When symptoms shape social ties: mental health as a predictor of online and in-person network evolution among gamers

Tyler Prochnow and Megan S. Patterson

Abstract

Purpose – *This study aims to examine how mental health symptoms and social support predict changes in online and in-person social networks among gamers over time. Although research has explored how social networks influence mental health, less is known about how mental health shapes the evolution of social connections in gaming contexts where relationships can form and dissolve fluidly.*

Design/methodology/approach – *Adult gamers (*n *= 236) completed surveys at two time points approximately six months apart measuring mental health symptoms (depressive symptoms, anxiety), perceived social support and characteristics of both their in-person and gaming-based social networks. Partial least squares regression models examined how Time 1 mental health and support measures predicted changes in network characteristics while controlling for baseline network measures.*

Findings – *Results revealed distinct patterns of network evolution across contexts. Higher initial depressive symptoms predicted strengthening of in-person relationships but decreases in online relationship quality over time. Anxiety emerged as a particularly influential predictor of online network development, with higher baseline anxiety associated with decreased closeness, confiding behavior and positive interactions in gaming relationships. Strong initial gaming community integration predicted decreased quality of in-person relationships, suggesting potential competition between virtual and physical social spheres.*

Originality/value – *This study provides longitudinal examination of how mental health symptoms distinctly influence the evolution of social networks across online and offline contexts among gamers. The findings demonstrate that different symptoms show unique patterns of association with network development over time, challenging assumptions about gaming spaces serving as universally accessible social environments.*

Keywords *Mental health, Social network analysis, Online gaming*

Paper type *Research paper*

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Introduction

Online gaming has evolved dramatically from its origins as a solitary activity into a complex social environment where millions of users build and maintain meaningful relationships (Kowert and Daniel, 2021; Mandryk *et al.*, 2020; Mandryk and Birk, 2017). Although extensive research has examined how gaming social networks influence mental health outcomes (Iacovides and Mekler, 2019; Halbrook *et al.*, 2019), less attention has been paid to the reverse relationship – how mental health symptoms may shape the formation, maintenance and dissolution of social connections within gaming communities (Perry *et al.*, 2018b; Depping *et al.*, 2018). Understanding these bidirectional relationships is crucial as online gaming becomes an increasingly significant source of social interaction and potential support.

The fundamental human need for social connection underlies the importance of understanding how mental health impacts relationship development in gaming spaces.

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Research consistently demonstrates that feeling close to others, having confidants to share personal information with and experiencing positive interactions are crucial for psychological well-being (Lieberman and Schroeder, 2020). These relationship qualities contribute to decreased loneliness, increased social support and improved mental health outcomes (Vella *et al.*, 2020; Vella-Brodrick *et al.*, 2023). Gaming environments provide unique opportunities for developing such meaningful connections through shared activities and goals while potentially offering lower barriers to initial relationship formation compared to face-to-face contexts (Depping *et al.*, 2018).

Mental health symptoms can impact social network formation and maintenance through multiple mechanisms. Depressive symptoms and anxiety often lead to social withdrawal, reduced energy for relationship maintenance and increased interpersonal difficulties (Kupferberg and Hasler, 2023; Liu *et al.*, 2024). For instance, symptoms of depression might reduce one's capacity or motivation to maintain regular contact with network members, whereas anxiety might influence the types of relationships individuals pursue or maintain (Liu *et al.*, 2024). The network episode model (NEM) provides a theoretical framework for understanding how health status shapes social network structure and function over time (Perry and Pescosolido, 2015; Pescosolido, 2021). The NEM suggests that individuals experiencing mental health symptoms may alter their pattern of social relationships in response to changing social capacities, needs and preferences.

Social network analysis (SNA) provides sophisticated methodological tools for examining how mental health shapes social structures and relationship quality (Valente, 2010). SNA enables examination of multiple network dimensions simultaneously, revealing how symptoms might differently affect various aspects of social connectivity (Perry and Pescosolido, 2015; Perry *et al.*, 2018a). Network metrics can capture changes in structural characteristics like network size and density, while also measuring important relationship qualities such as emotional closeness, confiding behavior and interaction valence (Peng *et al.*, 2021). This comprehensive measurement approach has been used in cross-sectional studies but longitudinal use is still rare (Prochnow *et al.*, 2023, 2020b, 2020a, 2021). Furthermore, this approach is particularly valuable for understanding how mental health symptoms might reshape both the structure and quality of social relationships over time (Perry *et al.*, 2018a; Perry and Pescosolido, 2015).

