generally

supports this latter integrated online communication framework.

Social media use by adolescents has become a significant aspect of family life and has changed the nature of family functioning. A majority of adolescents perceive that the use of electronic communication technologies, such as texting, video chats, and phone calls, helps to keep in touch with family members regardless of geographical distance and facilitates greater perceived family cohesion, connectedness, and support (Carvalho et al. 2015; Pew Research Center 2018a; Rideout 2012). Parents of adolescents also often report that family social media use allows them to be more involved with their children's lives and improves parent-child communication (Dworkin et al. 2018). However, family conflict also may increase as a result of the intergenerational tension between youth, who use social media extensively and perceive it as a valid extension of the physical world, and their parents, who tend to be less knowledgeable or wary about social media and worry for their children's safety online (Carvalho et al. 2015; Dworkin et al. 2018). Indeed, parents of adolescents also report having frequent arguments with their child about monitoring social media activities, disruption of family events due to their child's relentless social media communication, and having a limited ability to be supportive and deal with the negative consequences of their child's social media use (Dworkin et al. 2018). Cross-sectional research focusing solely on social media, as opposed to general electronically-mediated communication, suggests that more time spent using social media by adolescents is associated with more frequent parent-child conflicts, greater interference with family activities, less perceived parental support, and greater isolation among family members (Carvalho et al. 2015; Dworkin et al. 2018; O'Keeffe 2016; Padilla-Walker et al. 2012; Shapiro and Margolin 2014). However, findings among emerging adults tend to find that social media use is related to better family functioning, and therefore it has been suggested that this association may change with the stage of the family life cycle (Carvalho et al. 2015). Early adolescence may be a developmental period in which frequent social media use leads to poorer family functioning because parents lose control of their child's virtual interactions and families are in the initial stages of negotiating social media boundaries.

In contrast to the potential deleterious impact of social media use on family functioning during early adolescence, recent findings suggest that social media use may yield positive benefits for friendships and social competence despite potential exposure to interpersonal stressors. Although social media use has been linked to increased risk for online victimization (Nesi et al. 2018b), the vast majority of adolescents report that social media use helps them to feel more connected to friends (81%) and feel

supported by friends and other peers during tough times (68%) (Pew Research Center 2018b). Indeed, more time spent using social media is associated with higher concurrent levels of friendship quality and intimacy, perceived friend support, belongingness, and social self-esteem in adolescents (Uhls et al. 2017). According to the transformation framework, the social media context also affords adolescents the opportunity to practice some core skills involved in forming and maintaining friendships, such as self-disclosure, text-based and visual communication, initiating "online exclusive" friendships, and providing support via online posts and direct messages (Nesi et al. 2018a). As such, it is conceivable that adolescents' competence in managing friendships may improve as a result of social media use.

Other Aspects of Social Media Use: Number and Type of Platforms

The vast majority of social media theory and research has focused on the overall time spent using social media platforms. Yet, emerging theories suggest that the *number* and the *type* of social media platforms used also are salient factors to consider when understanding how social media usage patterns impact psychosocial functioning.

Number of platforms

According to the "technology overload" hypothesis (Lee et al. 2016), the frequent use of multiple social media platforms exacerbates stress and emotional suffering, also referred to as "social media fatigue" (Dhir et al. 2018), as a result of failing to meet unrealistic expectations that individuals need to check for updates and respond in a timely manner, as well as maintain personal accounts with novel content. Moreover, being bombarded with an array of information from numerous social media platforms has been proposed to result in cognitive fatigue, decreased attentional and inhibitory control, and multitasking problems that impair individuals' ability to exert self-regulation over emotions and behaviors (Lee et al. 2016). The behavioral and emotional dysregulation resulting from this technology, information, and communication overload is hypothesized to lead to poor psychological functioning and impairment in interpersonal relationships. Initial research supports this theory, as general media multitasking has been linked to anxiety, depression, family conflict, and low social success with peers in adolescents (van Der Schuur et al. 2015). In the only two known studies focused on social media, late adolescents and young adults who used a greater number of social media platforms on a daily basis reported higher concurrent levels of anxiety, depressive symptoms, alcohol use, and illicit drug use, above and beyond the effects of the overall time spent using social media (Primack et al. 2017; Vannucci et al. 2018). It is possible that the impact of using multiple social media platforms on psychosocial functioning may be stronger for early adolescents because they have limited cognitive control abilities due to an immature prefrontal cortex (Caballero et al. 2016).

Type of platform

An affordances framework with a developmental perspective may be useful for conceptualizing how key attributes of social media platforms differentially influence psychosocial functioning during adolescence because social media platforms have a vast array of usage features and are undergoing constant evolution (Boyd 2010; Karahanna et al. 2018; Moreno and Uhls 2019). Affordances are "design aspects of objects that suggest to the user how the object should be used" (Zhao et al. 2013, p. 289). A combination of perceived and actual affordances of social media platforms are designed to attract certain types of users and trigger different behaviors by providing users with strong clues about how each platform should be used and the developmental needs that can be fulfilled (Boyd 2010; Karahanna et al. 2018; Moreno and Uhls 2019). According to the developmental affordances framework (Moreno and Uhls 2019), categories of affordances that apply to social media use during adolescence include: (1) *social affordances* that influence social connectedness, social interactions, and metavoicing to a broad context (e.g., hashtags, comments, direct messages, video chats, publicness of posts); (2) *identity affordances* that influence identity exploration and expression (e.g., profiles, sharing life events, privacy); (3) *emotional affordances* that generate emotional reactions and social comparisons (e.g., "likes" or "dislikes", "upvoting" or "downvoting", favorite function); (4) *cognitive affordances* that impact information seeking and sharing, allocation of cognitive resources, and triggered attending to content updates (e.g., customizability of content, text-based and visual communication tools, automated alerts); and (5) *functional affordances* related to content replicability, scalability, searchability, and permanence as well as communication synchronicity and composition time (e.g., retweets, autodelete function, editing and removal capabilities).

According to the developmental affordances framework of social media (Moreno and Uhls 2019), perceived and actual affordances of social media platforms are hypothesized to influence psychological and social functioning by promoting and constraining certain cognitions, emotions, and behaviors. Yet, little is known about how different social media platforms may be differentially related to domains of psychosocial functioning, and few studies apply an affordances framework.

Two studies of late adolescents and young adults comparing social media platforms in relation to their psychosocial correlates lend preliminary support for the developmental affordances framework (Pittman and Reich 2016; Vannucci et al. 2018). Findings from these studies suggest that Facebook use is uniquely associated with depressive symptoms, Snapchat use with substance use, and Snapchat and Instagram use with less loneliness. Facebook may be closely linked to internalizing problems because the high identity, social interactivity, emotion, content visibility and permanence, and prompted attending affordances may trigger misinterpretation of social cues, increased online "drama" and stress, and upward social comparisons (Pew Research Center 2013; Utz et al. 2015). Although Facebook's friendship model and high social affordances may satisfy developmental needs for connectedness and belonging, this platform may thwart early adolescents' autonomy and authentic identity expression and cause difficulties in family relationships because youth are prompted to befriend parents and other family members who limit privacy. By contrast, the high social interactivity, identity, emotion, and visual content affordances but greater privacy and autonomy affordances provided by Instagram, Snapchat, Google +, and pin boards are hypothesized to foster identity formation, creative self-expression, friendships, peer connections, and social competence (Shapiro and Margolin 2014; Wang et al. 2016; Zawawi et al. 2017). Social media platforms with low content visibility and/or permanence but high social interactivity and information sharing affordances, such as Snapchat, Tumblr, and discussion boards, encourage authentic self-disclosure and identity exploration; however, these affordances also may lead early adolescents to take on riskier roles that promote externalizing problems such as peer aggression, trolling, and engaging in delinquent acts (Moreno and Uhls 2019; Renninger 2015). Social media platforms with low identity affordances, including Tumblr and discussion boards, also may facilitate risk for externalizing problems in a similar manner (Moreno and Uhls 2019). Twitter use may not exert a strong impact on psychosocial problems due to Twitter's unique combination of affordances in high social connectedness, metavoicing, information sharing, and content scalability and permanence, but low identity and social interactivity. Overall, initial data and theory suggest that each social media platform has a unique constellation of affordances that may lead to differential psychosocial outcomes. Moving forward, it is important to consider the type of social media platform and their affordances when examining the impact of social media use patterns on psychosocial functioning during early adolescence.

The Present Study

It is crucial to understand social media use patterns and their impact on psychosocial functioning during early adolescence. Notably, the vast majority of prior research has focused on the overall time spent using social media and concurrent psychosocial correlates in cross-sectional designs among middle-to-late adolescents and college students. As such, little is known about social media use during *early* adolescence, despite the likely importance of the social media context at this age in which identity exploration, peer acceptance, and friendships become central to values and daily functioning (Gerwin et al. 2018). In addition, there are likely inter-individual differences in social media use patterns that vary based on the time spent using social media, the number of platforms used, and the type of social media platforms used. Identifying such subgroups of early adolescents and then evaluating whether these subgroups predict distinct aspects of psychosocial functioning is vital to optimizing development. It is crucial to examine multiple aspects of positive and negative psychosocial functioning to elucidate the complex influence of social media use patterns on development. Finally, longitudinal studies are sorely needed to clarify whether social media use patterns confer long-term risk or resilience for psychopathology and social problems. Addressing these knowledge gaps have the potential to provide needed specificity to the multitude of social media use theories, identify social media use patterns that contribute to poor psychosocial adjustment and positive psychosocial development, and suggest areas of focus for prevention programs, clinical practice, and policy.

The primary objectives of the current longitudinal study, therefore, are to: (1) identify subgroups of early adolescents based on their time spent using a variety of social media platforms; and (2) examine whether social media subgroup membership predicts psychosocial functioning six months later in a diverse community sample of early adolescents (11- to 14-years). Based on uses and gratifications theories (Katz et al. 1973; Sundar and Limperos 2013) and initial studies in emerging adults (Hargittai and Hsieh 2010; Scott et al. 2017; Yang and Lee 2018), it was hypothesized that at least three social media use subgroups would be identified using latent profile analysis. It was expected that the subgroups would distinguished by: (1) infrequent social media use across most platforms (e.g., "dabblers", "samplers"); (2) frequent, daily use of solely Instagram and Snapchat in light of research demonstrating the popularity of these platforms among adolescents (e.g., "devotees", platform-differentiated users) (Pew Research Center 2018a); and (3) frequent, daily-to-hourly social media use across most platforms (e.g., "omnivores").

With regard to the second study objective, it was hypothesized that psychosocial outcomes of membership in high social media use subgroup would align most closely with the displacement hypothesis (Kraut et al. 1998) and the technology overload hypothesis (Lee et al. 2016). It was expected, therefore, that membership in the high social media use subgroup would predict widespread psychosocial adjustment problems, including higher follow-up levels of internalizing and externalizing problems and poorer peer and family functioning, relative to the other social media subgroups. By contrast, the developmental affordances framework of social media (Moreno and Uhls 2019) is likely especially relevant when conceptualizing the relationship between membership in the high Instagram and Snapchat subgroup and psychosocial outcomes. Given that adolescents use Instagram and Snapchat primarily for social connection with peers (Pew Research Center 2018b), it was expected that membership in the high Instagram and Snapchat subgroup would predict higher follow-up levels of competence within close friendships and perceived friend support relative to the high and low social media use subgroups. According to the transformation framework (Nesi et al. 2018b), the developmental affordances framework (Moreno and Uhls 2019), and related theories (Boyd 2010; Karahanna et al. 2018; Shapiro and Margolin 2014; Strasburger 2007), the unique features and affordances of Instagram and Snapchat (e.g., high social interactivity and content visibility to peers, high emotional reactions, public social commentary, quantifiable feedback from others, inescapability) intensifies adolescents' peer acceptance concerns and exacerbates adolescents' tendencies toward negative self-evaluations, maladaptive interpersonal behaviors, and positive perceptions of risky behavior. As such, it also was hypothesized that membership in the high Instagram and Snapchat group would predict higher levels of internalizing and externalizing problems relative to the low social media use subgroup. Finally, in line with the integrated framework of online communication (Subrahmanyam and Greenfield 2008), displacement hypothesis (Kraut et al. 1998), and technology overload hypothesis (Lee et al. 2016), the low social media use subgroup was hypothesized to predict the highest family functioning and lowest risk for internalizing and externalizing problems.

