



Who's most at risk of poor body image? Identifying subgroups of adolescent social media users over the course of a year[☆]

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ARTICLE INFO

Handling Editor: Catalina L Toma

Keywords:

Social media
Body image
Subgroups
Prospective
Adolescents
Stability

ABSTRACT

Types and stability of appearance-related social media use patterns remain under-explored despite established links between social media use and wellbeing. This study aimed to identify subgroups of social media users, and explore whether subgroup membership was stable over time and associated with body image-related outcomes. Adolescents ($N = 766$; $M_{\text{age}} = 12.76$, $SD = 0.73$; 49.40% female) completed four surveys across 1-year, reporting several social media use indices, body dissatisfaction, dietary restraint, and strategies to increase muscle. Latent profile analyses identified two subgroups (moderate and high users), that remained reasonably stable over time. The high subgroup exhibited poorer body image at baseline, though differences seemed to dissipate somewhat over 1-year. Examination of subgroup transition over time showed more rapid increases in poor body image outcomes among social media increasers and more rapid declines for reducers. Prevention programs which aim to reduce high levels of social media use among children, young adolescents, and high-risk individuals (i.e., appearance-focused users) appear warranted.

Social media use is prevalent and pervasive, especially among adolescents (Vannucci & Ohannessian, 2019). Concerningly, time spent on social media, particularly appearance-focused use, has been found to predict body dissatisfaction, dietary restraint, and strategies to increase muscle (Yee et al., 2020; Zhang, Wang, Li, & Wu, 2021). However, the social media experience is not homogenous. Users engage at different frequencies, with different types of content, for different reasons, and with different activities. In addition, little is known about who is at greatest risk for poor body image. Person-centred approaches that focus on individuals with shared patterns of use across a variety of social media use variables can be leveraged to fill this gap. Accordingly, the present study aimed to identify and track subgroups of adolescent social media users and examine if these subgroups are useful for prediction of body image related outcomes over 1-year, specifically body dissatisfaction, dietary restraint, and strategies to increase muscle.

According to sociocultural theories of the development of body image, high levels of social media use have a detrimental impact on body image and related outcomes due to its visual, appearance-focused, and often idealised nature (Rodgers, 2016). While the majority of research has used cross-sectional data to explore this (e.g., Saiphoo & Vahedi, 2019), some prospective evidence suggests that use of appearance-focused social media may be especially detrimental to body image, as compared to overall time spent online (de Valle, Gallego-Garcia, Williamson, & Wade, 2021; Fioravanti, Bocci Benucci, Ceragioli, & Casale, 2022; Ryding & Kuss, 2019). Furthermore, uses and gratification theory (Katz, Haas, & Gurevitch, 1973) proposes that users are purposive in their media use in order to fulfil certain psychological needs. Prospective evidence in the social media context supports this, with reciprocal relationships found between social media use and body image through appearance comparisons (Jarman, McLean, Slater,

[☆] All authors have agreed to the submission. The article is not currently being considered for publication by any other print or electronic journal.

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<https://doi.org/10.1016/j.chb.2023.107823>

Received 4 April 2023; Received in revised form 23 May 2023; Accepted 25 May 2023

Available online 2 June 2023

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Marques, & Paxton, 2021). This suggests a feedback cycle (Perloff, 2014) whereby higher social media use predicts more body image concerns, which then encourages greater engagement in social media, and so on. As a result, social media engagement patterns may determine level of risk for body image concerns.

Concerningly, the high uptake of social media among adolescents also coincides with a developmental period of heightened vulnerability for poor body image. Specifically, a range of developmental factors contribute to elevated levels of appearance concerns during adolescence, including physical changes to the body during puberty and increased importance of peer relationships and pressures (Markey, 2010). Key features of the social media environment (e.g., idealised appearance images, public and quantifiable feedback) can exacerbate these concerns, especially for adolescent girls who also experience gender-related societal pressures which place greater emphasis on the importance of physical attractiveness for girls and women (Choukas-Bradley, Roberts, Maheux, & Nesi, 2022). These factors all contribute to make adolescents especially at-risk for detrimental impacts on body image-related outcomes.

1. Distinct types of social media users

Given that social media platforms present various features and content, it is likely that users have distinct patterns of engagement which can be discerned as typologies (i.e., subgroups). Research has also identified different types of adolescent users based on their frequency of social media use, including low users, high overall users, and high Instagram and Snapchat users (Vannucci & Ohannessian, 2019). In addition, Coyne, Padilla-Walker, Holmgren, and Stockdale (2018) found that type of user subgroups remained stable (84%; i.e., moderate users), increased in their social media use (11%), or increased then returned to baseline levels (6%) over 6-years. Subgroups based on usage type have also been found to have distinct well-being outcomes over time, with moderate users reporting more favourable outcomes (e.g., lower depression; Coyne et al., 2018) and high users reporting poorer outcomes (e.g., higher depressive symptoms and lower social support; Vannucci & Ohannessian, 2019). Extending on multivariable methodologies which evaluate whether a variable predicts an outcome, this latent profile analysis offers an approach to explore whether high scores on a range of key predictors are common and whether they tend to fit together. However, no research has yet used latent approaches to examine social media use beyond frequency (i.e., on aspects such as appearance-focused use) and the impact of these distinct usage patterns on body image-related outcomes.

Only a small number of studies have examined the stability of adolescent social media use subgroups over time. Winstone, Mars, Haworth, Heron, and Kidger (2022) identified four subgroups of social media users among adolescents; high communicators (47.8%; frequent interacting and moderate content sharing), moderate communicators (33.1%; moderate interacting and minimal content sharing), broadcasters (12.6%; frequent content sharing and interacting), and minimal users (6.5%; non- or infrequent use). Over 1-year, users became more active, demonstrating some transition across groups. While the prevalence of the broadcaster and high communicators subgroups increased, the other two subgroups decreased; with the minimal user subgroup shrinking so substantially it disappeared, leaving a three-class solution. These findings demonstrate variation and transition in adolescent subgroups over time. However, more research is needed to examine this further, including how this is related to body image outcomes.