The structure of social relationships in gaming communities can be understood through the lens of social capital, which emerges through distinct network patterns of bridging and bonding connections (Prochnow *et al.*, 2023; Williams, 2006; Korkeila, 2023). Mental health symptoms may differentially impact these forms of social capital. Bonding social capital, characterized by close ties, high trust and intimate disclosure, may be particularly vulnerable to disruption when individuals experience symptoms that affect intimacy and self-disclosure (Korkeila, 2023; Vella *et al.*, 2020). Depressive symptoms might reduce the emotional resources needed to maintain these deep connections (Liu *et al.*, 2024). Meanwhile, bridging social capital, involving diverse weak ties, might be the first to deteriorate when individuals experience symptoms that lead to social withdrawal (Lieberman and Schroeder, 2020; Korkeila, 2023; Halbrook *et al.*, 2019).

Previous research suggests online and offline social relationships serve distinct functions and might have varying associations with mental health (Mandryk *et al.*, 2020; Vella *et al.*, 2020). The lower social demands and increased control in online interactions might make these networks more resilient to mental health disruption compared to in-person networks. Online gaming environments offer unique features that might buffer against network disruption, such as the ability to maintain connections through shared activities rather than direct social interaction, or the option to modulate social engagement levels without completely withdrawing (Lieberman and Schroeder, 2020; Halbrook *et al.*, 2019; Depping *et al.*, 2018). However, the reduced social obligation in online relationships might also make them more susceptible to abandonment when individuals experience mental health

symptoms. The development of close relationships in gaming spaces may be particularly important for well-being outcomes. Research demonstrates that feeling emotionally connected to others, having trusted confidants and experiencing positive interactions contribute significantly to psychological health (Mandryk *et al.*, 2020; Mandryk and Birk, 2017). These relationship qualities can provide crucial social support during periods of mental health difficulty. However, the extent to which gaming relationships fulfill these functions may depend on both individual mental health characteristics and the specific features of gaming environments that facilitate or hinder deep connection (Vella *et al.*, 2020; Depping *et al.*, 2018).

The present study uses SNA to examine how mental health symptoms influence the evolution of online and in-person social networks over time among gamers. While cross-sectional studies have identified associations between gaming networks and mental health (Mandryk *et al.*, 2020; Prochnow *et al.*, 2023, 2020b, 2020a), they cannot determine how symptoms shape subsequent network development. Understanding these temporal relationships is crucial for identifying how mental health status influences both the structure and quality of social connections in gaming communities. This research will inform the development of appropriate support strategies for maintaining beneficial social relationships during periods of mental health difficulty, while advancing our understanding of how different mental health symptoms uniquely impact various forms of social connection in contemporary gaming environments.

Methods

Participants and procedure

The study recruited online gamers ($n = 236$) from various gaming platforms and communities using CloudResearch Connect. Participants completed surveys at two time points, approximately six months apart (T1 and T2). This time frame was selected to allow sufficient time for mental health symptoms to influence network composition while minimizing participant attrition. Eligibility criteria included being at least 18 years old, currently engaging in online gaming activities and being able to provide informed consent. To minimize attrition, participants who completed the T1 survey received email reminders one month before T2 data collection. Each survey took 20–30 min to complete. Participants received $10 compensation for completing T1 and $15 for completing T2. Quality checks were performed at both time points, with participants needing to pass three of four quality checks for inclusion. All procedures were approved by the referent Institutional Review Board and participants were required to view an informed consent page prior to participation. All research was conducted in accordance with the Declaration of Helsinki.

Measures

Demographic and gaming variables

Participants reported standard demographic information including age and gender. Gaming engagement was assessed through self-reported estimates of typical weekly time spent playing online games. These variables were included as controls in all analyses given their established relationships with both mental health outcomes and social network characteristics in previous research.

Mental health predictors

The study assessed four key mental health constructs at T1 as predictors of subsequent network changes.