Method

Participants

Adolescents enrolled full-time in the 7th and 8th grades from public middle schools in the New England region of the U.S. during the 2016–2017 academic year were eligible to participate in the study. Adolescents who could not comprehend any survey items as a result of a teacher-reported severe developmental disorder or due to limited English language skills were excluded during the assent process (1%). The sample was comprised of 1,205 adolescent girls and boys (51% girls) who were between the ages of 11 and 14 years ($M_{age} = 12.73$, $SD = 0.69$). The race/ethnicity composition was: 51% Non-Hispanic White, 21% Hispanic/Latinx, 9% Black/African American, 3% Asian, 15% Multi-Racial/Ethnic, and 1% other. Adolescents reported a wide range of values with regard to their family's perceived socioeconomic status ($M = 5.10$, $SD = 1.48$; range = 0–9) using a widely used measure that converges with other socioeconomic status indicators (Goodman et al. 2001). The sample composition for adolescents' perceived socioeconomic status was: 4% for scores of 0–2 (lowest third of possible scores), 30% for scores of 3–4 (below average), 29% for scores of 5 (average), 33% for scores of 6–7 (above average), and 4% for scores of 8–9 (highest possible scores). Adolescents reported their parents' highest level of educational attainment as being: less than high school for 6% of mothers and 6% of fathers; high school or GED for 32% of mothers and 39% of fathers; two years of college or trade school for 14% of mothers and 16% of fathers; four years of college for 28% of mothers and 25% of fathers; and graduate, medical, or law school for 20% of mothers and 14% of fathers. The demographic composition of participants were comparable to the broader communities from which they were recruited (U.S. Census Bureau 2016).

Procedures

In the Fall of 2016, 7th and 8th grade students enrolled full-time at five public middle schools located in Connecticut and central Massachusetts ($N = 1589$) were invited to participate in a longitudinal study investigating risk and protective factors for internalizing symptoms (Vannucci and Ohannessian 2018a; pandaresearchproject.org). Parents were mailed a letter inviting their child to participate in the study. Informed parental consent was obtained passively, such that parents who did not want their adolescent(s) to participate in the study contacted the research team directly (2%; $N = 27$). Adolescents provided written assent prior to data collection in the fall of 2016 ($N = 1,344$). Among adolescents with parental consent, those who did not provide their assent to participate were either absent on the day of data collection ($n = 102$), declined to participate ($n = 108$), or were excluded ($n = 8$). Data collection occurred in schools during the fall of 2016 (T1) and six months later, during the spring of 2017 (T2). Trained research personnel administered the surveys, which took ~60 min to complete. Among the 1,205 adolescents who were included in this

study at T1, there was 88% participant retention at T2 (n = 1,060). Attrition resulted from adolescents transferring out of the school district (n = 18), being absent on the day of data collection (n = 56), and declining follow-up participation (n = 71). At each time point, participants received a movie pass as compensation for completing the survey. Study procedures were approved by the Connecticut Children's Institutional Review Board.

Measures

Social media use

The Technology Use Questionnaire (TUQ; Ohannessian 2009) assessed adolescents' social media use. Adolescents were asked to rate how often they used a range of social media platforms on a typical day. Response options included: 0 = *never*, 1 = *less than once a week*, 2 = *once a week*, 3 = *several times a week*, 4 = *once a day*, 5 = *several times a day*, 6 = *once an hour*, 7 = *several times an hour*, and 8 = *almost constantly*. The TUQ was adapted to include contemporary social media platforms previously assessed in studies of adolescent social media use patterns implemented by the Pew Research Center (2018a), including Discussion Boards, Facebook, Google +, Instagram, Pin Boards, Snapchat, Tumblr, and Twitter. In addition, the total number of platforms used was calculated by coding each social media platform as either 0 = *never used* and 1 = *used at least once or more*, and then summing these usage scores. Finally, adolescents were asked to report how much time, overall, they spend using social media platforms on a typical day (in hours). Similar social media use metrics have demonstrated convergent validity with psychological well-being in adolescents (Vannucci et al. 2018).

Anxiety disorder symptoms

The Screen for Childhood Anxiety Related Disorders (SCARED; Birmaher et al. 1999) assessed adolescents' facets of anxiety disorder symptoms. Adolescents were asked to rate how true 41 statements were for them over the past three months (sample item: "I am nervous"), with responses ranging from 0 = *not true or hardly ever true* to 2 = *very true or often true*. The five SCARED subscales were utilized, which assessed symptoms of generalized anxiety disorder (9 items), panic disorder (13 items), separation anxiety disorder (8 items), significant school avoidance (4 items), and social anxiety disorder (7 items). Item responses were summed to generate subscale scores, with higher scores indicating greater anxiety symptoms. The SCARED has demonstrated good reliability and validity in adolescents (Muris et al. 2002). In this sample,

the SCARED subscales had excellent internal consistency at T1 (α = 0.70–0.89) and T2 (α = 0.74–0.92).

Delinquent behaviors

The Problem Behaviors Scale (PBS; Gault-Sherman 2013; Prinstein et al. 2001) assessed adolescents' delinquent behaviors. Adolescents were asked to report how frequently they engaged in 17 delinquent behaviors in the past 6 months (sample items: starting physical fights, skipping school, stealing). The response scale ranged from 0 = *never* to 5 = *about once a week or more*. A mean PBS total score was generated. Higher scores indicated more frequent engagement in delinquent behaviors (range = 0–5). The PBS has demonstrated good reliability and validity in community samples of adolescents (Gault-Sherman 2013; Prinstein et al. 2001). The PBS total score had excellent internal consistency at T1 (α = 0.95) and T2 (α = 0.96) in this sample.

Depressive symptoms

The Center for Epidemiological Studies Depression Scale for Children (CES-DC; Weissman et al. 1980) assessed adolescents' depressive symptoms in the past week. Adolescents were asked to rate how frequently they experienced 20 symptoms (sample item: "I feel sad"), with responses ranging from 0 = *not at all* to 3 = *a lot*. Responses were summed to generate a total score, with higher scores indicating greater depressive symptoms (range = 0–60). The CES-DC has good psychometric properties in adolescents (Faulstich et al. 1986). The CES-DC total score had excellent internal consistency at T1 and T2 (αs = 0.91) for this sample.

Family conflict

The Family Conflict Scale (FCS; Herrenkohl et al. 2009) assessed the degree of conflict within adolescents' families. Adolescents were asked to rate the frequency with which family members typically argue, are critical of each other, and yell at each other, with responses ranging from 0 = *almost never* to 4 = *almost always*. A mean total score was generated, with higher scores indicating greater family conflict (range = 0–4). The FCS has demonstrated good reliability and convergent validity with internalizing symptoms among adolescents (Herrenkohl et al. 2009). In this sample, the FCS had good internal consistency at T1 (α = 0.85) and at T2 (α = 0.87).

Close friend competence

The Self-Perception Profile for Adolescents, Revised Question Format (SPPA-R; Wichstraum 1995) assessed

perceived self-competence in forming and maintaining close friendships. Adolescents were asked to rate how well 5 statements described them (sample item: "I am able to make really close friends"). Responses ranged from $1 =$ *describes me very poorly* to $4 =$ *describes me very well*. The scale was generated by averaging the item responses, with higher scores indicating better competence (range = 1–4). The SPPA-R has demonstrated good psychometric properties in adolescents (Wichstraum 1995). The SPPA-R close friendship competence subscale had acceptable internal consistency at T1 ($\alpha = 0.70$) and T2 ($\alpha = 0.75$) for this sample.

Social support

The Multidimensional Scale of Perceived Social Support (MSPSS; Zimet et al. 1988) assessed adolescents' perceptions of support from family and friends. Adolescents were asked to rate how much they agreed with 8 items (sample item: "I get the emotional help and support I need from my family"). Responses ranged from $1 =$ *very strongly disagree* to $7 =$ *very strong agree*. The MSPSS family and friends subscales were generated by averaging the four items for each scale, with higher scores indicating more perceived support (range = 1–7). The MSPSS has very good psychometric properties in adolescents (Canty-Mitchell and Zimet 2000). Both subscales had excellent internal consistency at T1 ($\alpha s = 0.90$–0.91) and T2 ($\alpha s = 0.92$–0.94).

Analytic Plan

Data screening

The distributions of the variables were inspected. The delinquent behaviors total score was positively skewed at T1 and T2. As such, logarithmic transformations were applied to achieve normal distributions. Following these transformations, all continuous variables exhibited satisfactory skew (< 2.0) and kurtosis (< 10.0), and no outliers ($M \pm 3\,SD$) were identified.

Social media subgroups

Latent profile analysis (LPA; Lazarsfeld and Henry 1968) was performed with Mplus 8.0 (Muthen and Muthen 1998–2017) to identify and characterize latent subgroups/classes of early adolescents based on their social media use patterns at T1. Indicators of latent profile analysis classes included the eight continuous T1 social media use variables (Facebook, Discussion Boards, Google +, Instagram, Pinboards, Snapchat, Tumblr, Twitter). Latent profile analysis models with between one to six latent classes were estimated. The indicator means were freely estimated across

latent classes, whereas the variance estimates were estimated but constrained to be equal across classes. Latent profile analysis models did not converge when attempting to freely estimate variances across classes. All models were estimated with 500 random initial start values and 50 optimizations to avoid solutions that represented local rather than global maxima. Examination of bivariate residuals indicated that the conditional independence assumption of latent profile analysis was met, as all values for the preferred latent profile analysis model were less than 3.00 and not statistically significant based on the Chi-Square test with one degree of freedom ($ps > 0.05$). Several indicators of model fit were considered when selecting the preferred number of latent social media use subgroups/classes (Nylund et al. 2007).[1]

Psychosocial outcomes

Following the identification of the preferred latent profile analysis model, the relationship between T1 social media use subgroup/class membership and T2 psychosocial outcomes were examined. The modified correction method of Bolck et al. (2004; BCH method) was applied to the non-inclusive classify-analyze (i.e., standard three-step) approach for estimating the associations between class membership and continuous psychosocial distal outcomes. First, the preferred latent profile analysis model was estimated. Second, participants were assigned to a latent class on the basis of posterior probabilities obtained from the latent profile analysis estimation in step one (i.e., assigned to a class for which the probability of membership is the largest), creating a "most likely class" variable. The BCH method also estimated participants' classification uncertainty for each latent class at this time, rather than treating class membership as if it is certain and observed as does the standard three-step approach. Finally, in the third step, the most likely class variable was used as the primary indicator variable, and the classification uncertainty rates were fixed at the probabilities obtained in step two in a general auxiliary model. Class-specific intercepts were generated for the distal outcome in a latent class auxiliary regression model, which represented the influence of the latent class indicator on the distal outcome. The BCH method protected the formation of latent classes from the influence of other variables in the model while also accounting for classification uncertainty when generating parameter estimates (Bolck et al. 2004).

---

[1] The most parsimonious number of latent classes was evaluated by examining the following fit indices: the Bayesian information criterion (BIC), the sample size adjusted BIC (aBIC), the consistent Akaike information criterion (cAIC), and the Lo-Mendell-Rubin likelihood ratio-based test (LMR-LRT). Classification accuracy also was examined using the entropy value and the average posterior probabilities.

The manual version of the BCH method in Mplus 8.0 (Muthen and Muthen 1998–2017) was used in the current study to allow for the inclusion of T1 covariates when examining the relationship between latent social media use subgroup/class membership at T1 and psychosocial outcomes at T2 (Asparouhov and Muthén 2014). These models estimated class-specific intercepts for the T2 psychosocial outcome, which represent the influence of the T1 social media use subgroup variable on the T2 psychosocial outcomes while controlling for the effect of T1 covariates. T1 covariates in all models included age (years), gender (coded as girls or boys), race/ethnicity (coded as non-Hispanic White or other), perceived socioeconomic status, and value of the T2 psychosocial outcome being examined (e.g., T1 depressive symptoms was included in the model examining whether social media use subgroup membership predicted T2 depressive symptoms). Each of the demographic covariates was selected because they have been related to systematic differences in social media use (Pew Research Center 2018a). The T2 dependent variables included the measures of internalizing problems, externalizing problems, and social functioning. When omnibus Wald χ^2 tests were statistically significant ($ps < 0.05$), Benjamini–Hochberg corrections were applied when examining pair-wise differences among latent social media use subgroups/classes. As such, the p value threshold for determining significant subgroup differences was 0.01.

Missing data

The amount of missing data across variables ranged from 0–13%. Little's missing completely at random (MCAR) test using the expectation-maximization (EM) estimation method was statistically significant, $\chi^2(203) = 268.74$, $p = 0.001$, suggesting that the data were not missing completely at random. Follow-up evaluations of missing data patterns indicated that there only was one pattern consisting of jointly missing data that accounted for greater than two percent of participants: adolescents who were missing all data at T2.[2] Missing data were handled using full information maximum-likelihood (FIML) estimation with robust standard errors (Wothke 2000). Notably, FIML utilizes all available data to yield unbiased parameter estimates under both data missing at random (MAR) and data missing completely at random (MCAR) assumptions (Wothke 2000).