While much research has focused on the impact of social media on body image, some evidence extends impacts to disordered eating outcomes (Zhang et al., 2021). Dietary restraint and muscle building are two forms of disordered eating behaviours which can manifest as a result of body image concerns (Rodgers, Slater, et al., 2020). By engaging in these behaviours, an individual may be seeking to achieve a body type which aligns with societal appearance ideals, namely the thin- and

muscular-ideal. Indeed, experimental research has demonstrated that exposure to fitspiration images led to urges to reduce body fat and increase muscularity among young men (Yee et al., 2020). Further research which explores the impact of social media on these types of behaviours is critical and will help inform the prevention of disordered eating and eating disorders.

1.1. Social media engagement

Time spent on social media is the most frequently used index of use and can provide a good indication of the level of exposure to certain social media platforms. Despite this, time spent on social media is a poor metric used in isolation given that it is not able to capture nuances, such as varied motivations, content, or types of activities. As a result, researchers have called for a broader range of metrics to be considered (Jarman et al., 2022). While less frequently assessed, social media use has been conceptualised across a number of different dimensions. Based on theory and empirical research (e.g., Rodgers & Melioli, 2016), a number of appearance-focused types of social media engagements have been identified as potential contributors to, and maintenance factors of, negative body image and, consequently, require exploration. Such dimensions include motivated social media use (e.g., for appearance, connection reasons), editing of photos, and appearance-focused conversations on social media.

In line with uses and gratification theory (Katz et al., 1973), an individual's motivation for media use often plays a role in engagement. Adolescents are motivated to use social media for a wide range of purposes, such as social connection, popularity, appearance feedback, or values and interests (Rodgers, McLean, et al., 2020). These will likely have differential impacts on body image. For example, motivations to engage with social media that are unrelated to appearance, and focused on values and interests may not be associated with body image as they instead encourage more varied interests and sources of self-worth. In contrast, higher motivations for appearance feedback may be related to poorer body image outcomes both directly, should the feedback be perceived as negative, and indirectly by reinforcing appearance investment and engagement in appearance-related online activities. Relatedly, photo editing is often used to alter appearance to align more closely with appearance ideals (Dhir, Pallesen, Torsheim, & Andreassen, 2016). This practice has been found to increase facial dissatisfaction and negative mood among women (Tiggemann, Anderberg, & Brown, 2020). The interactive and visual nature of social media also facilitates appearance-focused conversations. Among adolescents, engagement in appearance conversations on social media has been identified as the most salient preceding risk factor for online appearance preoccupation five years later (Zimmer-Gembeck, Hawes, Scott, Campbell, & Webb, 2023). This activity may reinforce pressure to conform to appearance ideals, resulting in greater body dissatisfaction (Tiggemann & Barbato, 2018).

While these findings suggest that greater appearance-focused social media engagement confers more risk, on their own, each of these indices only paint part of the picture. Consequently, it would be helpful to consider these elements in concert to capture subgroups of users based on their patterns of use. This would indicate which variables may cluster together to be associated with poor body image outcomes or, in contrast, lower risk. As well as examining subgroups at one timepoint, it would be informative to evaluate stability in these subgroups are over time to understand whether this risk may be temporary or more enduring, and how transition between usage subgroups may contribute to risk.

1.2. The present study

Previous social media research has relied on cross-sectional data to explore the relationship between social media use and body image (e.g., Saiphoo & Vahedi, 2019), meaning causality cannot be inferred. To address this, the present study used a longitudinal design where

adolescents were asked to complete a survey on four occasions over 1-year. In addition, the present study builds on prior work by evaluating a broader range of social media constructs and aims to determine: (1) whether individuals can be differentiated based on patterns of use; (2) whether these subgroups are stable over time; and (3) whether subgroup membership is associated with body dissatisfaction, dietary restraint, and strategies to increase muscle at baseline and over 1-year. It was hypothesised that a subgroup of individuals would exhibit higher levels of appearance-focused social media use across a range of social media use indices (Hypothesis 1), and that this pattern of use would remain largely stable over 1-year (Hypothesis 2) and be associated with poorer body image-related outcomes compared to other patterns of use (Hypothesis 3).

2. Method

2.1. Participants

A baseline sample of 775 adolescents was recruited from eight schools in Melbourne, Australia, of which five were government and three were independent schools, as part of a larger intervention study (Gordon et al., 2020). Participants identified as female ($n = 381$; 49.03%), male ($n = 385$; 49.68%), other ($n = 3$; 0.39%), responded that they would prefer not to say ($n = 6$; 0.77%), or did not report gender ($n = 1$; 0.01%). Gender was included as a covariate within the analyses and given the small proportion of individuals who identified with a gender other than male or female or did not identify their gender ($n = 10$), these participants were omitted from the sample prior to analyses. The final sample comprised 766 participants ($M_{\text{age}} = 12.76$, $SD = 0.73$, range = 11–15 years; 50.33% male). In line with ethical approval, six of the schools required written parental consent and the remaining three required informed opt out parent consent. Active participant assent was also collected for all participants. Participants were invited to participate in an online survey across four timepoints over 1-year. The majority of participants were born in Australia and lived in areas of high socioeconomic advantage (Australian Bureau of Statistics, 2018). For a detailed description of the full sample, please refer to Gordon et al. (2020).

2.2. Measures

2.2.1. Demographics

Participants self-reported their age, gender, and country of birth. Home postcode was also collected as a means to calculate socioeconomic status.

2.2.2. Social media use engagement

2.2.2.1. Time spent on appearance-focused platforms. The frequency of Instagram and Snapchat use was used as a measure of appearance-focused social media use. Participants were asked to report the frequency of their use of each platform on a 5-point scale from 1 (never) to 5 (always). A mean score was calculated, with higher values indicating greater exposure to appearance-focused platforms. The Spearman-Brown coefficient for this two-item scale indicated moderate internal consistency ($r_s = 0.52$ – 0.75).