Depressive symptoms were measured using the eight-item Patient Health Questionnaire (PHQ-8; Kroenke *et al.*, 2001), which assesses the frequency of depressive symptoms over

the past two weeks with responses ranging from “not at all” (0) to “nearly every day” (3). The PHQ-8 evaluates key symptoms of depression including changes in sleep, energy, appetite, concentration and mood, providing a comprehensive assessment of depressive symptomatology. This measure has demonstrated strong diagnostic accuracy in meta-analyses (Manea *et al.*, 2015, 2012).

Anxiety symptoms were assessed using the trait subscale of the State-Trait Anxiety Inventory (STAI; Spielberger, 1970), a 20-item measure assessing general anxiety tendencies. The STAI examines enduring patterns of anxiety response including worry, tension, apprehension and nervous response. Participants rate how they generally feel regarding anxiety symptoms using a four-point scale ranging from “almost never” to “almost always”. The STAI has shown strong validity in both clinical and research settings (Seligman *et al.*, 2004).

Social connectedness measures

Social support at baseline was assessed using the abbreviated Multidimensional Scale of Perceived Social Support (MSPSS; Zimet *et al.*, 1990). The MSPSS comprehensively examines perceived support through four distinct domains: family support, friend support, significant other support and online support. Each support domain contains four items rated on a seven-point scale ranging from “very strongly disagree” to “very strongly agree”. The measure examines multiple facets of social support including emotional availability, instrumental assistance and perceived caring across different relationship types.

Social isolation was measured using the shortened UCLA Loneliness Scale (Hughes *et al.*, 2004), which consists of three items scored on a three-point scale. This measure evaluates participants’ subjective feelings of isolation, disconnection and lack of companionship. The abbreviated version maintains strong correlation with the full scale while reducing participant burden. Participants indicate how often they experience feelings of isolation ranging from “hardly ever” to “often”.

The final connectedness construct examined sense of community within online gaming spaces. This construct was measured using a four-item scale (Peterson *et al.*, 2008) adapted for the gaming context. The scale examines participants’ feelings of belonging, need fulfillment, community pride and perceived community strength within their gaming communities. Items are rated on a four-point scale from strongly disagree to strongly agree, with examples including assessments of belonging, personal need fulfillment through community membership, pride in community participation and perceived community cohesion. This adaptation builds on previous work examining how online spaces can serve as vital “third places” for social connection beyond work and home environments (Blanchard, 2007).

Social network outcomes

At both time points, participants identified up to five people they interacted with most through online gaming and up to five people they interacted with most in-person over the past 30 days (Prochnow *et al.*, 2020b; Perry *et al.*, 2018a; Prochnow *et al.*, 2020a; Reich *et al.*, 2012). Networks were limited to five connections to capture the most salient relationships while minimizing participant burden (Adams, 2019). For each identified connection, participants provided detailed relationship information through four key metrics. Average closeness was rated on a five-point scale from “not at all close” to “extremely close”. Confiding behavior was measured as the percentage of interactions involving personal information sharing. Finally, average feeling about interactions was rated on a five-point scale from “very negative” to “very positive”. These were specifically chosen as they have been associated with mental health and online gaming outcomes (Prochnow and Patterson, 2024).

Data analysis

The study used partial least squares (PLS) regression models to examine how Time 1 mental health indicators, social support and demographic variables predicted Time 2 network characteristics while controlling for Time 1 network measures. PLS regression was selected as the primary analytical approach due to its ability to handle multicollinearity among predictors and accommodate multiple correlated outcome variables (Wold *et al.*, 2001). The analysis examined eight distinct models investigating changes in network characteristics. Four models focused on in-person networks examining changes in average closeness, interaction frequency, confiding behavior and average feelings about interactions. Four parallel models examined these same characteristics within online gaming networks. Model estimation involved determining optimal components by examining variance explained in both predictor and outcome variables. The analytical process paid particular attention to incremental variance explained by each additional component. Variable importance in projection (VIP) scores above 1.0 identified key predictors, indicating variables contributing more than average to the model's predictive ability. Standardized coefficients revealed the direction and magnitude of relationships between predictors and outcomes. Model fit assessment incorporated multiple indicators including explained variance in predictors, explained variance in outcomes, total variance explained through R^2 values and adjusted R^2 values accounting for model complexity. This comprehensive analytical framework enabled examination of how different mental health symptoms and social support factors uniquely predicted changes in various aspects of both online and in-person social networks over time. All data were analyzed using SPSS v.29 (IBM, 2022).