Results

The early adolescent participants, on average, reported using social media for nearly 3 h each day ($M = 2.70$, $SD = 3.18$) and using approximately three different social media platforms ($M = 3.03$, $SD = 1.93$). The sample prevalence of each social media platform was: 73% Instagram, 70% Snapchat, 41% Google +, 27% Facebook, 26% Twitter, 21% Pin Boards 20% Discussion Boards, and 14% Tumblr. Table 1 depicts the bivariate correlations among study variables. Age was significantly and positively correlated with time spent using social media daily, the total number of different social media platforms used, and the use of Facebook, Instagram, Snapchat, and Twitter ($rs = 0.06–0.16$, $ps < 0.05$). Perceived socioeconomic status was unrelated to social media use measures ($rs = −0.03–0.05$, $ps > 0.05$).

As shown in Table 2, a number of gender and racial/ethnic differences in social media use were observed at T1. Relative to boys, girls spent more hours using social media each day, used more different types of social media platforms, and more frequently used Instagram, Snapchat, and Pin Boards ($ps < 0.05$). However, boys reported more frequent use of Twitter and Discussion Boards ($ps < 0.05$). There were no gender differences in the use of Facebook, Tumblr, or Google + ($ps > 0.05$). There were no racial/ethnic differences in the overall time spent using social media or number of platforms used ($ps > 0.05$). However, Hispanic/Latinx adolescents reported using Facebook more frequently than non-Hispanic White, Black, and Multi-Racial/Ethnic adolescents ($p < 0.001$). In addition, adolescents identifying as Hispanic/Latinx, Black, or Multi-Racial/Ethnic reported more frequent use of Pin Boards and Discussion Boards than White adolescents ($ps < 0.01$). Hispanic/Latinx and Multi-Racial/Ethnic adolescents also reported using Tumblr more frequently than non-Hispanic White and Black adolescents ($ps < 0.01$). No racial/ethnic differences were found for the use of Instagram, Snapchat, Twitter, Tumblr, or Google + ($ps > 0.05$).

Identification of Latent Social Media Subgroups

Table 3 depicts the fit indices for latent profile analysis models estimated. The information-based fit indices did not converge around a particular solution. However, findings from the LMR-LRT suggested that the presence of a three- or four-class solution, as both solutions provided significantly superior fits than the solutions with one fewer classes estimated ($ps < 0.05$). A five-class solution did not

---

[2] There were no differences in T1 race/ethnicity, perceived socioeconomic status, social media use, and psychosocial variables when comparing adolescents who participated in both T1 and T2 with those who did not participate in T2 ($ps > 0.05$). There were small differences with regard to age and gender ($ps < 0.05$). Adolescents who completed both surveys were younger (Completed T1 and T2: $M_{age} = 12.73$, $SD = 0.67$ vs. Missing T2: $M_{age} = 12.95$, $SD = 0.78$; $d = 0.30$) and more likely to be girls than boys (Completed T1 and T2: 57% girls vs. Missing T2: 51% girls; $\phi = 0.08$).

Table 1 Bivariate correlations among continuous study variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Age	–	-0.01	0.15	0.07	0.06	0.04	0.01	-0.04	0.05	0.01	0.01	0.04	0.11	0.08	-0.08	-0.08	-0.08
2. Socioeconomic status	-0.01	–	-0.05	0.02	0.06	0.04	-0.01	0.01	0.02	-0.01	-0.12	-0.15	-0.03	-0.15	0.14	0.07	-0.01
3. Facebook	0.16	-0.01	–	0.21	0.18	0.17	0.18	0.16	0.20	0.16	0.11	0.13	0.24	0.09	-0.10	-0.06	-0.09
4. Instagram	0.10	0.05	0.18	–	0.69	0.30	0.01	0.14	0.07	0.16	0.04	0.08	0.19	0.08	-0.07	0.14	0.11
5. Snapchat	0.09	0.05	0.19	0.69	–	0.22	-0.01	0.09	0.03	0.12	0.02	0.06	-0.06	0.09	-0.04	0.16	0.13
6. Twitter	0.06	0.02	0.34	0.31	0.24	–	0.11	0.40	0.26	0.25	0.01	0.07	0.19	0.03	-0.03	0.03	0.02
7. Google+	-0.01	-0.02	0.32	0.11	0.09	0.22	–	0.22	0.22	0.15	0.10	0.11	0.14	0.04	-0.03	-0.04	-0.07
8. Tumblr	0.04	0.01	0.31	0.22	0.19	0.52	0.27	–	0.29	0.32	0.15	0.17	0.18	0.08	-0.10	-0.10	-0.11
9. Discussion boards	0.05	-0.03	0.31	0.17	0.16	0.35	0.29	0.40	–	0.39	0.09	0.16	0.21	0.08	-0.10	-0.07	-0.10
10. Pin boards	0.01	-0.03	0.29	0.18	0.16	0.32	0.19	0.41	0.54	–	0.14	0.08	0.12	0.02	0.01	0.05	0.05
11. Anxiety symptoms	0.02	-0.12	0.05	0.01	0.02	0.02	0.05	0.12	0.02	0.14	–	0.65	0.23	0.29	-0.21	-0.12	-0.05
12. Depressive symptoms	0.06	-0.19	0.13	0.09	0.08	0.05	0.08	0.14	0.09	0.17	0.66	–	0.30	0.39	-0.42	-0.24	-0.18
13. Delinquent behaviors	0.17	-0.03	0.26	0.17	0.11	0.21	0.18	0.21	0.21	0.16	0.18	0.27	–	0.37	-0.31	-0.12	-0.18
14. Family conflict	0.06	-0.13	0.06	0.16	0.13	0.03	0.05	0.06	0.07	0.01	0.25	0.36	0.33	–	-0.47	-0.16	-0.17
15. Family support	-0.09	0.17	-0.11	-0.09	-0.05	-0.07	-0.04	-0.10	-0.12	-0.05	-0.20	-0.40	-0.28	-0.37	–	0.28	0.50
16. Friend competence	-0.05	0.12	-0.08	0.14	0.21	-0.03	-0.05	-0.06	-0.06	0.04	-0.14	-0.26	-0.11	-0.11	0.25	–	0.56
17. Friend support	-0.05	0.05	-0.07	0.05	0.14	-0.08	-0.07	-0.06	-0.11	0.04	-0.09	-0.22	-0.15	-0.13	0.46	0.57	–

Pearson bivariate correlation (r) values ≥ |0.06| were statistically significant (ps < 0.05). Correlations among Time 1 (T1) continuous study variables are presented on the bottom half of the table, and correlations among Time 2 (T2) continuous study variables are presented on the top half of the table.

provide a superior fit to the four-class solution. Inspection of both the three- and four-class solutions suggested that the additional fourth class was very small and conceptually redundant to one of the other three classes. As such, the three-class solution was selected as the preferred model. The entropy was excellent (0.93) for the three-class solution. The average posterior probabilities for most likely class membership ranged between 0.97–0.98, also suggesting excellent classification accuracy.

As illustrated in Fig. 1, the three latent social media use subgroups/classes at T1 were distinguished by: (1) frequent, daily overall social media use across platforms (high social media use subgroup; $n = 89$; 8%); (2) hourly use of Instagram and Snapchat use only, with low use of all other social media platforms (high Instagram/Snapchat use subgroup; $n = 642$; 53%); and (3) relatively infrequent (less than once daily) use of all social media platforms (low social media use subgroup; $n = 474$; 39%). Notably, early adolescents in the high Instagram/Snapchat use subgroup reported using these platforms at the same, hourly frequency as early adolescents in the high social media use subgroup (ps > 0.05), indicating that the primary difference between these groups of the daily use of numerous other social media platforms among those in the high social media use subgroup.

Figure 2 depicts the results of social media use subgroup comparisons on social media use frequency across platforms when assigning adolescents to subgroups on the basis on the highest posterior probability. Adolescents in the high social media use subgroup reported using Facebook, Google+, Tumblr, discussion boards, and pin boards more frequently than those in the high Instagram/Snapchat use and low social media use subgroups (ps < 0.001), which did not differ from each other (ps > 0.05). Adolescents in the high social media use and high Instagram/Snapchat use subgroups reported comparable levels of Snapchat use (p > 0.05), who reported significantly more frequent Snapchat use as compared to adolescents in the low social media use subgroup (ps < 0.001). Finally, adolescents in the high social media use subgroup reported using Instagram and Twitter the most frequently, followed by adolescents in the high Instagram/ Snapchat use subgroup (ps < 0.01); adolescents in the low social media use subgroup used Instagram and Twitter the least frequently (ps < 0.001). However, it is notable that the differences were small when comparing Instagram use frequency between the high social media use and high Instagram/Snapchat use subgroup and when comparing Twitter use frequency between the high Instagram/Snapchat use and low social media use subgroups (ds = 0.34–0.38). By contrast, all other significant subgroups differences were large (ds = 0.95–4.61).

To further facilitate interpretation of the classes, social media use subgroups were compared on the number of hours spent using social media on a daily basis. Adolescents

Table 2 Social media use at Time 1 (T1) by gender and race/ethnicity

Social media use variable	Gender		Race/ethnicity			
	Girls ($n = 615$) M (SD)	Boys ($n = 590$) M (SD)	White ($n = 616$) M (SD)	Black ($n = 113$) M (SD)	Hispanic ($n = 256$) M (SD)	Multi-Racial ($n = 184$) M (SD)
Social media (hours)	3.14[a] (3.32)	2.26[b] (2.97)	2.48 (2.82)	3.46 (4.96)	2.95 (3.04)	3.06 (3.49)
Social media platforms (#)	3.23[a] (1.75)	2.81[b] (2.07)	2.83 (1.70)	3.03 (2.03)	3.34 (2.20)	3.40 (2.20)
Facebook	1.00 (2.10)	0.97 (2.07)	0.61[a] (1.44)	1.03[a] (1.90)	1.96[b] (1.90)	1.16[a] (2.32)
Instagram	4.23[a] (2.92)	3.40[b] (2.95)	3.85 (2.81)	3.57 (3.10)	3.68 (3.21)	4.10 (3.06)
Snapchat	4.82[a] (3.06)	3.31[b] (3.11)	4.03 (3.11)	4.07 (3.33)	4.12 (3.25)	4.43 (3.24)
Twitter	0.70[a] (1.69)	0.92[b] (1.91)	0.69 (1.39)	0.50 (1.39)	1.07 (2.08)	1.09 (2.20)
Google+	1.51 (2.31)	1.63 (2.45)	1.33 (2.14)	1.58 (2.50)	2.02 (2.80)	1.82 (2.44)
Tumblr	0.66 (1.82)	0.47 (1.58)	0.38[a] (1.37)	0.44[a] (1.39)	0.84[b] (1.56)	1.05[b] (1.36)
Pin boards	1.28[a] (2.02)	0.62[b] (1.69)	0.75[a] (1.59)	1.41[b] (1.92)	1.30[b] (2.36)	1.43[b] (2.27)
Discussion boards	0.63[a] (1.72)	0.87[b] (1.92)	0.45[a] (1.37)	1.06[b] (2.14)	1.26[b] (2.40)	0.95[b] (2.07)

Subscripts that differ represent statistically significant differences between groups using a Bonferroni–Hochberg post-hoc test. Adolescents identifying as Asian or other ($n = 36$) were not included in race/ethnicity comparisons due to the small sample size

Table 3 Fit indices for the latent profile analysis of social media use subgroups

Latent Classes	Parameters	LL	BIC	aBIC	cAIC	LMR-LRT	Entropy
1	16	−20890.80	41895.11	41844.29	41911.11	–	1.00
2	25	−19644.09	39465.53	39386.12	39490.53	2454.98***	0.99
3	34	−19134.26	38509.73	38401.73	38543.73	1003.93***	0.93
4	43	−18498.09	37301.24	37164.65	37344.24	926.32***	0.94
5	52	−18153.52	36675.94	36510.77	36727.94	678.52	0.94
6	61	−17849.41	36131.57	35937.81	36192.57	600.47	0.95

BIC = Bayesian Information Criterion; cAIC = Consistent Akaike Information Criterion; LL = Log-likelihood; LMR-LRT = Lo–Mendell–Rubin Likelihood Ratio Test; Lower BIC, aBIC, and cAIC values indicated better model fit. LMR-LRT p values < 0.05 indicated that the k-class solution was a superior fit compared to a $k−1$ class solution. Entropy provided a measure of classification accuracy, with higher values closer to 1.00 indicating better accuracy

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

in the high social media use subgroup reported spending significantly more time using social media ($M = 4.70$, $SD = 4.58$) than adolescents who were in the high Instagram/Snapchat use subgroup ($M = 3.58$, $SD = 3.28$), and both reported more daily time spent using social media than the low social media use subgroup ($M = 1.15$, $SD = 1.76$), $F(2, 1203) = 115.72$, $p < .001$. The magnitude of the difference between the high social media use and high Instagram/Snapchat use subgroups was small ($d = 0.28$). Yet, large effect sizes were identified for comparisons with the low social media use subgroup ($ds = 0.92$–1.02).