2.2.2.2. Motivated social media use. The Motivations for Social Media Use Scale (Rodgers, McLean, et al., 2020) was used to assess social media behaviour as motivated across four areas: social connection (3-items; e.g., “I use social media otherwise I might miss out on what is going on with my friends”), popularity (4-items; e.g., “I use social media to increase my popularity”), appearance feedback (5-items; “I use social media to know if my pictures look attractive”), and values and interests (3-items; e.g., “I use social media to promote issues that matter to me”).

Participants responded on a 5-point scale ranging from 1 (never) to 5 (always). Means were calculated for each subscale, with higher values indicating greater frequency of behaviour motivated by connection, popularity, appearance feedback, and values and interests. Internal reliability was high across each subscale ($\omega = 0.75$ – 0.84).

2.2.2.3. Photo editing on social media. To assess whether participants edited their social media photos, participants were asked “Do you edit or add filters to photos of yourself (including selfies) that you post or share on social media to make yourself look better?” using a 5-point scale from 1 (never) to 5 (always).

2.2.2.4. Appearance-focused conversations on social media. Engagement in appearance-focused conversations on social media was assessed with 2-items (“On social media, I give and receive comments about appearance (how attractive or unattractive someone is)” and “On social media, I give and receive comments about body size, shape or muscles”). Participants responded on 5-point scale from 1 (never) to 5 (always). A mean score was calculated, with higher values indicating greater appearance-focused conversations on social media. The Spearman-Brown coefficient for this two-item scale indicated high internal consistency ($r_s = 0.76$ – 0.79).

2.2.3. Body dissatisfaction

The Weight and Shape Concern subscale of the Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994) assessed body dissatisfaction. Participants responded to the 12-items (e.g., “Have you had a strong desire to lose weight?”) on a 7-point scale from 0 (not at all) to 6 (markedly). A mean score was calculated, with higher values indicating greater body dissatisfaction. Internal reliability was high across all timepoints ($\omega = 0.92$).

2.2.4. Dietary restraint

The Restraint subscale of the Dutch Eating Behaviour Questionnaire (van Strien, Frijters, Bergers, & Defares, 1986) was used to measure frequency of dietary restraint. Participants responded to the 10-items (e.g., “Do you deliberately eat less in order not to become heavier?”) using a 5-point scale from 1 (never) to 5 (very often). A mean score was calculated, with higher values indicating greater dietary restraint. Internal reliability was high across all timepoints ($\omega = 0.91$).

2.2.5. Strategies to increase muscle size

The Strategies to Increase Muscle Size subscale of the Body Change Inventory (Ricciardelli & McCabe, 2002) assessed frequency of attitudes and behaviours that reflect strategies to increase muscle. Participants responded to the 6-items (e.g., “How often do you change your levels of exercise to increase the size of your muscles?”) using a 5-point scale from 1 (never) to 5 (always). A mean score was calculated, with higher values indicating greater attitudes and behaviours that reflect strategies to increase muscle. Internal reliability was high across all timepoints ($\omega = 0.86$).

2.3. Procedure

This study received ethics approval from the University’s ethics committee (HEC17-020). Data were collected between November 2017 and August 2019. In line with the intervention design of the original research, participants in Grade 7–8 were invited to complete an online survey on four separate occasions over 1-year (baseline, 5-week follow-up, 6-month follow-up, and 12-month follow-up). All measures presented above were included in each survey. Study measures have been used and validated among adolescent populations. For a full description of the psychometric properties of the measures, see Gordon et al. (2020). Data collection was facilitated by a research team, alongside the classroom teachers, and surveys were completed online through Qualtrics.

Surveys were matched using a unique participant code which was generated by each participant.

2.4. Statistical analysis

Preliminary analysis was conducted in SPSS. While a substantial amount of data were missing across the four timepoints (0–37.59%), this was largely due to dropout at follow-up timepoints (e.g., absenteeism). Despite this, missing data analysis found that these were missing completely at random: $\chi^2(4796, N = 766) = 4642.58, p = .943$. This supports that missing data was at random, likely due to random chance of who was present or not present at school on the day of each data collection. Associations between study variables were examined using Pearson correlations.

For the main analyses, data were tested using Mplus 8 (Muthén & Muthén, 2017). First, latent profile analysis (LPA) was performed to test Hypothesis 1. Subgroups were identified based on their social media use across a number of baseline indicators, including frequency of Instagram and Snapchat use, editing photos, appearance conversations on social media, and motivated social media use (social connection, popularity, appearance feedback, and values and interests). Imputation was performed on the data to impute a small number of missing values for covariates. Analyses required no missing data on covariates so given only a small amount of data were missing, single rather than multiple imputation was used. The steps laid out by Ferguson, Moore, W, and Hull (2019) were followed. The mean and variance of the profile indicators were freely estimated in all profiles (Peugh & Fan, 2013).

To determine the optimal number of profiles, model fit and interpretability were evaluated. In line with previous recommendations (e.g., Spurk, Hirschi, Wang, Valero, & Kauffeld, 2020), a number of indices were examined including Bayesian information criteria (BIC) values, classification accuracy (i.e., entropy), the Lo, Mendell, and Rubin likelihood ratio test (LMR-LRT), and the proportion of people in each class. Lower values on BIC and higher values on entropy indicate better fit. A significant p-value for LMR-LRT suggests that the current model provides better fit than a model with one less class. Next, given the theoretical grounds that age, gender, and intervention condition could impact the results, they were all added to the model as covariates. Note, these data were from a randomised controlled trial which evaluated a social media literacy intervention among adolescents (Gordon et al., 2021). However, only minor intervention effects ($d = 0.19$ – 0.29) were found so including this variable (intervention condition) as a covariate was deemed appropriate.