Results

The study sample consisted of 236 participants (Table 1). The majority of participants identified as men ($n = 157$, 66.5%) and white or Caucasian ($n = 186$, 78.8%). Additional racial/ethnic representation included black or African American ($n = 31$, 13.1%), Asian ($n = 18$, 7.6%) and Hispanic, Latino/a/x or Spanish origin ($n = 34$, 14.4%) participants. Participants averaged 34.92 years of age (SD = 8.71). Educational attainment was high among the sample, as most participants had completed some form of postsecondary education. Specifically, 37.3% held a Bachelor's degree ($n = 88$) and 7.2% held graduate degrees ($n = 17$). Most participants were actively employed, with 63.1% working for wages and 15.7% being self-employed. The most commonly reported household income bracket was $50,000–$74,999, representing 23.0% of the sample. In terms of relationships, 38.6% of participants reported not currently dating ($n = 91$) and 30.9% were married ($n = 73$).

Partial least squares results

For in-person average closeness change, PLS regression analysis with two latent factors explained 38.9% of predictor variance and 16.0% of variance in closeness change ($R^2 = 0.160$, adjusted $R^2 = 0.151$; see Table 2). VIP scores indicated sense of community (VIP = 1.772), online social support (VIP = 1.589), friend social support (VIP = 1.193), depressive symptoms (VIP = 1.113), significant other support (VIP = 1.022) and social isolation (VIP = 1.029) were the most influential predictors. Sense of community ($b = -0.041$), online social support ($b = -0.035$) and friend support scores ($b = -0.009$) measured at baseline were associated with reporting reductions in closeness within in-person networks overtime. On the contrary, significant other support ($b = 0.015$), depressive symptoms ($b = 0.013$) and social isolation ($b = 0.005$) scores measured at baseline were associated with increased feelings of closeness within in-person networks overtime. In other words, while strong initial social support from gaming communities and online sources predicted decreased in-person closeness over time, those who began the study period with higher levels of

Table 1 Participant demographics ($n = 236$)

Characteristic	n *(%)*
Gender	
Man	157 (66.5)
Woman	78 (33.1)
Other	1 (0.4)
Race/ethnicity	
White or Caucasian	186 (78.8)
Black or African American	31 (13.1)
Asian	18 (7.6)
American Indian/Alaska native	4 (1.7)
Native Hawaiian/pacific islander	2 (0.8)
Other	6 (2.5)
Hispanic or Latinx	34 (14.4)
Education	
High school or less	54 (22.8)
Some college/technical training	49 (20.8)
Associates degree	28 (11.9)
Bachelor's degree	88 (37.3)
Graduate degree	17 (7.2)
Employment	
Employed for wages	149 (63.1)
Self-employed	37 (15.7)
Unemployed	29 (12.3)
Student	9 (3.8)
Other	12 (5.1)
Annual household income	
Less than $24,999	48 (20.4)
$25,000–$49,999	51 (21.7)
$50,000–$74,999	54 (23.0)
$75,000–$99,999	33 (14.0)
$100,000 or more	49 (20.8)

Note: Percentages may not sum to 100 due to rounding and participants being able to select multiple racial categories
Source: Table by authors

depressive symptoms, significant other support and social isolation showed increases in the closeness of their in-person relationships during the following six months.

Analysis of changes in in-person confidant relationships yielded a two-factor model explaining 33.8% of predictor variance and 14.4% of variance in confiding behavior change ($R^2 = 0.144$, adjusted $R^2 = 0.135$; see Table 2). Significant other support (VIP = 1.829), trait anxiety (VIP = 1.407), depressive symptoms (VIP = 1.472), sense of community (VIP = 1.105) and gaming hours (VIP = 1.287) demonstrated the highest VIP scores. Increases in average confidant scores within in-person networks were associated with significant other support ($b = 0.016$), depressive symptoms ($b = 0.008$) and gaming hours ($b = 0.003$) measured at baseline, whereas decreases in average confidant scores were associated with anxiety ($b = -0.003$) and sense of community ($b = -0.012$). Stated differently, initial levels of significant other support, depressive symptoms and gaming hours positively predicted increased confiding behavior over time, whereas higher initial anxiety and gaming sense of community suggested decreases over time.