Demographic Associations with Social Media Use Subgroups

Table 4 presents the associations between T1 demographic characteristics and the likelihood of membership in the latent T1 social media use subgroups/classes. Older adolescents were significantly more likely to be in the high

Instagram/Snapchat use subgroup relative to the low social media use subgroup ($p = 0.003$). For gender, girls were more likely than boys to be in the high Instagram/Snapchat use subgroup and the high social media use subgroup as compared to the low social media use subgroup ($ps < 0.001$). With regard to race/ethnicity, white adolescents were more likely than non-white adolescents to be in the low social media use subgroup and the high Instagram/Snapchat use subgroup as compared to the high social media use subgroup ($ps < 0.01$). Finally, perceived socio-economic status at T1 was unrelated to social media use subgroup membership ($ps > 0.05$).

Social Media Use Subgroups Predicting Time 2 (T2) Psychosocial Outcomes

Table 5 presents results from models using the BCH method to examine latent T1 social media use subgroup/class differences in predicting T2 psychosocial outcomes. These

findings adjusted for T1 age, gender, race/ethnicity, perceived socioeconomic status, and each T1 psychosocial variable under investigation.

Internalizing problems

Adolescents in the high social media use subgroup reported significantly higher levels of T2 depressive symptoms and panic disorder symptoms than those in both the Instagram/Snapchat use subgroup and the low social media use subgroup ($ps < 0.01$). There were no differences between the high Instagram/Snapchat use
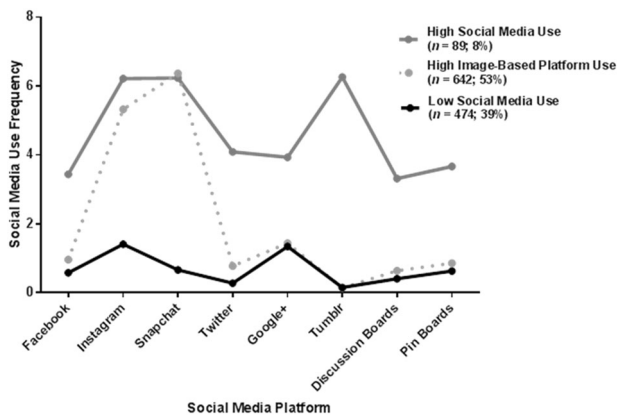
Fig. 1 Unstandardized means of latent profile analysis indicators among social media use subgroups. Notes. Social media use frequency scores are interpreted as follows: 0 = never; 1 = less than once a week; 2 = once a week; 3 = several times a week; 4 = once a day; 5 = several times a day; 6 = once an hour; 7 = several times an hour; 8 = almost constantly

subgroup and the low social media use subgroup in these T2 internalizing problems ($ps > 0.05$). Adolescents in the both the high social media use and high Instagram/Snapchat use subgroups reported significantly higher levels of anxiety-related school avoidance at T2 than those in the low social media use subgroup ($ps < 0.01$), and did not differ from each other ($p > 0.05$). There were no social media use subgroup differences in T2 symptoms of generalized anxiety disorder, separation anxiety disorder, or social anxiety disorder ($ps > 0.05$).

Externalizing problems

Significant social media use subgroup differences were observed for T2 delinquent behaviors ($p < 0.001$). Specifically, adolescents in the high social media use subgroup reported higher levels of T2 delinquent behaviors than adolescents in the high Instagram/Snapchat use subgroup ($p < 0.01$). Both of these social media use subgroups, in turn, had significantly greater T2 delinquent behaviors than the low social media use subgroup ($ps < 0.01$).

Family functioning

Significant differences in T2 family functioning were observed between the high social media use subgroup and both the high Instagram/Snapchat use and low social media use subgroups, which did not differ from each other ($ps < 0.05$). Specifically, adolescents in the high social media use subgroup reported significantly greater family conflict and lower perceived family support at T2 than those

Fig. 2 Social media use subgroup comparisons of latent profile analysis indicators. Notes. Adolescents were assigned to subgroups on the basis of the highest posterior probability prior to making subgroup comparisons. Social media use frequency scores are interpreted as follows: 0 = never; 1 = less than once a week; 2 = once a week; 3 = several times a week; 4 = once a day; 5 = several times a day; 6 = once an hour; 7 = several times an hour; 8 = almost constantly
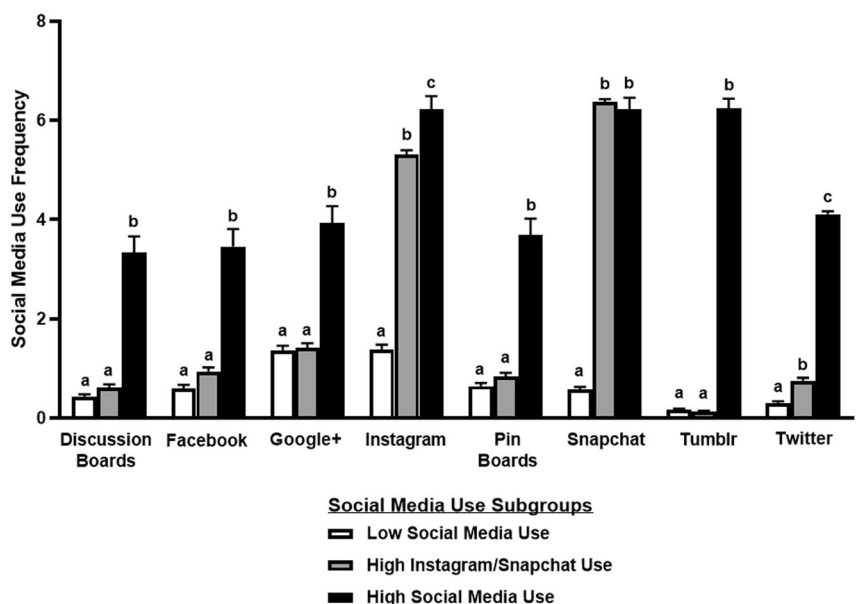
Table 4 Associations between demographic characteristics and membership in latent social media use subgroups

Variable	High social media use subgroup (vs. low social media use subgroup)	High instagram/snapchat use subgroup (vs. low social media use subgroup)	High social media use subgroup (vs. high instagram/ snapchat use subgroup)
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age	1.29 (0.87, 1.91)	1.37** (1.11, 1.68)	0.94 (0.65, 1.38)
Gender	2.02** (1.22, 3.34)	2.63*** (1.99, 3.47)	0.77 (0.47, 1.26)
Race/ethnicity	0.47** (0.28, 0.80)	1.25 (0.95, 1.65)	0.38*** (0.23, 0.63)
Perceived socioeconomic status	1.14 (0.96, 1.35)	1.10 (1.00, 1.21)	1.04 (0.87, 1.23)

These findings were derived from a multinomial logistic regression model conducted within the context of the preferred three-class LPA model, which utilized the Mplus auxiliary option to automate the standard three-step approach for examining latent class membership and continuous concurrent correlates. OR = odds ratio; CI = confidence interval. Age and perceived socioeconomic status are continuous variables. Gender is coded as 1 = girl and 0 = boy. Race/ethnicity is coded as 1 = non-Hispanic White and 0 = non-White

$*p < 0.05$; $**p < 0.01$; $***p < 0.001$

Table 5 Latent social media use subgroup differences in predicting psychosocial outcomes

Time 2 outcome variable	Low social media use subgroup M^1 (SE)	High instagram/ snapchat use subgroup M^1 (SE)	High social media use subgroup M^1 (SE)	Latent subgroup comparison (omnibus test) Wald χ^2	Effect size Cramer's V
Internalizing problems					
Generalized anxiety disorder symptoms	6.09 (0.25)	6.23 (0.22)	6.70 (0.74)	0.67	.02
Panic disorder symptoms	4.99[a] (0.28)	5.53[a] (0.26)	8.17[b] (1.03)	9.48**	.07
Separation anxiety disorder symptoms	3.43 (0.17)	3.47 (0.14)	4.14 (0.54)	1.60	.03
Significant school avoidance symptoms	1.89[a] (0.10)	2.18[b] (0.09)	2.67[b] (0.31)	7.94*	.06
Social anxiety disorder symptoms	5.80 (0.20)	5.30 (0.17)	5.61 (0.52)	3.14	.04
Depressive symptoms	15.15[a] (0.61)	15.32[a] (0.49)	21.83[b] (1.73)	13.91**	.08
Externalizing problems					
Delinquent behaviors[2]	0.17[a] (0.01)	0.21[b] (0.01)	0.28[c] (0.03)	19.03***	.10
Family functioning					
Family conflict	2.56[a] (0.05)	2.70[a] (0.05)	2.98[b] (0.14)	9.45**	.07
Perceived family support	5.23[a] (0.07)	5.22[a] (0.07)	4.50[b] (0.22)	10.57**	.07
Friend functioning					
Close friendship competence	3.01[a] (0.04)	3.25[b] (0.03)	2.97[a] (0.09)	28.40***	.12
Perceived friend support	5.15[a] (0.08)	5.60[b] (0.06)	5.02[c] (0.11)	22.37***	.10

Adjusted for baseline (Time 1) age, gender, race/ethnicity, perceived socioeconomic status, and the T1 psychosocial variable of interest for each model. Superscript letters that differ represent significant subgroup differences based upon Bonferroni–Hochberg post-hoc comparison tests

$*p < 0.05$; $**p < 0.01$; $***p < 0.001$

[1] Means estimated from subgroup intercept values generated from the BCH approach to examining latent social media use subgroup differences in continuous distal outcomes

[2] Values presented were back-transformed from the logarithm-transformed variables used in analyses

in both the high Instagram/Snapchat use and low social media use subgroups ($ps < 0.01$).

Peer functioning

Significant social media use subgroup differences were found for all T2 peer functioning outcomes ($ps < 0.01$). Adolescents in the high Instagram/Snapchat use subgroup reported higher T2 self-competence in close friendships than adolescents in the low and high social media use subgroups ($ps < 0.01$), which did not differ from each other ($p > 0.05$). Adolescents in the high Instagram/ Snapchat use subgroup also reported significantly higher T2 perceived friend support than those in the low and high social media use subgroups ($ps < 0.01$). The low social media use subgroup, in turn, predicted higher levels of T2 perceived friend support than the high social media use subgroup ($p < 0.01$).

Sensitivity Analyses

All analyses were conducted utilizing solely adolescents with complete data to investigate the potential influence of missing data, and all results were comparable. Gender differences in the longitudinal relationship between social media subgroups and psychosocial outcomes also were examined in post-hoc exploratory analyses, which are described in the Appendix. There were no significant gender × social media subgroup interactions present for any psychosocial outcome ($ps > 0.05$).

Discussion

Social media appears to be a pervasive and salient developmental context in the daily lives of early adolescents. On average, early adolescents in the current study reported using social media for nearly 3 h each day and engaging with three different platforms daily, which aligns with recent data in middle-to-late adolescents (Pew Research Center 2018a). In fact, the findings from this study suggest that social media is nearly ubiquitous among early adolescents, as only 8% reported never using any social media platforms. The widespread use of numerous social media platforms reported by early adolescents confirms the importance of the current longitudinal study, which was the first seeking to increase knowledge about individual differences in social media use patterns and how these patterns influence psychopathology risk and social functioning during the vulnerable early adolescent developmental period.

Social Media Use Subgroups

In line with study hypotheses, findings from the latent profile analysis suggested that there were three empirically and conceptually distinct subgroups of early adolescents based on their patterns of social media use. Consistent with prior studies examining social media use subgroups in a sample of emerging adults (Hargittai and Hsieh 2010; Scott et al. 2017), there was a "low social media use" subgroup distinguished by infrequent (once a week or less) use of all social media platforms and also a "high social media use" subgroup defined by frequent (daily-to-hourly) use across all social media platforms. The low social media use subgroup is similar to the "dabblers" and "samplers" subgroups identified in a prior study of emerging adults who occasionally use one or more social media platforms (Hargittai and Hsieh 2010), suggesting that this pattern can be observed in different developmental periods. The high social media use subgroup is comparable to the "omnivores" subgroup who often use nearly all available social

media platforms, which repeatedly has been identified in emerging adults (Hargittai and Hsieh 2010; Scott et al. 2017). The third subgroup was characterized by frequent, hourly use of only Instagram and Snapchat, which is consistent with uses and gratifications theory (Katz et al. 1973; Sundar and Limperos 2013), the developmental affordances framework (Moreno and Uhls 2019), and extant research suggesting that the collective attributes of Instagram and Snapchat (e.g., high social interactivity, photo and video features, ability to provide and receive "likes", comments, and re-shares) fulfill adolescents' needs for self-expression, social connection with peers, and privacy from adults (Gerwin et al. 2018). Yet, this novel finding is reminiscent of some subgroups from studies of emerging adults, including those characterized by "devotees" who often use one social media platform (Hargittai and Hsieh 2010) or by differentiated platform use (Yang and Lee 2018). It is possible that subgroups distinguished from other social media use patterns primarily by platform type, rather than usage frequency or number of platforms, are more amenable to change with developmental stage and historical time because they most closely reflect usage motivations and vary by platform-specific features. Overall, these findings suggest that person-centered approaches, such as latent profile analysis, may hold utility for understanding the nature of social media use patterns during adolescence and across the lifespan.