Given the initial LPA was examined using baseline data only, latent transition analysis (LTA) was conducted to test Hypothesis 2; namely, the temporal stability of the profiles over time. First, the LPA solution at time 1 and time 4 were examined to see if the same number of profiles was found for both. Next, measurement invariance testing was conducted by running both timepoints together in two steps: (1) an unconstrained model (i.e., without parameter constraints); and (2) a constrained model (i.e., where parameters are forced to be equal over time). The model log likelihood values were then compared using the Satorra-Bentler correction approach for multilevel modelling (MLM; Satorra & Bentler, 2010) to test if the models were significantly different. If full measurement invariance was not supported (i.e., models were significantly different) then partial invariance would be tested using the forward approach whereby equality constraints are introduced sequentially (Nylund-Gibson et al., 2022). The order of parameters added was determined by the size of the discrepancy for the same class over time, starting from the smallest to the largest discrepancy across all 14 parameters. Each model would then be tested and compared to the baseline model without parameter constraints until the models were found to be significantly different to identify at what stage the model becomes invariant. Additionally, to explore membership stability/transition over 1-year, four groups were created of individuals who remained stable and those who transitioned. Group differences were

then examined across all demographic and social media use variables to identify predictors of group transition. A series of one-way analysis of variance were performed on continuous data (age, social media use variables) and a chi-square analysis was performed on categorical data (gender).

To test the final hypothesis, of whether subgroup membership predicted body dissatisfaction, dietary restraint, and strategies to increase muscle at baseline and 1-year follow-up, MLM was performed. Data were collected across time so were hierarchical in nature, whereby participants completed a survey at four different timepoints (level 1) which was nested within individuals (level 2). MLM was performed to account for this structure model. For repeated measures designs, MLM considers each individual as a distinct group, thus providing estimates of within- and between-individual variation in the relationship between the outcome variables across time. Time was coded as 0, 0.1, 0.5, and 1 to reflect spacing between data collection timepoints. Maximum likelihood estimation with robust standard errors and full information maximum likelihood were used. Analysis proceeded in several steps. First, the random effect of time was modelled at Level 1 and changes in body image-related outcomes were tested by regressing the outcome variable (i.e., body dissatisfaction, dietary restraint, or body change strategies to increase muscle) on time. Each outcome variable was modelled separately. Given rate of change may differ between participants, this effect was allowed to vary across individuals. Second, the random effect was modelled at Level 2 whereby outcome variables were regressed onto the predictors, including covariates. This step evaluated whether social media subgroup predicted (1) baseline scores on outcome variables, and (2) the magnitude of time-related changes in outcome variables. These analyses were also run with dummy coded membership transition as a predictor to determine if this was associated with body image-related outcomes.

3. Results

3.1. Preliminary analyses

On average, participants reported using social media ‘sometimes’ and reported low-to-moderate scores across the social media variables. Correlations between study variables at baseline are presented in Table 1. Pearson correlations in the full sample showed that the baseline indices of subgroups (frequency of use, motivated use, photo editing, and appearance-focused conversations on social media) were all positively associated with each other, with moderate-to-strong relationships. Similarly, the body image-related outcomes had largely strong positive correlations with each other. When examined together, the baseline social media indices and body image-related outcomes were weakly-to-moderately positively correlated.

3.2. Identifying subgroups (hypothesis 1)

In Table 2, the fit indices of the 2-, 3-, 4-, 5-, and 6-class models of social media use are presented. According to the adjusted LMR-LRT, the 2-class solution appeared to be most appropriate given the significant value. Further, all other solutions contained a class with approximately 3–5% of the sample which are often omitted as they can be considered spurious (Delucchi, Matzger, & Weisner, 2004; He & Fan, 2019). Consequently, a 2-class solution was retained in the present study.

Table 3 displays the mean scores for each baseline indicator variable across the two social media use classes, herein referred to as subgroups. In the final 2-class solution, the subgroups were defined by the authors as: (1) moderate and (2) high appearance-focused social media use. Subgroup 1 comprised 633 participants (82.64%) who tended to report moderate social media use, photo editing practices, appearance conversations on social media, and motivation for use, and hence were labelled ‘moderate users’. Subgroup 2 comprised 133 participants (17.36%) who reported higher scores on each index than the moderate

Table 1
Correlations of social media use indices and body image-related outcomes at baseline.

	1	2	3	4	5	6	7	8	9	10
Baseline indices of social media use										
1. Frequency of Instagram and Snapchat use	–	.45	.34	.30	.21	.47	.37	.25	.19	.23
2. Connection-motivated social media use		–	.61	.54	.47	.38	.39	.33	.30	.26
3. Popularity-motivated social media use			–	.75	.39	.31	.50	.36	.35	.32
4. Appearance feedback-motivated social media use				–	.38	.40	.53	.44	.42	.34
5. Values and interests-motivated social media use					–	.23	.36	.23	.26	.18
6. Photo editing						–	.35	.27	.18	.20
7. Appearance-focused conversations							–	.32	.35	.33
Baseline body image-related outcomes										
8. Body dissatisfaction								–	.76	.46
9. Dietary restraint									–	.54
10. Strategies to increase muscle										–

Note. All correlations were significantly related at $p < .001$ (two-tailed).

Table 2
Fit indices for varying class solutions of social media use indices at baseline.

Number of classes	BIC	Adjusted LMR-LRT p-value	Smallest class n	Entropy
2	12670.492	.008 (2 > 1)	133 (17%)	.95
3	12217.092	.467 (3 < 2)	34 (5%)	.97
4	11883.738	.338 (4 < 3)	33 (4%)	.86
5	11697.087	.532 (5 < 4)	25 (3%)	.88
6	11615.887	.475 (6 < 5)	20 (3%)	.89

Note. BIC = Bayesian information criteria values; LMR-LRT = Lo–Mendell–Rubin likelihood ratio test.

subgroup, hence they were labelled ‘high users.’ For most indices, scores were elevated in the high-use subgroup compared to the moderate subgroup, for example constituting “often” vs “sometimes” frequency of social media use. Notably, a pattern emerged for motivations such that moderate users had slightly higher connection- and values and interests-motivated social media use than for other purposes whereas the high users had slightly higher connection-motivated social media use than for other purposes.