For in-person relationship quality (as measured by how good the alters made the respondent feel), the two-factor model accounted for 35.4% of predictor variance and 15.5% of variance in feeling change ($R^2 = 0.155$, adjusted $R^2 = 0.146$; see Table 2). Based on VIP scores, sense of community (VIP = 1.990), gender (man: VIP = 1.693; woman:

Table 2 Partial least squares regression results for network change models

Outcome variable	*In-person average closeness*	*In-person percent confide*	*In-person average feeling*	*Online average closeness*	*Online percent confide*	*Online average feeling*
Model fit						
X variance	38.9%	33.8%	35.4%	32.5%	29.4%	33.6%
Y variance	16.0%	14.4%	15.5%	16.7%	14.4%	15.8%
R^2	0.160	0.144	0.155	0.167	0.144	0.158
Adjusted R^2	0.151	0.135	0.146	0.158	0.135	0.149
Variable effects b (VIP)						
Gender (man)	−0.030 (0.035)	0.022 (0.621)	0.038 (1.693)	−0.076 (0.649)	−0.038 (0.923)	−0.030 (0.473)
Gender (woman)	−0.031 (0.138)	−0.007 (0.599)	−0.120 (1.775)	−0.042 (0.633)	−0.053 (0.989)	−0.050 (0.483)
Age	−0.008 (0.862)	−0.003 (0.516)	−0.003 (0.750)	−0.005 (0.707)	−0.001 (1.037)	0.000 (0.083)
Gaming hours	0.001 (0.118)	0.003 (1.287)	0.000 (0.150)	0.002 (0.388)	0.000 (0.730)	−0.002 (1.306)
Online gaming sense of community	−0.041 (1.772)	−0.012 (1.105)	−0.037 (1.990)	−0.005 (0.406)	0.004 (1.071)	−0.016 (1.348)
Family support	0.007 (0.920)	0.000 (0.927)	0.013 (0.825)	−0.025 (0.838)	0.003 (0.927)	0.010 (0.640)
Significant other support	0.015 (1.022)	0.016 (1.829)	−0.005 (0.447)	−0.005 (0.315)	0.004 (1.049)	0.010 (1.224)
Friend support	−0.009 (1.193)	0.002 (0.797)	0.006 (0.469)	0.063 (1.677)	0.011 (0.797)	0.017 (0.177)
Online support	−0.035 (1.589)	−0.007 (0.303)	−0.002 (1.666)	−0.073 (1.642)	−0.014 (1.252)	−0.035 (1.666)
Social isolation	0.005 (1.029)	−0.011 (0.696)	0.004 (0.363)	−0.024 (1.009)	−0.001 (0.150)	0.044 (0.806)
Depressive symptoms	0.013 (1.113)	0.008 (1.472)	0.001 (0.190)	0.006 (1.113)	0.002 (1.472)	−0.013 (1.445)
Anxiety	−0.003 (0.523)	−0.003 (1.407)	−0.001 (0.363)	−0.025 (2.321)	0.005 (2.313)	−0.010 (1.470)

Notes: VIP = variable importance in projection; all models used two factors
Source: Table by authors

VIP = 1.775) and online social support (VIP = 1.666) were the most influential predictors. Feeling worse about relationships within in-person networks overtime was associated with baselines measures of sense of community ($b = -0.037$) online social support (b = −0.002) and being female ($b = -0.120$). Being male ($b = 0.038$) was the sole predictor related to feeling better about in-person relationships overtime among this sample of online gamers. Higher baseline levels of sense of community and online social support predicted decreased positive feelings about in-person interactions over time, whereas gender showed differential effects with being male positively associated with feeling changes.