The high social media use subgroup of "omnivores" represented a small proportion of the sample (8%), indicating that a minority of early adolescents frequently uses a wide variety of social media platforms on a daily basis for, on average, 4 to 5 h per day. By contrast, 45–55% of emerging adults are social media omnivores (Hargittai and Hsieh 2010; Scott et al. 2017), suggesting that this social media use pattern becomes more prevalent in later stages of development. When considering uses and gratifications theory (Katz et al. 1973; Sundar and Limperos 2013), these youth likely use these social media platforms in diverse ways to fulfill different developmental needs. These needs may involve generating content for self-expression; viewing pictures or videos to escape from real world problems; messaging with friends to stay socially connected; and reacting to others' posted content to seek peer acceptance (Gerwin et al. 2018). In addition, adolescents identifying as a racial/ethnic minority were more likely than white adolescents to be in the high social media use subgroup than the other subgroups. Early adolescents who identify as racial/ethnic minorities may be driven to use a variety of social media platforms to express their racial/ethnic identities and connect with similar peers (Chan 2017). Notably, the prevalence rate of the high social media use subgroup is comparable to other studies identifying subgroups of adolescents based on the intensity of communication

technology engagement (Fuster et al. 2017). Although adolescents in the high social media use subgroup cannot be considered to have a behavioral addiction, this pattern of widespread and frequent social media use may confer risk or be an indicator for problematic engagement with mobile phones or social media itself.

Frequent, hourly use of Instagram and Snapchat but minimal use of other social media platforms appears to be normative during early adolescence, as just over half of the adolescents (53%) were in the high image-based social media use subgroup. Adolescents in this subgroup reported, on average, using social media platforms for nearly 4 h per day, which represented only a small difference from the high social media use subgroup. This finding extends recent research indicating that the rates of Instagram and Snapchat use are increasing among middle-to-late adolescents (Pew Research Center 2018a). Of note, Instagram and Snapchat have emerged as a primary means through which adolescents communicate with peers via posting and sharing videos and photos and making comments on others' posts (Lenhart et al. 2015). From the perspective of uses and gratifications theory (Katz et al. 1973; Sundar and Limperos 2013), it is not surprising that the majority of early adolescents gravitate towards Instagram and Snapchat given that the needs for friendships and social acceptance are of paramount importance during this developmental stage (Gerwin et al. 2018).

Gender differences in social media use patterns were identified in this study, such that girls were more likely than boys to be in the high social media use and high Instagram/ Snapchat use subgroups as compared to the low social media use subgroup. This finding is consistent with results from the overall sample characteristics, which suggest that girls spend more overall time using social media on a daily basis, use more different types of social media platforms, and more frequently use Instagram, Snapchat, and pin boards relative to boys. Adolescent girls tend to place a higher value on social goals and consider relationships and physical appearance as being more central to self-worth as compared to adolescent boys (Rose and Rudolph 2006; Vannucci and Ohannessian 2018b). Furthermore, adolescent girls' offline relational styles are characterized by more active interpersonal engagement compared to boys, as girls generally spend more time in dyadic interactions, engage in more frequent self-disclosure, and care more about cultivating intimate friendships (Rose and Rudolph 2006). These offline gender differences in relationship processes may manifest online as greater engagement across numerous social media platforms. Adolescent girls are more likely than boys to engage in self-disclosure about their feelings, family, and personal problems via posting photos and videos on social media platform, and to use technology for

purposes of social connection (Vannucci and Ohannessian 2018b; Pew Research Center 2018b). Instagram and Snapchat, therefore, may be especially attractive platforms to girls for forming and maintaining friendships because these highly visual, interactive platforms are primarily used by adolescents for peer communication (Lenhart et al. 2015). When considering the transformation framework (Nesi et al. 2018a), it is possible that the highly visual, public, and interactive nature of content on Snapchat and Instagram may reinforce girls' differentiated use of these platforms because they provide novel opportunities for frequent, immediate, and salient displays of friendship, support, co-rumination, and feedback seeking (Nesi et al. 2018a). Given the centrality of physical appearance to adolescent girls' self-worth and social status (Vannucci and Ohannessian 2018b), girls may be highly motivated to use highly visual platforms such as Instagram, Snapchat, Tumblr, and pin boards because these platforms serve as primary resources for information on dieting, exercise, hair and makeup tips, fashion, and skincare (Fardouly and Vartanian 2016; Saunders and Eaton 2018). A unique constellation of features specific to Instagram and Snapchat, including the photo and video posting filters, ability to provide and receive "likes" and comments, and retouching features, also may fulfil girls' desires to portray idealized self-images, receive positive feedback from peers, and compare themselves to their peers (Nesi et al. 2018b; Nesi and Prinstein 2015; Saunders and Eaton 2018).

In contrast to the widespread assumption that adolescents use numerous social media platforms constantly (Pew Research Center 2018a), 39% of early adolescents reported relatively infrequent use across all social media platforms (once a week or less). These rates contrast research indicating that only a small proportion of emerging adults (10–14%) are social media dabblers or samplers (Hargittai and Hsieh 2010; Scott et al. 2017). It is possible that many youth in this subgroup have less autonomy to use social media platforms freely because parents may place restrictions on mobile phone usage and the ability to register for social media accounts during early adolescence relative to the high school years (Dworkin et al. 2018). Indeed, younger adolescents were more likely to be in the low social media use subgroup than the high Instagram/Snapchat use subgroup. It also is conceivable that some adolescents in the low social media use subgroup turn to other forms of technology and in-person activities to fulfil their needs for self-expression, peer acceptance, social connection, and entertainment. For example, playing video games is nearly universal among adolescent boys, who are more likely to use this technology over social media as a primary means of interacting with peers, maintaining friendships, and enhancing social status (Lenhart et al. 2015).

Predicting Psychosocial Outcomes from Social Media Use Subgroups

The high social media use subgroup was linked to the worst psychosocial functioning across nearly all outcomes. Notably, membership in the high social media use subgroup uniquely predicted greater internalizing problems, including depressive symptoms, panic disorder symptoms, and anxiety-related school avoidance, as well as delinquent behaviors, with large differences from other subgroups. By contrast, the extant literature focusing on overall time spent using social media and simple, direct associations with internalizing and externalizing problems have been equivocal, with either small, positive associations or null findings (Seabrook et al. 2016; Galica et al. 2017). Notably, similar findings were observed in this sample when examining bivariate associations. It is possible that the strong detrimental impact that high social media use patterns exert on psychological functioning drives the small, positive associations rather than overall time spent using social media. However, early adolescents in the high social media use subgroup nonetheless reported the most overall time spent using social media on a daily basis relative to the other social media use subgroups, albeit by only a small margin compared to the high Instagram/Snapchat use subgroup. These findings suggest that the displacement hypothesis (Kraut et al. 1998) may be applicable for understanding, in part, why adolescents in this subgroup are at elevated risk for a broad array of internalizing and externalizing problems.

The primary distinguishing feature of the high social media use subgroup was the frequent, daily use across all social media platforms, suggesting that the number of platforms used may adversely influence psychosocial development beyond overall time spent using social media among early adolescents. This hypothesis is supported by extant cross-sectional research in emerging adults demonstrating that the number of platforms, as opposed to overall time spent using social media or platform type, had the most consistent and robust associations with anxiety, depressive symptoms, and substance use (Vannucci et al. 2018). These findings, therefore, support the technology overload hypothesis suggesting that the frequent use of numerous social media platforms leads to impaired self-regulation and interpersonal relationships as a result of social media fatigue, decreased cognitive control, and multitasking problems (Lee et al. 2016). The self-regulation and executive functioning deficits stemming from technology overload may exacerbate risk for internalizing and externalizing problems among adolescents in the high social media use subgroup (Wills et al. 2016). It also is possible that concerns and worries about peer acceptance become heightened among early adolescents in this subgroup as a result of frequent

exposure to public commentary across social media platforms to the extent that maladaptive cognitions and behaviors develop that exacerbate internalizing and externalizing problems (Shapiro and Margolin 2014). According to the transformation framework (Nesi et al. 2018a) and initial research (Hoge et al. 2017; Nesi and Prinstein 2015), such maladaptive tendencies linking social media use to psychopathology may include excessive interpersonal feedback seeking via social media posts; negative social comparisons upon viewing others' posts; digital status seeking via posting content of themselves and their friends engaging in delinquent acts; and rumination about social media activities of the self and peers.

With regard to social functioning, the high social media use subgroup uniquely predicted the experience of more frequent family conflict, low perceived family support, and the lowest levels of perceived friend support. These findings do not support the stimulation hypothesis (Valkenburg and Peter 2011) or the integrated online communication framework (Subrahmanyam and Greenfield 2008). Rather, the displacement hypothesis (Kraut et al. 1998) may partially account for these findings, as early adolescents in this subgroup may develop more frequent conflicts with parents and isolation from family members because their extensive social media use replaces quality time spent with parents and interferes with family activities (Dworkin et al. 2018). Indeed, research suggests that excessive social media use patterns may be a primary source of frequent family conflicts in the form of struggling over negotiating rules and boundaries around technology use (Dworkin et al. 2018). According to the transformation framework (Nesi et al. 2018a), frequent social media use across many platforms can lead to decreased perceived support from friends because the lack of interpersonal cues and asynchronicity of responses negatively impacts conflict resolution skills, intimacy, and support seeking. It also is possible that the frequent use of many social media platforms amplifies unrealistic expectations that friends should be constantly accessible to the extent that early adolescents in this subgroup become concerned or have uncertainty about their friendships if they do not receive immediate responses (Nesi et al. 2018a). Finally, in line with the technology overload hypothesis (Lee et al. 2016), the social media multitasking demonstrated by youth in the high social media use subgroup may interfere with in-person interactions due to frequent distractions and interruptions by mobile devices, or "technoference," resulting in decreased friend and family support (van Der Schuur et al. 2015).

In addition to the displacement and technology overload hypotheses (Kraut et al. 1998; Lee et al. 2016), it is also plausible that the developmental affordances framework (Moreno and Uhls 2019) may in part account for the widespread psychosocial problems stemming from the high

social media use subgroup. The high social media use subgroup was distinguished from other social media use subgroups by the daily use of Facebook, Google+, Tumblr, Twitter, discussion boards, and pin boards. Only Facebook, Tumblr, and discussion board use frequency, however, exhibited broad, direct associations with poor psychosocial functioning across all measured domains in this study. As such, affordances common to these platforms may be most likely to promote maladaptive cognitions, emotions, and behaviors. Facebook, Tumblr, and discussion boards have high social interactivity affordances (e.g., hashtags, comments, direct message, video chats), emotional affordances (e.g., "likes" and "dislikes", "upvoting" and "downvoting"), and information sharing affordances (e.g., self-generated customizable content; content visibility, publicness, and permanence; continuous reverse-chronological content updates). There is also a perceived sense of privacy either due to either low content visibility (e.g., direct messages, video chats) or low identity (e.g., few profile requirements) affordances. This constellation of affordances may encourage early adolescents to disclose or seek out information regarding emotionally sensitive topics and deviant roles and risky behaviors, which ultimately may lead to psychological problems as a result of receiving reinforcement for maladaptive thoughts and behaviors and/or feeling rejected or worse than others as a result of dislikes or upward social comparisons, and (Moreno and Uhls 2019; Renninger 2015). Facebook, Tumblr, and discussion boards also provide simplified communication venues, such as text-only messaging and asynchronous communication, that may increase risk for social problems with friends and family by triggering the misinterpretation of social cues and escalations in public online "drama" (Moreno and Uhls 2019; Pew Research Center 2013; Utz et al. 2015).