When the covariates were added to the model, two of these three variables significantly predicted subgroups, namely gender ($B = -0.88$, $SE = 0.23$, $p < .001$) and age ($B = -0.55$, $SE = 0.13$, $p < .001$). Females and older adolescents were more likely to be in the high users subgroup than the moderate users. Compared to moderate users, high users were more than twice as likely to be female (odds ratio [OR] 2.41, 95% confidence interval [CI] 1.552–3.741). The intervention condition did not predict subgroup membership ($B = -0.32$, $SE = 0.24$, $p = .175$).

3.3. Stability of subgroups over time (hypothesis 2)

When the LPA was performed at time 1 and time 4 separately, a 2-class solution was superior at both timepoints and the means appeared to be somewhat similar for each subgroup at each timepoint.

Table 3
Scores on baseline social media use variables across total sample and by subgroups.

	Score range	Total sample (n = 766) M (SD)	Subgroup 1 Moderate users (n = 633) M (SD)	Subgroup 2 High users (n = 133) M (SD)	Cohen’s d
Frequency of Instagram and Snapchat use	1–5	2.98 (1.43)	2.77 (1.40)	4.00 (1.06)	0.99
Connection-motivated social media use	1–5	2.48 (1.17)	2.16 (1.02)	3.79 (0.82)	1.76
Popularity-motivated social media use	1–5	1.67 (0.93)	1.32 (0.51)	3.12 (0.91)	2.44
Appearance feedback-motivated social media use	1–5	1.43 (0.77)	1.12 (0.26)	2.74 (0.83)	2.63
Values and interests- motivated social media use	1–5	2.12 (1.13)	1.90 (1.02)	3.00 (1.12)	1.03
Photo editing	1–5	1.95 (1.20)	1.72 (1.03)	3.07 (1.35)	1.12
Appearance-focused conversations	1–5	1.48 (0.84)	1.27 (0.57)	2.47 (1.15)	1.32

Measurement invariance testing found significant differences in model fit when parameters were forced to be equal over time, therefore partial invariance was used by forcing equality on parameters sequentially. This approach was taken until the partial invariance model did not significantly differ from the baseline model. The finalised model contained 8 invariant and 6 non-invariant parameters. This lack of measurement invariance across subgroups indicated that, although there were similarities between time 1 and time 4, differences also existed. Specifically, for moderate users, frequency of Instagram and Snapchat use increased and values and interests-motivated social media use decreased over time. For high users, popularity- and connection-motivated social media use and photo editing decreased and appearance conversations increased over time.

In the LTA for time 1, the moderate and high subgroup consisted of 625 (81.6%) and 140 (18.4%) participants, respectively. At time 4, the moderate and high subgroups consisted of 567 (74.1%) and 198 (25.9%) participants, respectively. Participants in the moderate subgroup at baseline had a high probability (0.83) of remaining in that subgroup and a low-moderate probability (0.38) of transitioning to the high subgroup at 1-year follow-up. Participants in the high subgroup at baseline had a moderate probability (0.62) of remaining in that subgroup and a low probability (0.17) of transitioning to the moderate subgroup at 1-year follow-up. These findings suggest that, while most participants remained in the same subgroup, a small proportion had transitioned between subgroups at 1-year follow-up.

Based on these data, four distinct groups were created; those who remained stable in the moderate group ($n = 548$) and high group ($n = 100$), and increasers (i.e., those who transitioned from moderate to high; $n = 80$) and reducers (i.e., those who transitioned from high to moderate; $n = 38$). Group differences were tested and found for all demographic and social media use variables. The groups differed by gender, $X^2(3, N = 766) = 43.60$, $p < .001$, whereby males were more likely to be stable moderate users or reducers while females were more likely to be stable high or increasers. Tukey’s post-hoc tests indicated that stable high users were significantly older than all other groups. Overall, for social media use, stable moderate users reported the lowest

usage followed by increasers, while stable high and reducers were largely equivalent. The full results are reported in supplementary materials.

3.4. Comparing subgroups based on body image-related outcomes (hypothesis 3)

Multilevel modelling was initially performed based on the two identified subgroups. Descriptive statistics for the subgroups for each outcome variable are presented in Table 4 and Fig. 1. For the overall sample, body dissatisfaction was found to significantly increase over time (B = 0.224, p < .001, R² = .004). When individual data were examined and all predictors added to the model (i.e., subgroups, age, gender, and intervention condition), social media subgroups predicted initial levels of body dissatisfaction, whereby high users had significantly higher body dissatisfaction at baseline than moderate users (B = 1.223, p < .001, R² = .790). The slope was also significant (B = -0.353, p = .025, R² = .014). As you can see from Fig. 1, increases in body dissatisfaction were more prominent among moderate users whereas high users scores were more stable.

In the overall sample, dietary restraint was not found to change significantly over time (B = 0.039, p = .271, R² = .000). Social media subgroups were found to predict initial levels of dietary restraint, whereby high users had significantly higher dietary restraint at baseline than moderate users (B = 0.720, p < .001, R² = 0.075). However, the slope was not significant (B = -0.201, p = .064, R² = 0.010), suggesting that subgroups changed at a similar rate over time.

For strategies to increase muscle in the overall sample, scores did not change significantly over time (B = -0.048, p = .146, R² = 0.001). Social media subgroups predicted initial levels of strategies to increase muscle, whereby at baseline, high users engaged in strategies to increase muscle significantly more than moderate users (B = 0.669, p < .001, R² = 0.075). The slopes were also significantly different (B = -0.288, p = .008, R² = 0.015). As you can see from Fig. 1, decreases in strategies to increase muscle were more prominent among high users whereas moderate users scores were more stable.