The model examining changes in online relationship closeness with two factors explained 32.5% of predictor variance and 16.7% of variance in closeness change ($R^2 = 0.167$, adjusted $R^2 = 0.158$; see Table 2). Trait anxiety (VIP = 2.321), friend social support (VIP = 1.677), online social support (VIP = 1.642), depressive symptoms (VIP = 1.113) and social isolation (VIP = 1.009) emerged as key predictors. Decreases in closeness within online networks was associated with baseline online social support ($b = -0.073$), trait anxiety ($b = -0.025$) and depressive symptoms ($b = 0.006$), whereas baseline reports of friend social support ($b = 0.063$) and social isolation ($b = -0.024$) were associated with increased closeness within online networks. Higher baseline levels of trait anxiety, online social support and depressive symptoms predicted decreased online closeness over time, whereas initial friend support showed positive associations with developing closer online relationships.

For online confidant relationships, the two-factor model explained 29.4% of predictor variance and 14.4% of variance in confiding behavior change ($R^2 = 0.144$, adjusted $R^2 = 0.135$; see Table 2). Trait anxiety (VIP = 2.313), online social support (VIP = 1.252), significant other support (VIP = 1.049), age (VIP = 1.037), sense of community (VIP = 1.071) and depressive symptoms (VIP = 1.472) emerged as important predictors. Increases in confidant relationships within online networks were associated with baseline levels of significant other support ($b = 0.004$), sense of community ($b = 0.004$), and age ($b = -0.001$), whereas decreases in confidant relationships within online networks were associated with trait anxiety ($b = 0.005$), online social support ($b = -0.014$) and

depressive symptoms ($b = 0.002$). Higher baseline levels of significant other support, sense of community and age predicted increased confiding behavior over time, whereas trait anxiety, online support and depressive symptoms showed negative associations.

Finally, the model examining changes in online relationship quality with two factors accounted for 33.6% of predictor variance and 15.8% of variance in feeling change ($R^2 = 0.158$, adjusted $R^2 = 0.149$; see Table 2). Online social support (VIP = 1.666), depressive symptoms (VIP = 1.445), gaming hours (VIP = 1.306), significant other support (VIP = 1.224) and trait anxiety (VIP = 1.470) demonstrated the highest VIP scores. Increased relationship quality within online networks was associated with initial depressive symptoms ($b = -0.013$) and significant other support ($b = 0.010$), whereas decreased relationship quality within online networks was associated with baseline levels of online social support ($b = -0.035$), gaming hours ($b = -0.002$) and trait anxiety ($b = -0.010$). Higher baseline depressive symptoms and significant other support predicted improved feelings about online interactions over time, whereas initial online social support, gaming hours and trait anxiety showed negative associations with changes in interaction quality.

Discussion

This study investigated how mental health symptoms and social support predicted changes in both online and in-person social networks among gamers over a six-month period. Our findings revealed that different forms of initial social support and mental health symptoms distinctly influence the evolution of social relationships across contexts. Most notably, while strong gaming community integration and online social support predicted decreases in in-person relationship quality over time, those with higher initial levels of depressive symptoms showed strengthening of in-person connections. However, trait anxiety and depressive symptoms were associated with reduced feelings of closeness and confidant ties within online networks over time. These results extend previous work by demonstrating the complex temporal dynamics between mental health and social network evolution in gaming spaces (Depping *et al.*, 2018; Lieberman and Schroeder, 2020).

Trait anxiety and network evolution

The consistent impact of trait anxiety across network evolution, particularly in online gaming relationships, extends recent findings suggesting that gaming spaces may serve unique social functions (Prochnow *et al.*, 2020a, 2020b). Higher baseline anxiety predicted significant decreases in relationship closeness, confiding behavior and positive feelings about online interactions over the six-month period. This finding challenges common assumptions about online gaming spaces serving as "safer" social environments for anxious individuals (Vella *et al.*, 2020). Rather than providing a comfortable alternative to in-person interaction, our results suggest that anxiety may specifically impair the development and maintenance of relationships in gaming contexts, potentially due to performance pressures and social evaluation concerns unique to gaming environments (Depping *et al.*, 2018). And, while anxiety showed strong negative associations with online closeness and interaction quality, its minimal impact on in-person networks suggests differentiated effects across contexts. This relationship builds upon work suggesting gaming communities can provide social support while also potentially creating unique social stressors through performance expectations and social evaluation (Carras *et al.*, 2018; Cole *et al.*, 2020). Moreover, given online relationships may not be as emotionally deep and represent more opportunity for bridging capital as opposed to bonding capital, someone who registers higher initial anxiety scores may feel more apprehensive to connect with people they do not know or with whom the feel less close (Ahmad *et al.*, 2023). Overall, the differential impact of anxiety on in-person versus online relationships also suggests gaming spaces may not universally provide more comfortable social environments, contrasting with some previous