The high Instagram/Snapchat use subgroup appears to confer developmental tradeoffs, such that membership in this subgroup predicted the highest close friendship competence and perceived friend support but also increased engagement in anxiety-related school avoidance and delinquent behaviors. The adaptive friendship outcomes of the high Instagram/Snapchat use subgroup are consistent with existing research focused on direct, simple associations between social media use frequency and positive social adjustment (Pew Research Center 2018b; Uhls et al. 2017). Notably, the high Instagram/Snapchat use subgroup predicted solely psychosocial outcomes that involve peers, which is consistent with research indicating that Instagram and Snapchat serve as a primary context through which adolescents interact with peers (Pew Research Center 2018a). These peer-centric findings support the developmental affordances framework (Moreno and Uhls 2019), which suggests that the distinct combinations of social media affordances may promote or constrain certain social

behaviors. Both Instagram and Snapchat are distinct from other social media platforms due to their combination of high identity, social interactivity, and social connectedness affordances, but low content visibility and privacy from adults; these platforms are also targeted toward adolescents and portrayed as being "cool" (Moreno and Uhls 2019; Wang et al. 2016; Zawawi et al. 2017). Taken together, these affordances encourage adolescents to use Instagram and Snapchat for communicating and connecting with existing friends and known peers in a perceived safe space. Similarly, the transformation framework (Nesi et al. 2018b) proposes that unique features of Instagram and Snapchat may encourage early adolescents in this subgroup to engage in self-disclosure, provide and receive support, and stay connected with friends, such as the ability to follow friends' activities; the array of entertaining photo and video posting filters; the ability to comment on posts and instant message with others; the numerous retouching features to create interesting images and videos; and the live streaming capabilities. These Instagram and Snapchat affordances and related behaviors may enhance friend support and skills related to the formation and maintenance of close friendships among early adolescents.

Although frequent use of solely Instagram and Snapchat may foster positive friendship development, this social media use pattern also appears to confer risk for delinquent behaviors. These findings align with peer influence models suggesting that exposure to peers' positive portrayals of risky behaviors on social media increases the likelihood that adolescents will engage in these behaviors to conform to perceived social norms and to seek increases in social status (Nesi et al. 2018b). Indeed, greater time spent using social media has been linked to greater exposure to images of peers engaging in risky behaviors posted on social media (Nesi et al. 2017). Findings from neuroimaging studies indicate that the nature of Instagram and Snapchat amplifies peer influence processes because the quantifiable reinforcement provided for images depicting risky behaviors in the form of "likes," comments, or shares has been shown to be highly rewarding and enhance the desire for peer acceptance, regardless of whether adolescents post self-images or view others' images (Sherman et al. 2016). In further support of this hypothesis, viewing or sharing social media images of risky behaviors and digital status seeking behaviors (e.g., striving to obtain "likes") has been shown to predict the onset of risky behaviors in adolescents above and beyond other social influence processes (Nesi and Prinstein 2018; Nesi et al. 2017). In support of the developmental affordances and transformation frameworks (Nesi et al. 2018b; Moreno and Uhls 2019), the low perceived content permanence affordance in the form of the auto-delete feature of Snapchat that leads to temporary content also may be compelling for sharing and viewing images

related to delinquent behaviors and aggression toward others due to the perceived privacy and lack of consequences (Vannucci et al. 2018), perhaps partly accounting for why early adolescents in the high Instagram/Snapchat use subgroup are at greater risk for delinquent behaviors.

Finally, the low social media use subgroup also is linked to notable developmental tradeoffs for early adolescents. Membership in the low social media use subgroup predicted the lowest levels of anxiety-related school avoidance symptoms and delinquent behaviors at follow-up as compared to the other social media use subgroups. Although this subgroup was linked longitudinally to better family functioning and fewer symptoms of depression and panic disorder than the high social media use subgroup, there were no differences between the low social media use and high Instagram/Snapchat subgroups on these indices of psychosocial adjustment. This pattern of findings is inconsistent with the displacement hypothesis (Kraut et al. 1998) and the integrated online communication framework (Subrahmanyam and Greenfield 2008), as youth in the high Instagram/Snapchat subgroups reported nearly the same amount of time spent using social media daily as those in the high social media use subgroup. Instead, it is possible that youth with low social media use across platforms may be uniquely protected from increases in anxiety-related school avoidance because they are exposed to fewer peer stressors and are less likely to experience in-person spillover from online "drama" relative to their peers who use social media daily (Pew Research Center 2018b), which aligns with stress exposure and generation models (Hankin et al. 2007; Hammen 2006). The social network contagion model (Scherer and Cho 2003), media-driven peer influence theories (Nesi et al. 2018b; Strasburger 2007), and the developmental affordances framework (Moreno and Uhls 2019) appear to be appropriate when conceptualizing the relationship between social media use patterns and externalizing problems, as membership in the low social media use subgroup predicted the lowest levels of delinquent behaviors. Indeed, initial evidence suggests that infrequent social media use minimizes exposure to positive portrayals of risky behaviors, prevents the development of deviant norms, and thwarts digital status-seeking behaviors (e.g., adolescents posting content of their risk taking), which ultimately constrains engagement in delinquent behaviors among early adolescents (Eleuteri et al. 2017; Nesi et al. 2017; Nesi and Prinstein 2018).

Despite some of the positive outcomes linked to infrequent (i.e., less than daily) social media use across platforms, there were indicators that this pattern of low social media use hinders adaptive social development within friendships relative to frequent, hourly use of Instagram and Snapchat. Membership in the low social media use subgroup predicted the lowest levels of perceived friend support as compared to the other social media use subgroups, as well as decreased self-competence in forming and maintaining close friendships to the same degree that was found for the high social media use subgroup. These findings are contrary to the stimulation hypothesis (Valkenburg and Peter 2011), displacement hypothesis (Kraut et al. 1998), and the integrated online communication framework (Subrahmanyam and Greenfield 2008), suggesting that common approaches to understanding how social media use patterns influence social functioning are insufficient. The transformation framework (Nesi et al. 2018a) and the developmental affordance framework (Moreno and Uhls 2019) may be preferable for understanding why low social media use is linked to poorer friendship functioning. These theories propose that the a combination of attributes of the social media context contributes to changes in friendship processes; for example, the asynchronicity of communication encourages self-disclosure by allowing adolescents to craft responses to their peers; the content features (e.g., filters, videos, text) enable adolescents to communicate with friends in a positive manner; and even the online "drama" allows for practice of conflict negotiation and social support skills (Nesi et al. 2018a; Moreno and Uhls 2019; Shapiro and Margolin 2014). Consistent with these frameworks, findings from this study suggest that frequent use of Instagram and Snapchat platforms provides an important context for the enhancement of perceived friend support, close friendship competence, and social development that early adolescents in the low social media use subgroup do not have the opportunity to experience.

Strengths and Limitations

This study was novel in its person-centered approach to examining social media use patterns during early adolescence, a sensitive developmental period during which little is known about social media use and its impact on psychosocial functioning. Additional strengths of the study are the longitudinal design and the high participant retention (88%), which allowed for the temporally sensitive examination of theoretically-driven hypotheses that membership in social media use subgroups would differentially predict early adolescents' psychopathology and social functioning. Moreover, the modified correction method of Bolck et al. (2004; BCH method) for examining continuous distal outcomes within the context of latent profile analysis only recently has been used in developmental research, but this method is superior to alternative methods because it protects latent class formation from the influence of other model variables, accounts for classification uncertainty, allows for the inclusion of baseline covariates, and is robust to violations in latent profile analysis model assumptions (Asparouhov and Muthén 2014). Other study strengths include the

large diverse community sample of early adolescent girls and boys, assessment of many social media platforms, and the inclusion of a variety of positive and negative psychosocial measures. Overall, these methodological strengths significantly extend prior research in this area that has had a tendency to focus on cross-sectional designs with an overall assessment of time spent using social media among middle-to-late adolescents.

Conclusions regarding the study findings also must be considered in light of the study limitations. Although participants were recruited from small and large middle schools spanning rural, suburban, and urban communities, it is notable that all schools were public and located in the Northeast region of the United States. As such, caution is warranted in generalizing the study findings to early adolescents from other school settings and geographic locations. In addition, the follow-up interval spanned six months, and therefore it is unknown as to whether the social media use subgroups predict long-term changes in psychosocial functioning across years. The consideration of the type, number, and time spent using social media platforms represents a significant advancement beyond most prior social media research. It's likely that some of the findings may be driven by subgroup differences in social media use frequency, but this time-centric interpretation alone is insufficient given that non-linear effects were found for measures of internalizing problems and social functioning. As such, the features of different social media platforms and the number of platforms used also are required to understand subgroup differences in psychosocial outcomes. In addition, there are other aspects of social media use that were not assessed in the current study (e.g., motivations, passive vs. active use, emotional engagement). Shared method variance also may have contributed to the study findings, as early adolescents provided self-reports of all constructs. Finally, the reliance on self-report questionnaires, rather than a clinical interview, to assess internalizing and externalizing problems does not allow for inferences to be made about clinical populations.

Implications and Future Directions

The findings from this study suggest that social media use theories should consider approaches that focus on identifying subgroups of individuals based on their patterns of social media use across platforms. Although it is useful to characterize overall social media use patterns to understand population level trends, the use of person-centered approaches such as latent profile analysis may help to minimize the inconsistency in research examining the impact of social media use on psychosocial functioning. Such an approach also more accurately captures the reality that most adolescents maintain multiple social media platforms on a daily

basis (Pew Research Center 2018a). Daily use of most social media platforms appears to confer risk for internalizing and externalizing problems as well as poor social functioning in family and peer domains, and therefore early adolescents with this social media use pattern may benefit from decreasing the number of platforms used to reduce technology overload, replacing some of the time spent using social media with health-promoting activities, and social skills training to learn strategies to more successful navigate their relationships at home and with peers. Similarly, teaching social skills for in-person and online interactions with peers is likely to help early adolescents with infrequent social media use across platforms or no social media use. Daily use of solely Instagram and Snapchat appears to foster positive friendship development and does not increase risk for depressive symptoms, most forms of anxiety, or family problems, but this pattern also increases risk for anxiety-related school avoidance and delinquent behaviors. A more tailored approach to understanding and minimizing social media behaviors related to school avoidance and externalizing problems is likely the most appropriate for early adolescents with this platform-differentiated pattern. In general, providers would benefit from assessing early adolescents' social media use patterns by querying about the number, type, and purposes of platforms used in addition to their daily time spent using each social media platform when conducting behavioral health evaluations. Families and providers also may benefit from an increased awareness of normative social media use patterns in early adolescents and recognizing that solely using Instagram and Snapchat yields positive social benefits, and that not using these platforms hinders social development. To minimize family conflict around social media use, the implementation of a personalized family media use plan to ensure that social media enhances the daily lives of early adolescents and their families.

Moving forward, it is important to examine moderators of the relationship between membership in social media use subgroups and subsequent psychosocial functioning to identify who is at the greatest risk for poor adjustment and who may garner the greatest benefits from certain social media use patterns. Indeed, there likely is a complex interplay among individual characteristics (e.g., age, gender identity, race/ethnicity, sexual orientation), contextual factors (e.g., family structure, friendships), and social media use patterns and affordances in contributing to positive and/or negative developmental outcomes. Longitudinal studies also are needed with multiple follow-up time points to examine the mechanisms hypothesized to account for the relationships between social media use patterns and aspects of psychosocial functioning. Such longitudinal research designs also allow for disentangling the direction of effects, as well as the potential to identify cascading effects of social

media use, psychological functioning, and social functioning. The use of multi-method assessments beyond retrospective self-reports may be especially important for advancing theoretical models and practice recommendations regarding social media use across the lifespan, including objective measures of social media use, laboratory experiments that manipulate attributes of social media platforms, and ecological momentary assessment to provide real-world assessments.

Conclusion

Social media is a vital context in the daily lives of adolescents. Yet, little is known about social media use patterns and their longitudinal impact on social development and psychopathology during early adolescence, which are crucial years during which social media use begins, peer acceptance and friendships become paramount, and risk for psychopathology increases. The objectives of this study, therefore, were to identify subgroups of early adolescents based on their social media use patterns and to examine whether these subgroups predicted psychosocial functioning six months later. The vast majority of early adolescents were in two subgroups distinguished by either infrequent social media use across all platforms (39%) or daily-to-hourly use of solely Instagram and Snapchat (53%), with a small proportion of youth (8%) in a high social media use subgroup characterized by frequent, hourly use of Instagram, Snapchat, and Tumblr and daily use of Facebook, Twitter, Google+, Discussion Boards, and Pin Boards. Furthermore, the findings suggest that social media use subgroups differentially predict psychosocial outcomes. The high social media use subgroup was the most problematic, as this subgroup heightened risk for internalizing and externalizing problems and poor functioning with family and friends. The high Instagram/Snapchat use and low social media use subgroups, however, conferred distinct developmental tradeoffs. The high Instagram/Snapchat use subgroup yielded the greatest benefits for friend support and competence in forming and maintaining close friendships and did not predict depressive symptoms, panic disorder symptoms, or poor family functioning, but this subgroup also was linked to increased anxiety-driven school avoidance and delinquent behaviors. Although the low social media use subgroup had the benefits of not promoting internalizing and externalizing problems or poor family functioning, this subgroup had compromised functioning in the friendship domain. Findings from this study indicate that it is crucial to consider the collective patterns of social media use across platforms because the impact of social media use on psychosocial development is more complex

than what can be described in simple, direct associations. To date, much of the scientific literature and nearly all of the popular media surrounding social media use has been alarmist and exaggerates the influence of social media on societal problems such as depression, suicide, and addiction, as is often observed when a new technology that alters society is introduced (Carvalho et al. 2015). This study does not support these pessimistic claims, instead indicating that social media use is neither inherently detrimental nor beneficial for early adolescents; rather, developmental harms and benefits stemming from social media use are contingent on how youth are using social media platforms. It is vital that future research continues to apply more sophisticated, nuanced approaches to understanding the social media context and establish both positive and negative effects to learn how to optimize early adolescents' development in the digital age.