3.4.1. The impact of group transition on body image-related outcomes

Given some transition between groups, models were also run with the transition grouping variable (stable high, stable moderate, reducers, and increasers) as an alternative predictor to the original subgroup variable in the MLM. Results revealed that the stable moderate group

Table 4
Descriptive statistics of outcome variables by total sample and separated by subgroups.

Outcome variable	Timepoint	Total sample (n = 766) M (SD)	Separated by subgroups	
			Moderate users (n = 633) M (SD)	High users (n = 133) M (SD)
Body dissatisfaction	1	1.63 (1.67)	1.34 (1.46)	2.92 (1.94)
	2	1.49 (1.62)	1.26 (1.47)	2.52 (1.90)
	3	1.63 (1.67)	1.44 (1.56)	2.63 (1.87)
	4	1.69 (0.78)	1.62 (1.61)	2.63 (1.83)
Dietary restraint	1	1.95 (0.98)	1.80 (0.87)	2.65 (1.14)
	2	1.79 (0.94)	1.66 (0.85)	2.37 (1.09)
	3	1.89 (1.00)	1.79 (0.95)	2.32 (1.09)
	4	1.91 (1.00)	1.81 (0.95)	2.39 (1.15)
Strategies to increase muscle	1	1.86 (0.90)	1.73 (0.81)	2.42 (1.08)
	2	1.67 (0.85)	1.57 (0.77)	2.16 (1.03)
	3	1.72 (0.85)	1.65 (0.82)	2.07 (0.91)
	4	1.71 (0.83)	1.66 (0.79)	2.00 (0.94)

Note. Scores range from 0 to 6 for body dissatisfaction and 1–5 for dietary restraint and strategies to increase muscle.

reported significantly lower initial levels of body dissatisfaction, dietary restraint, and strategies to increase muscle than reducers (B = 1.107, p < .001, R² = .024; B = 0.442, p < .001, R² = .011; B = 0.835, p < .001, R² = .042) and stable high, respectively (B = 1.300, p < .001, R² = .067; B = 0.819, p < .001, R² = .073; B = 0.622, p < .001, R² = .050). The stable moderate group also reported lower initial levels of strategies to increase muscle than increasers (B = 0.202, p = .031, R² = .006) whereas no effect was found for either body dissatisfaction or dietary restraint.

Over time, stable moderate users had less rapid declines in body dissatisfaction, dietary restraint, and strategies to increase muscle than reducers (B = -0.665, p = .007, R² = .016; B = -0.362, p = .035, R² = .012; B = -0.573, p = .001, R² = .027). For body dissatisfaction and dietary restraint, stable moderate users had less rapid inclines than increasers (B = 0.698, p < .001, R² = .036; B = 0.551, p < .001, R² = .055). The effect for strategies to increase muscle was approaching significance (B = 0.219, p = .051, R² = .010). However, no differences were found in slopes between stable moderate and stable high. To ease interpretation, means have been presented in Fig. 2 across the four groups.

4. Discussion

Research is needed to deepen understanding of social media use patterns and who may be at greatest risk of poor body image-related outcomes. To address this, the present research aimed to determine: (1) whether individuals can be differentiated based on their patterns of social media use; (2) whether these subgroups are stable over time; and (3) whether subgroup membership is associated with body dissatisfaction, dietary restraint, and strategies to increase muscle at baseline and over 1-year. Two distinct subgroups were identified representing moderate and high appearance-focused social media users. While the majority of participants remained stable in these subgroups over 1-year, some transition occurred. At baseline, the high social media users reported significantly poorer body image-related outcomes than the moderate users across all outcomes. However, these levels dissipated slightly over 1-year follow-up. When group membership transition was examined, the most rapid increases in poor body image were found for increasers (i.e., those who transitioned from moderate to high) and the most rapid declines were found for reducers (i.e., those who transitioned from high to moderate), whereas stable moderate and stable high users scores remained consistent.

Of the two subgroups identified, one exhibited higher appearance-focused social media use across a range of social media use indices, in line with Hypothesis 1. Within the subgroups, patterns of engagement were consistent across the wide variety of social media uses and activities examined. These findings are in line with those of Scott, Bay-Cheng, Prince, Nochajski, and Collins (2017) whereby differences in subgroups were mostly uniform across indices, emphasising the breadth of use. Individuals who engage in social media to a high degree also tend to be highly motivated for use and often engage in a range of behaviours on social media, including appearance-related uses. The covariates of age and gender were also significant predictors of subgroup membership suggesting that at baseline, high users were more likely to be older and female, which is consistent with age and gender differences in social media use among adolescent boys and girls (Vogel, Rainie, & Nolan, 2022). This finding supports the developmental-sociocultural framework proposed by Choukas-Bradley et al. (2022), whereby girls appear especially vulnerable to harmful impacts of social media due to gendered pressures which place greater emphasis on the physical appearance of girls and women. In particular, our findings support the contention of Choukas-Bradley et al. (2022) that social media exposure may increase focus on others' appearance (e.g., assessed as time spent on appearance focused platforms like Instagram and Snapchat in the present study) and increase focus on one's own appearance (e.g., assessed as photo editing in the present study) and that collectively, these