assumptions about online social interaction (Marston and Kowert, 2023; Halbrook *et al.*, 2019). These findings indicate the need to consider how specific mental health symptoms might uniquely influence different types of social relationships within gaming communities.

Depressive symptoms and network evolution

Like trait anxiety, depressive symptoms similarly showed context-specific effects, with positive associations to in-person closeness but negative relationships with online interaction quality. Higher initial depressive symptoms predicted increases in both the closeness and confiding nature of in-person relationships over time, challenging assumptions about depressive symptoms leading primarily to social withdrawal (Lieberman and Schroeder, 2020). This finding aligns with recent work suggesting individuals experiencing depressive symptoms may actively strengthen their in-person connections as a coping mechanism (Pescosolido, 2021). Furthermore, this could be explained by previous research that shows people who seek support for depression oftentimes start off finding support online, but transition to in-person support sources (Alavi *et al.*, 2023). However, strong initial integration in gaming communities predicted decreased quality of in-person relationships, suggesting potential competition between virtual and physical social spheres – a dynamic previously theorized but not empirically demonstrated (Perry *et al.*, 2018b). It could also be that those who experience more emotional support online, and therefore trend toward bonding social capital within their online networks, may require less from their in-person networks (Pan *et al.*, 2020).

Although depressive symptoms predicted strengthening of in-person relationships, it showed consistent negative associations with online relationship quality over time. This pattern suggests that individuals experiencing depressive symptoms may preferentially invest in strengthening their existing in-person connections rather than developing new relationships through gaming platforms (Cole *et al.*, 2020), and that as someone might need more emotional support from bonding ties, they may turn to those they have quality relationships with in-person. This finding advances our understanding of how different mental health symptoms may lead to distinct patterns of social investment across contexts. It also challenges assumptions about online gaming primarily serving as a compensatory social environment during periods of depressive symptoms (Halbrook *et al.*, 2019; Lieberman and Schroeder, 2020).

Social support and network evolution

The role of initial social support in shaping online network development provides additional insight into the complex dynamics at play. Higher baseline levels of online social support predicted decreased development of new gaming relationships over time, suggesting possible saturation effects in online social networks. However, strong initial friend support showed positive associations with developing closer online relationships, indicating that those with robust offline friendship networks may be better positioned to build meaningful connections in gaming spaces (Perry *et al.*, 2018b). This supports recent work suggesting that gaming relationships may serve to supplement rather than replace traditional support systems for some individuals (Di Blasi *et al.*, 2020). For in-person networks, significant other support predicted increases in both closeness and confiding behavior, whereas friend support and online social support predicted decreases in in-person relationship quality. This pattern extends recent findings about the distinctive characteristics of different support types in gaming contexts (Raith *et al.*, 2021; Snodgrass *et al.*, 2018), and how strong online support systems could reduce investment in in-person relationships, supporting theories about potential displacement effects in social gaming (Raith *et al.*, 2021; Snodgrass *et al.*, 2018).

Age and sense of community also emerged as important factors in online network evolution. Higher initial sense of community predicted increased confiding behavior in online relationships over time, suggesting that feeling integrated into gaming communities may facilitate deeper relationship development. However, this same strong community integration was associated with decreased in-person relationship quality, highlighting potential trade-offs between investment in online and offline social spheres (Cole *et al.*, 2020, 2017; Cole and Griffiths, 2007; Di Blasi *et al.*, 2020). These findings extend previous work on the distinctive characteristics of gaming communities by demonstrating how initial community attachment may shape subsequent relationship development patterns.