Compliance with Ethical Standards

Appendix

Post-Hoc Exploratory Analyses: Gender Differences

Analytic Plan. To examine whether there were gender differences in the relationships between T1 social media use subgroup membership and T2 psychosocial functioning, adolescents were assigned to a latent subgroup on the basis of the which subgroup had the highest posterior probability. Then, analyses of covariance (ANCOVAs) were conducted to examine gender × social media use subgroup interactions for all T2 psychosocial outcomes. Each model included the main effects of gender and of social media use subgroup membership and their interaction effect, as well as the T1 covariates of age, race/ethnicity, perceived socioeconomic status, and psychosocial variable of interest. Separate models for girls and boys were conducted when the gender × social media use subgroup interaction term was statistically significant to understand the nature of the gender differences ($ps < 0.05$), Bonferroni-Hochberg corrections were applied when examining pair-wise differences among latent social media use subgroups/classes in girls and boys.

This case assignment approach was necessary because it is currently not possible to conduct a multiple group analysis using the modified correction method of Bolck et al. (2004; BCH method) to examine gender as a moderator. It is important to acknowledge that the case assignment approach does not capture the probabilistic nature of the latent class model and the reality that latent subgroup membership is not fixed, often producing attenuated estimates (Bray et al. 2015). However, the case assignment method may be considered acceptable for latent class solutions with very high classification accuracy (>0.95) because classification error is minimized and individuals can be assigned to latent classes with a high degree of certainty (Masyn 2013), which was observed in the current study (0.97–0.98). To evaluate the possibility that classification uncertainty impacted analyses, the BCH method was conducted separately in girls and boys. For all models, the pattern and significance of the findings were highly comparable, suggesting minimal bias in using the case assignment approach to examine gender differences.

Results. There was no significant gender × social media subgroup interaction for any psychosocial outcomes in this study, including anxiety disorder symptoms, $F(2, 1103) = 0.87$, $p > 0.05$, $\eta^2 = 0.000$, depressive symptoms, $F(2, 1125) = 0.01$, $p > 0.05$, $\eta^2 = 0.000$, delinquent behaviors, $F(2, 1076) = 0.33$, $p > 0.05$, $\eta^2 = 0.001$, family conflict, $F(2, 1140) = 0.10$, $p > 0.05$, $\eta^2 = 0.000$, family support, $F(2, 1130) = 0.29$, $p > 0.05$, $\eta^2 = 0.001$, close friend competence, $F(2, 1170) = 0.63$, $p > 0.05$, $\eta^2 = 0.001$, and friend support, $F(2, 1126) = 2.21$, $p > 0.05$, $\eta^2 = 0.005$.

Discussion. Surprisingly, no gender differences were found in the extent to which social media use subgroups

predicted psychosocial functioning. It is possible that some aspects of peer relationship processes have become more similar among girls and boys within the social media context, accounting for the lack of gender differences observed for internalizing problems, delinquent behaviors, and social functioning. The immediate, quantifiable, and public nature of peer feedback that occurs through relentless content updates and tools such as "likes," comments, and sharing as well as exposure to "drama" and the stressors of others may be equally salient for both girls and boys, whereas boys may not be as attuned to these issues during in-person interactions. This hypothesis aligns with a recent study indicating that there were no gender differences in adolescents' perceptions that social media use led them to experience negative emotions (e.g., feeling overwhelmed due to online drama, feeling worse about their own life, pressure to post idealized content of themselves) and positive emotions (e.g., feeling more connected to friends, pleasure from expressing creativity) (Pew Research Center 2018a, 2018b). Alternatively, gender differences may become more apparent when examining adolescents' interpersonal processes within the social media context, as technology-based feedback seeking and social comparisons predicted increases in depressive symptoms to a greater extent for adolescent girls relative to boys (Nesi and Prinstein 2015). Gender differences in the relationship between social media use subgroups and psychosocial functioning also may become more robust during middle-to-late adolescence, when gender differences in internalizing and externalizing problems become more stable (Evans-Polce et al. 2015).

References

Arnett, J. J. (2014). Identity development from adolescence to emerging adulthood: what we know and (especially) what we don't know. In K. C. McLean & M. Syed (Eds.), *The Oxford handbook of identity development* (pp. 53–79). Oxford, UK: Oxford University Press.

Asparouhov, T., & Muthén, B. (2014). Auxiliary variables in mixture modeling: using the BCH method in Mplus to estimate a distal outcome model and an arbitrary secondary model. *Mplus Web Notes*, *21*(2), 1–22.

Bandura, A. (1977). *Social learning theory*. New York, NY: General Learning Press.

Barry, C. T., Sidoti, C. L., Briggs, S. M., Reiter, S. R., & Lindsey, R. A. (2017). Adolescent social media use and mental health from adolescent and parent perspectives. *Journal of Adolescence*, *61*, 1–11.

Birmaher, B., Brent, D. A., Chiappetta, L., Bridge, J., Monga, S., & Baugher, M. (1999). Psychometric properties of the screen for child anxiety related emotional disorders: a replication study. *Journal of the American Academy of Child & Adolescent Psychiatry*, *38*(10), 1230–1236.

Bolck, A., Croon, M., & Hagenaars, J. (2004). Estimating latent structure models with categorical variables: one-step versus three-step estimators. *Political Analysis*, *12*(1), 3–27.

Boyd, D. (2010). Social network sites as networked publics: affordances, dynamics, and implications. In Z. Papacharissi Ed., *Networked self: identity, community, and culture on social network sites* (pp. 39–58). Milton Park, UK: Routledge.

Bray, B. C., Lanza, S. T., & Tan, X. (2015). Eliminating bias in classify-analyze approaches for latent class analysis. *Structural Equation Modeling: A Multidisciplinary Journal*, 22(1), 1–11.

Caballero, A., Granberg, R., & Tseng, K. Y. (2016). Mechanisms contributing to prefrontal cortex maturation during adolescence. *Neuroscience & Biobehavioral Reviews*, 70, 4–12.

Canty-Mitchell, J., & Zimet, G. D. (2000). Psychometric properties of the multidimensional scale of perceived social support in urban adolescents. *American Journal of Community Psychology*, 28(3), 391–400.

Carvalho, J., Francisco, R., & Relvas, A. P. (2015). Family functioning and information and communication technologies: how do they relate? A literature review. *Computers in Human Behavior*, 45, 99–108.

Casey, B. J. (2015). Beyond simple models of self-control to circuit-based accounts of adolescent behavior. *Annual Review of Psychology*, 66, 295–319.

Chan, J. (2017). Racial identity in online spaces: social media's impact on students of color. *Journal of Student Affairs Research and Practice*, 54(2), 163–174.

Dhir, A., Yossatorn, Y., Kaur, P., & Chen, S. (2018). Online social media fatigue and psychological wellbeing—a study of compulsive use, fear of missing out, fatigue, anxiety and depression. *International Journal of Information Management*, 40, 141–152.

Dworkin, J., Rudi, J. H., & Hessel, H. (2018). The state of family research and social media. *Journal of Family Theory and Review*, 10, 796–813.

Eccles, J. S., & Roeser, R. W. (2011). Schools as developmental contexts during adolescence. *Journal of Research on Adolescence*, 21(1), 225–241.

Eleuteri, S., Saladino, V., & Verrastro, V. (2017). Identity, relationships, sexuality, and risky behaviors of adolescents in the context of social media. *Sexual and Relationship Therapy*, 32(3-4), 354–365.

Evans-Polce, R. J., Vasilenko, S. A., & Lanza, S. (2015) Changes in gender and racial/ethnic disparities in rates of cigarette use, regular heavy episodic drinking, and marijuana use: Ages 14 to 32. *Addictive Behaviors*, 41, 218–222.

Fardouly, J., & Vartanian, L. R. (2016). Social media and body image concerns: current research and future directions. *Current Opinion in Psychology*, 9, 1–5.

Faulstich, M. E., Carey, M., Ruggiero, L., Enyart, P., & Gresham, F. (1986). Assessment of depression in childhood and adolescence: an evaluation of the center for epidemiological studies depression scale for children (CES-DC). *American Journal of Psychiatry*, 143(8), 1024–1027.

Fuster, H., Chamarro, A., & Oberst, U. (2017). Fear of missing out, online social networking and mobile phone addiction: a latent profile approach. *Aloma: Revista de Psicologia, Ciències de l'Educació i de l'Esport*, 35(1), 23–30.

Galica, V. L., Vannucci, A., Flannery, K. M., & Ohannessian, C. M. (2017). Social media use and conduct problems in emerging adults. *Cyberpsychology, Behavior, and Social Networking*, 20(7), 448–452.

Gault-Sherman, M. (2013). The gender gap in delinquency: does SES matter? *Deviant Behavior*, 34(4), 255–273.

Gerwin, R. L., Kaliebe, K., & Daigle, M. (2018). The interplay between digital media use and development. *Child and Adolescent Psychiatric Clinics of North America*, 27(2), 345–355.

Glover, J., & Fritsch, S. L. (2017). KidsAnxiety and social media: a review. *Child and Adolescent Psychiatric Clinics of North America*, 27, 171–182.

Goodman, E., Adler, N. E., Kawachi, I., Frazier, A. L., Huang, B., & Colditz, G. A. (2001). Adolescents' perceptions of social status: development and evaluation of a new indicator. *Pediatrics*, 108(2), e31.

Hankin, B. L., Mermelstein, R., & Roesch, L. (2007). Sex differences in adolescent depression: stress exposure and reactivity models. *Child Development*, 78(1), 279–295.

Hammen, C. (2006). Stress generation in depression: reflections on origins, research, and future directions. *Journal of Clinical Psychology*, 62(9), 1065–1082.

Hargittai, E., & Hsieh, Y. P. (2010). Predictors and consequences of differentiated practices on social network sites. *Information, Communication & Society*, 13(4), 515–536. https://doi.org/10.1080/13691181003639866.

Herrenkohl, T. I., Kosterman, R., Hawkins, J. D., & Mason, W. A. (2009). Effects of growth in family conflict in adolescence on adult depressive symptoms: mediating and moderating effects of stress and school bonding. *Journal of Adolescent Health*, 44(2), 146–152.

Hoge, E., Bickham, D., & Cantor, J. (2017). Digital media, anxiety, and depression in children. *Pediatrics*, 140(Suppl. 2), S76–S80.

Karahanna, E., Xin, Xu,S., Xu, Y., & Zhang, N. (2018). The needs-affordances-features perspective for the use of social media. *MIS Quarterly*, 42(3), 737–756.

Katz, E., Blumler, J. G., & Gurevitch, M. (1973). Uses and gratifications research. *The Public Opionion Quarterly*, 37(4), 509–523.

Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukophadhyay, T., & Scherlis, W. (1998). Internet paradox: a social technology that reduces social involvement and psychological well-being? *American Psychologist*, 53(9), 1017.

Lazarsfeld, P. F., & Henry, N. W. (1968). *Latent structure analysis*. Boston, MA: Houghton Mifflin.

Lee, A. R., Son, S.-M., & Kim, K. K. (2016). Information and communication technology overload and social networking service fatigue: a stress perspective. *Computers in Human Behavior*, 55, 51–61.

Lenhart, A., Anderson, M., Duggan, M., & Perrin, A. (2015). *Teens, technology, and friendships*. Washington, DC: Pew Research Center. http://www.pewinternet.org/2015/08/06/teens-technology-and-friendships/.

Masyn, K. E. (2013). Latent class analysis and finite mixture modeling. In: K. E. Masyn and T. Little (Eds.), *Oxford handbook of quantitative methods in psychology* (pp. 551–611). Oxford, UK: Oxford University Press.

McFarland, L. A., & Ployhart, R. E. (2015). Social media: a contextual framework to guide research and practice. *Journal of Applied Psychology*, 100(6), 1653–1677.

McLaughlin, K. A., & King, K. (2015). Developmental trajectories of anxiety and depression in early adolescence. *Journal of Abnormal Child Psychology*, 43(2), 311–323.

Miech, R. A, Johnston, L. D, O'Malley, P. M, Bachman, J. G, Schulenberg, J. E., & Patrick, M. E. (2017). *Monitoring the Future national survey results on drug use, 1975–2016: Volume I, Secondary school students*. Ann Arbor: Institute for Social Research, The University of Michigan. http://monitoringthefuture.org/pubs.html#monographs.