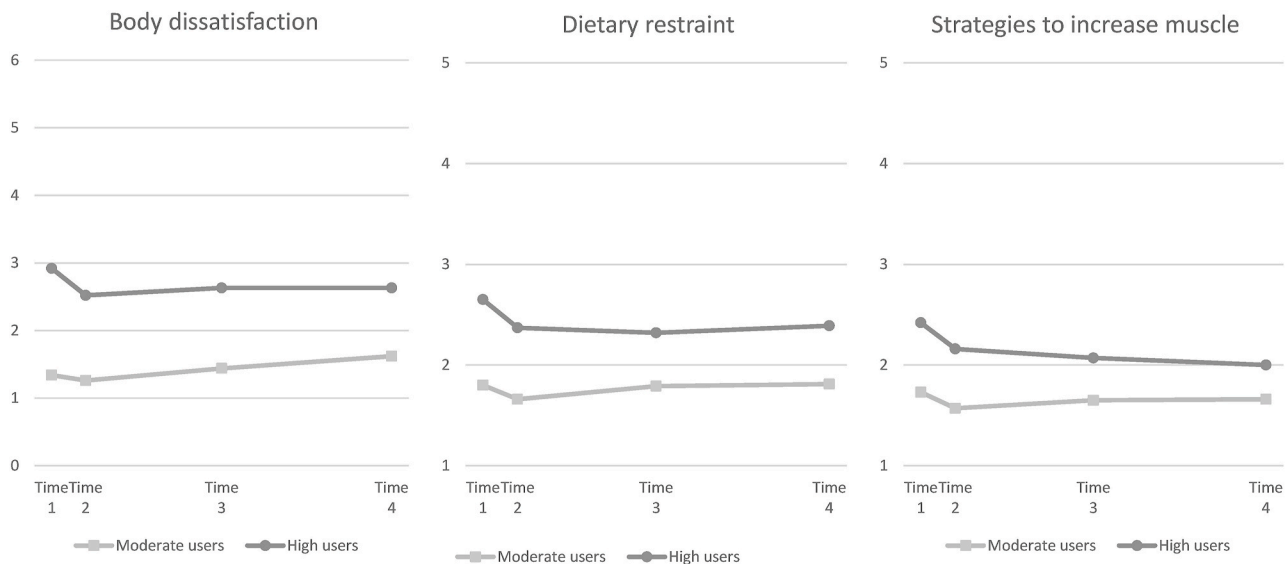


Fig. 1. Change over time in body image-related outcomes across social media subgroups
Note. The timepoints are spaced to represent the time between each survey completion.

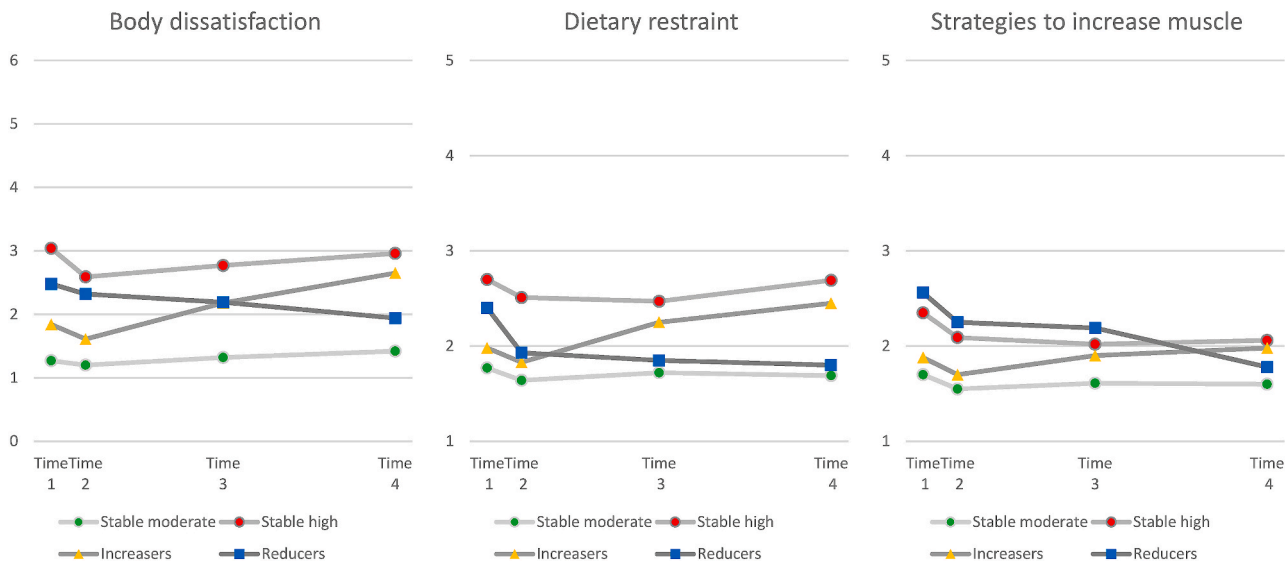


Fig. 2. Change over time in body image-related outcomes across social media membership transition groups
Note. The timepoints are spaced to represent the time between each survey completion.

experiences may contribute to body image concerns and disordered eating.

The pattern of use remained somewhat stable over 1-year, supporting Hypothesis 2. This shows that at this young age, many adolescents already exhibited frequent and broad use of appearance-focused social media. Given the interactive nature of social media and validation sought by many adolescents, it is likely that high social media use and motivated behaviours will work to reinforce and maintain social media engagement over time (Throuvala, Griffiths, Rennoldson, & Kuss, 2019). These findings highlight the importance of prevention and intervention efforts among adolescents. Despite some stability, subgroup transition was found for a number of participants. At the final timepoint, the proportion of participants in the high user subgroup had increased from 18% to 26%. This is consistent with findings from Winstone et al. (2022) which revealed that adolescent users became more active over 1-year. Specifically, the proportions of users in the high use subgroups from Winstone et al. (2022; broadcasters and high communicators) increased

while the moderate communicators subgroup decreased. Further, the minimal use subgroup became so small the class solution reduced from four to three. Together, these findings suggests a slight shift to higher use in a sizeable proportion of participants, which could reflect higher social media use as adolescents age (Coyne, Rogers, Zurcher, Stockdale, & Booth, 2020). Given ~15% of the sample did not remain stable over time, it would be interesting for future research to explore factors which contributed to this. By understanding the reason behind this organic change in use, researchers could inform prevention and intervention efforts.