Theoretical implications

These findings advance theoretical understanding of how mental health shapes modern social network development in several important ways. Although previous work has examined gaming spaces as social environments (Halbrook *et al.*, 2019), our results demonstrate the need for more nuanced frameworks that account for simultaneous development of virtual and physical relationships. The distinct patterns of association between mental health symptoms and different types of social connections suggest gaming communities may serve unique social functions that existing theoretical models do not fully capture (Korkeila, 2023; Kowert and Oldmeadow, 2015). The temporal nature of our findings particularly highlights the need to consider network evolution rather than static relationships. This extends recent theoretical work on gaming social capital (Kim *et al.*, 2022; Trepte *et al.*, 2012) by demonstrating how different forms of social connection may develop asynchronously or even competitively. Our results also challenge traditional assumptions about online spaces as uniformly supportive environments for individuals experiencing mental health symptoms, suggesting need for more nuanced theoretical models of how specific symptoms influence different types of social interaction. These findings contribute to emerging frameworks for understanding gaming communities as distinctive social environments with their own patterns of relationship development and maintenance (Reer and Quandt, 2020).

Practical implications

For mental health practitioners, these results highlight several key considerations for clinical practice with gaming populations. Recent clinical frameworks have begun incorporating gaming experiences into assessment protocols (Colder Carras *et al.*, 2020) and our findings support this approach while suggesting need for more nuanced evaluation. The differential effects of anxiety and depressive symptoms on network development indicate practitioners should consider how specific symptoms might influence various types of social connections differently. This extends beyond simple assessment of gaming time or addiction risk to consider the quality and context of gaming relationships (Stavropoulos *et al.*, 2019). Practitioners should particularly note that strong gaming community integration might coincide with reduced in-person relationship maintenance, though this pattern varies based on individual mental health characteristics. The positive association between depressive symptoms and in-person closeness among gamers also suggests gaming relationships might serve protective functions that clinicians should consider before recommending reduced gaming engagement (Kowert and Daniel, 2021).

Game developers and community managers can also draw several practical insights from these findings. The strong influence of trait anxiety on online relationship development suggests need for features that reduce performance pressure while maintaining social engagement opportunities. Recent work has highlighted the importance of flexible social features in gaming spaces (Reer and Quandt, 2020) and our results support this while suggesting specific attention to anxiety-related barriers. Developers might consider implementing graduated social engagement options that allow players to build comfort over

time. The complex relationship between sense of community and network development also suggests value in features that support transfer of gaming relationships to other contexts, building on recent work about social capital development in gaming spaces (Tseng *et al.*, 2015; Korkeila, 2023; Mandryk *et al.*, 2020).

Limitations and future directions

Several methodological considerations affect interpretation of these findings. Although our models captured multiple relationship qualities, the modest variance explained suggests examination of additional factors. Future work should consider specific game types, communication methods and playing patterns that may influence relationship development (Kowert and Oldmeadow, 2015; Kowert and Daniel, 2021). The role of game genre particularly warrants investigation, as different types of games may create distinct social environments and opportunities for relationship development. In addition, investigation of more complex network metrics beyond dyadic measures could provide richer understanding of how mental health shapes overall network structure (Prochnow *et al.*, 2023). Our sampling approach and timeline present additional limitations requiring consideration. The six-month follow-up period may not capture longer-term network evolution patterns that could emerge over extended timeframes. Future research should examine these relationships across longer periods with more frequent measurement points to better understand temporal dynamics. Our sample also primarily consisted of adult gamers in the USA, potentially limiting generalizability. The demographic composition, while reflecting much of the gaming population, suggests a need for examination across more diverse groups as well as in other countries and cultures. Recent work has highlighted cultural differences in gaming social experiences (Kim *et al.*, 2022), indicating value in cross-cultural investigation of these patterns. Finally, although this work displays quantitative associations, additional qualitative work may be needed to explore these relationships further.

Conclusion

This study provides important insights into how mental health symptoms and social support distinctly influence the evolution of online and in-person social networks among gamers. The findings suggest gaming communities offer unique opportunities and challenges for social connection that vary based on individual mental health characteristics. As gaming continues to grow as a social space, understanding these complex relationships becomes increasingly important for supporting healthy social development. Future work should build on these findings to develop more comprehensive models of how virtual and physical relationships interact in contemporary social life, whereas practitioners can apply these insights to better support individuals navigating multiple forms of social connection.

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