Moreno, M. A., & Uhls, Y. T. (2019). Applying an affordances approach and a developmental lens to approach adolescent social media use. *Digital Health*, 5, 1–6.

Muris, P., Merckelbach, H., Ollendick, T., King, N., & Bogie, N. (2002). Three traditional and three new childhood anxiety questionnaires: their reliability and validity in a normal adolescent sample. *Behaviour Research and Therapy*, 40(7), 753–772.

Muthen, L. K., & Muthen, B. O. (1998). *Mplus user's guide: statistical analysis with latent variables*. 7th Edn. Los Angeles, CA: Muthen & Muthen. 2017.

Nelson, E. E., Jarcho, J. M., & Guyer, A. E. (2016). Social re-orientation and brain development: an expanded and updated view. *Developmental Cognitive Neuroscience*, *17*, 118–172.

Nesi, J., Choukas-Bradley, S., & Prinstein, M. J. (2018a). Transformation of adolescent peer relations in the social media context: Part 1—a theoretical framework and application to dyadic peer relationships. *Clinical Child and Family Psychology Review*, *21*(3), 267–294.

Nesi, J., Choukas-Bradley, S., & Prinstein, M. J. (2018b). Transformation of adolescent peer relations in the social media context: Part 2—application to peer group processes and future directions for research. *Clinical Child and Family Psychology Review*, *21*(3), 295–319.

Nesi, J., Miller, A. B., & Prinstein, M. J. (2017). Adolescents' depressive symptoms and subsequent technology-based interpersonal behaviors: a multi-wave study. *Journal of Applied Developmental Psychology*, *51*, 12–19.

Nesi, J., & Prinstein, M. J. (2015). Using social media for social comparison and feedback-seeking: gender and popularity moderate associations with depressive symptoms. *Journal of Abnormal Child Psychology*, *43*(8), 1427–1438.

Nesi, J., & Prinstein, M. J. (2018). In search of likes: longitudinal associations between adolescents' digital status seeking and health-risk behaviors. *Journal of Clinical Child & Adolescent Psychology*, *8*, 1–9. [Epub ahead of print].

Nesi, J., Rothenberg, W. A., Hussong, A. M., & Jackson, K. M. (2017). Friends' alcohol-related social networking site activity predicts escalations in adolescent drinking: mediation by peer norms. *Journal of Adolescent Health*, *60*(6), 641–647.

Nylund, K. L., Asparouhov, T., & Muthén, B. O. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: a Monte Carlo simulation study. *Structural Equation Modeling*, *14*(4), 535–569.

O'Keeffe, G. S.(2016). Social media: challenges and concerns for families. *Pediatric Clinics*, *63*(5), 841–849.

Obar, J. A., & Wildman, S. S. (2015). Social media definition and the governance challenge: An introduction to the special issue. *Telecommunications Policy*, *39*(9), 745–750.

Ohannessian, C. M. (2009). Does technology use moderate the relationship between parental alcoholism and adolescent alcohol and cigarette use? *Addictive Behaviors*, *34*(6–7), 606–609.

Padilla-Walker, L. M., Coyne, S. M., & Fraser, A. M. (2012). Getting a high-speed family connection: Associations between family media use and family connection. *Family Relations*, *61*(3), 426–440.

Petersen, I. T., Bates, J. E., Dodge, K. A., Lansford, J. E., & Pettit, G. S. (2015). Describing and predicting developmental profiles of externalizing problems from childhood to adulthood. *Development and Psychopathology*, *27*(3), 791–818.

Pew Research Center (2013). *Teens, social media, and privacy*. Pew Research Center. https://www.pewinternet.org/2013/05/21/teens-social-media-and-privacy/.

Pew Research Center (2018a). *Teens, social media, and technology 2018*. Pew Research Center. http://www.pewinternet.org/2018/05/31/teens-social-media-technology-2018/.

Pew Research Center (2018b). *Teens' social media habits and experiences*. Pew Research Center. http://www.pewinternet.org/2018/11/28/teens-social-media-habits-and-experiences/.

Pittman, M., & Reich, B. (2016). Social media and loneliness: why an instagram picture may be worth more than a thousand Twitter words. *Computers in Human Behavior*, *62*, 155–167.

Primack, B. A., Shensa, A., Escobar-Viera, C. G., Barrett, E. L., Sidani, J. E., Colditz, J. B., & James, A. E. (2017). Use of multiple social media platforms and symptoms of depression and anxiety: a nationally-representative study among US young adults. *Computers in Human Behavior*, *69*, 1–9.

Prinstein, M. J., Boergers, J., & Vernberg, E. M. (2001). Overt and relational aggression in adolescents: social-psychological adjustment of aggressors and victims. *Journal of Clinical Child Psychology*, *30*(4), 479–491.

Renninger, B. J. (2015). "Where I can be myself… where I can speak my mind": networked counterpublics in a polymedia environment. *New Media & Society*, *17*(9), 1513–1529.

Rideout, V. J. (2012). *Social media, social life: How teens view their digital lives*. San Francisco, CA: Common Sense Media.

Rose, A. J., & Rudolph, K. D. (2006). A review of sex differences in peer relationship processes: potential trade-offs for the emotional and behavioral development of girls and boys. *Psychological Bulletin*, *132*(1), 98–131.

Rudolph, K. D., Flynn, M., & Abaied, J. L. (2008). A developmental perspective on interpersonal theories of depression. In J. R. Z. Abela & B. L. Hankin (Eds.), *Handbook of depression in children and adolescents* (pp. 79–102). New York, NY: Guilford Press.

Saunders, J. F., & Eaton, A. A. (2018). Snaps, selfies, and shares: how three popular social media platforms contribute to the socio-cultural model of disordered eating among young women. *Cyberpsychology, Behavior, and Social Networking*, *21*(6), 343–354.

Scherer, C. W., & Cho, H. (2003). A social network contagion theory of risk perception. *Risk Analysis: An International Journal*, *23*(2), 261–267.

Scott, C. F., Bay-Cheng, L. Y., Prince, M. A., Nochajski, T. H., & Collins, R. L. (2017). Time spent online: latent profile analyses of emerging adults' social media use. *Computers in Human Behavior*, *75*, 311–319.

Seabrook, E. M., Kern, M. L., & Rickard, N. S. (2016). Social networking sites, depression, and anxiety: a systematic review. *JMIR Mental Health*, *3*(4), e50.

Shapiro, L. A. S., & Margolin, G. (2014). Growing up wired: social networking sites and adolescent psychosocial development. *Clinical Child and Family Psychology Review*, *17*(1), 1–18.

Sherman, L. E., Payton, A. A., Hernandez, L. M., Greenfield, P. M., & Dapretto, M. (2016). The power of the like in adolescence: effects of peer influence on neural and behavioral responses to social media. *Psychological Science*, *27*(7), 1027–1035.

Shifflet-Chila, E. D., Harold, R. D., Fitton, V. A., & Ahmedani, B. K. (2016). Adolescent and family development: autonomy and identity in the digital age. *Children and Youth Services Review*, *70*, 364–368.

Shulman, E. P., Smith, A. R., Silva, K., Icenogle, G., Duell, N., Chein, J., & Steinberg, L. (2016). The dual systems model: review, reappraisal, and reaffirmation. *Developmental Cognitive Neuroscience*, *17*, 103–117.

Strasburger, V. C. (2007). Super-peer theory. In J. J. Arnett (Ed.), *Encyclopedia of children, adolescents, and the media*. Thousand Oaks, CA: Sage Publications, Inc.

Subrahmanyam, K., & Greenfield, P. (2008). Online communication and adolescent relationships. *The Future of Children*, *18*(1), 119–146.

Sundar, S. S., & Limperos, A. M. (2013). Uses and grats 2.0: new gratifications for new media. *Journal of Broadcasting & Electronic Media*, *57*(4), 504–525.

Tottenham, N., & Galván, A. (2016). Stress and the adolescent brain: amygdala-prefrontal cortex circuitry and ventral striatum as developmental targets. *Neuroscience & Biobehavioral Reviews*, *70*, 217–227.

U.S. Census Bureau. (2016). County Population by Characteristics: 2010–2017. https://www.census.gov/data/datasets/2017/demo/popest/counties-detail.html-par_textimage_138860752.

Uhls, Y. T., Ellison, N. B., & Subrahmanyam, K. (2017). Benefits and costs of social media in adolescence. *Pediatrics*, *140*(Supplement 2), S67–S70.

Utz, S., Muscanell, N., & Khalid, C. (2015). Snapchat elicits more jealousy than Facebook: a comparison of Snapchat and Facebook use. *Cyberpsychology, Behavior, and Social Networking*, 18(3), 141–146.

Valkenburg, P. M., & Peter, J. (2011). Online communication among adolescents: an integrated model of its attraction, opportunities, and risks. *Journal of Adolescent Health*, 48(2), 121–127.

van Der Schuur, W. A., Baumgartner, S. E., Sumter, S. R., & Valkenburg, P. M. (2015). The consequences of media multitasking for youth: a review. *Computers in Human Behavior*, 53, 204–215.

Vannucci, A., Ohannessian, C. M., & Gagnon, S. (2018). Use of multiple social media platforms in relation to psychological functioning in emerging adults. *Emerging Adulthood*. [ahead of print].

Vannucci, A. & Ohannessian, C. M. (2018a). Psychometric properties of the brief loss of control over eating scale (LOCES-B) in early adolescents. *International Journal of Eating Disorders*, 51(5), 459–464.

Vannucci, A., & Ohannessian, C. M. (2018b). Self-competence and depressive symptom trajectories during adolescence. *Journal of Abnormal Child Psychology*, 46(5), 1089–1109.

Wang, R., Yang, F., Zheng, S., & Sundar, S. S. (2016). Why do we pin? New gratifications explain unique activities in Pinterest. *Social Media & Society*, 2(3), 1–9.

Weissman, M. M., Orvaschel, H., & Padian, N. (1980). Children's symptom and social functioning self-report scales comparison of mothers' and children's reports. *The Journal of Nervous and Mental Disease*, 168(12), 736–740.

Wheeler, L. (1966). Toward a theory of behavioral contagion. *Psychological Review*, 73(2), 179–192.

Wichstraum, L. (1995). Harter's self-perception profile for adolescents: reliability, validity, and evaluation of the question format. *Journal of Personality Assessment*, 65(1), 100–116.

Wills, T. A., Simons, J. S., Sussman, S., & Knight, R. (2016). Emotional self-control and dysregulation: a dual-process analysis of pathways to externalizing/internalizing symptomatology and positive well-being in younger adolescents. *Drug and Alcohol Dependence*, 163, S37–S45.

Wothke, W. (2000). Longitudinal and multigroup modeling with missing data. In T. D. Little, K. U. Schnabel & J. Baumert (Eds.), *Modeling longitudinal and multilevel data: practical issues, applied approaches, and specific examples* (pp. 219–240). Mahwah, NJ: Lawrence Erlbaum.

Yang, C. C., & Lee, Y. (2018). Interactants and activities on Facebook, Instagram, and Twitter: Associations between social media use and social adjustment to college. *Applied Developmental Science*. https://doi.org/10.1080/10888691.2018.1440233.

Zawawi, B. F., Al Abri, M. H., & Dabbah, N. (2017). Affordance analysis of Google+features: advancing teaching and learning in higher education. *Journal of Educational Multimedia and Hypermedia*, 26(4), 425–443.

Zhao, Y., Liu, J., Tang, J., & Zhu, Q. (2013). Conceptualizing perceived affordances in social media interaction design. *Aslib Proceedings*, 65(3), 289–303.

Zimet, G. D., Dahlem, N. W., Zimet, S. G., & Farley, G. K. (1988). The multidimensional scale of perceived social support. *Journal of Personality Assessment*, 52(1), 30–41.

Zimmer-Gembeck, M. J., & Collins, W. A. (2008). Autonomy development during adolescence. In G. Adams & M. Berzonsky (Eds.), *Blackwell handbook of adolescence* (pp. 175–204). Hoboken, NJ: Wiley-Blackwell.

Zimmer-Gembeck, M. J., & Skinner, E. A. (2011). The development of coping across childhood and adolescence: an integrative review and critique of research. *International Journal of Behavioral Development*, 35(1), 1–17.

Anna Vannucci is a research associate at Connecticut Children's Medical Center, and her research focuses on understanding the relationships between stress and emotional development during adolescence, as well as characterizing the biopsychosocial mechanisms that confer risk and resilience for psychopathology in youth.

Christine McCauley Ohannessian is the director of the Center for Behavioral Health Research at Connecticut Children's Medical Center and a professor in the departments of psychiatry and pediatrics at the University of Connecticut School of Medicine. Her research focuses on adolescent adjustment, especially in the areas of technology use, family functioning, and substance use.