In line with Hypothesis 3, membership to the high social media user subgroups was associated with worse body image-related outcomes at baseline, with moderate effect sizes. Specifically, higher use was associated with poorer outcomes in all variables: namely body dissatisfaction, dietary restraint, and muscle building behaviours. This adds to the mounting evidence of the behavioural impacts of social media use and suggest that social media exposure may be linked with aspects of

disordered eating (Rounsefell et al., 2020). In line with sociocultural theory (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999), the pattern of greater appearance-focused engagement (e.g., photo editing) reported by the high users is likely linked to their elevated body image concerns and disordered eating/exercising. Although body dissatisfaction and strategies to increase muscle decreased more rapidly in the high as compared to the moderate subgroup, with small effects sizes, inspection of the means shows that scores were mostly stable across subgroups. Although these small changes suggest a weak effect, it is important to highlight that the high social media use subgroup still reported poorer outcomes across all timepoints as compared to the moderate user subgroup.

When transition groups were examined, results were found to vary between groups. Individuals who remained stable in their use experienced small slopes of change in all three body image-related outcome measures. However, individuals who increased their use experienced more rapid increases in poor body image and individuals who decreased their use experienced more rapid decreases in poor body image. These findings are consistent with theoretical models (e.g., sociocultural theories; Thompson et al., 1999), highlighting how increases in exposure to social media use may be damaging whereas decreases may be protective. Importantly, this cross-over of effects would be missed in research examining overall samples, highlighting the more nuanced understanding provided by examining users who transitioned across groups over time. While this suggests a concurrent relationship between social media use and body image, which could be proposed to be bidirectional (Jarman et al., 2021), directionality cannot be confirmed within the present findings and so requires further exploration.

Although the present research enhances our understanding of social media users and body image-related outcomes, a number of limitations must be acknowledged. First, while the inclusion of a variety of social media predictors was a strength, some of the measures used in the present study were problematic. For example, social media frequency does not ascertain how social media is used, and the appearance conversations on social media scale combined giving (i.e., active use) and receiving (i.e., passive use) comments. As a result, the nuances of social media use were likely not fully captured. In addition, the list of measures was not completely exhaustive, meaning there were inevitably aspects of use which were not measured (e.g., content viewed or posted). These factors limit the generalisability of the findings. Second, due to the sample size, gender and age were included as covariates. However, the authors fully encourage exploration by gender and age in future research, including non-binary genders and more narrow developmental stages.

The present findings have important theoretical implications. As noted above, findings are consistent with sociocultural theories (Thompson et al., 1999), including the recently proposed developmental-sociocultural framework that outlines the ways in which social media enhances appearance focus on self- and others may have implications for body image and disordered eating among girls (Choukas-Bradley et al., 2022). Our findings would suggest that this framework may also be applicable to adolescent boys, as patterns of social media use which reflect exposure to others' ideal appearance and engagement with one's own appearance were related to increased body image concerns over time among boys. Furthermore, in examining several aspects of social media use, including motivations for use, the findings of the present study suggest that considerations of motivations, as proposed by Rodgers and Laveway (2022) in the theory of development of critical body awareness require further empirical examination.

Together, these findings emphasise the need to target adolescents, particularly those who are engaged in high social media use as they may be more vulnerable to poor body image and related outcomes. In line with our findings, this appears to be adolescents at the upper age limit (14–15 years old) and females who reported higher use at baseline and 1-year follow-up. Interestingly, although the present sample was relatively young (~12 years at baseline), the stability in social media use

and their detrimental effects appear to be already entrenched. Effects appear to have occurred prior to baseline, supporting the need for prevention and intervention efforts among children and younger adolescents. For example, teaching media literacy skills in schools is one way to build resilience and ensure social media can be used in a safe and positive manner (e.g., Bell, Taylor, Paddock, & Bates, 2021). High-risk individuals (e.g., high or increasing social media users) could also be targeted, to encourage them to reduce their appearance-focused engagement to moderate instead of high levels of use. This could either be presented as additional modules within a universal program or as selective prevention program. A recent randomised controlled trial aimed at reducing risk for emotional disorders found larger effect sizes when additional personalised modules were provided alongside the main intervention (Vivas-Fernandez et al., 2023), emphasising the potential gain of add-on modules tailored to an individual's needs.

4.1. Conclusion

In the present study, person-centred approaches were used to examine social media use patterns across adolescents and identify who may be more vulnerable to body image concerns. Extending cross-sectional evidence, the present study collected data from adolescent boys and girls across four timepoints over 1-year. Of the two subgroups identified, one reported elevated appearance focused use. The proportion of individuals in this subgroup increased over 1-year, suggesting a trend towards this pattern of use among middle adolescents. Compared to moderate users, high users reported greater body dissatisfaction, dietary restraint, and muscle building behaviours at baseline, although differences dissipated over time. Although body image-related outcomes appeared somewhat stable over time, when scores were examined based on transition between groups over 1-year, a more complex understanding was obtained. Specifically, individuals who increase in their social media use over 1-year also report simultaneous declines in their body image, and vice versa. Given social media use appears already entrenched in the lives of young adolescents, prevention and intervention efforts are needed among children and young adolescents. Users with higher appearance-focused social media use appear to be most at-risk, so selective interventions could be targeted among these individuals.

Author contributions

Study conception and design were performed by HKJ, SJP, and MFT. Material preparation and data collection were performed by HKJ and CSG. Data analysis was performed by HKJ and MFT. The first draft of the manuscript was written by HKJ and all authors reviewed and edited previous versions of the manuscript. All authors read and approved the final manuscript.

Funding

This work was supported by the Australian Research Council Discovery Grant [DP170100709]. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: HKJ has provided independent services for Dove, Unilever. The authors declare no other potential conflicts of interest in relation to this work.

Data availability

The authors do not have permission to share data.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.chb.2023.107823>.

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