It's All Just Fun and Games… Right? Habitual Gaming Links with Body Dissatisfaction, Psychological Distress, and Lower Self-Esteem

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Research assessing the links between gaming and psychological well-being is based primarily on adolescent samples. This study used data from the New Zealand Attitudes and Values Study to assess the extent to which self-reported casual (0.1-5.0 hours per week; 15.4%) and habitual gaming (≥5.0 hours per week; 7.6%) was associated with body satisfaction, psychological distress, and self-esteem for men and women (N=21,060). Both men and women who gamed habitually reported lower body satisfaction, higher psychological distress, and lower self-esteem than casual gamers and non-gamers. Casual gaming was weakly associated with lower body satisfaction for both genders, and self-esteem for men. This study is the first to document a negative dose-response relationship between time spent gaming and psychological well-being using a nationally representative adult sample. The magnitude of these associations appear to be broadly similar for men and women.

Keywords: *Video games, gaming, body satisfaction, psychological distress, self-esteem, gender differences*

Introduction

In 2018, New Zealand's video game industry generated approximately $548 million in sales (Interactive Games and Entertainment Association, 2018). Recent samples suggest that approximately 67% of New Zealanders play video games, and that 73% of players are adults aged 18 and over (Brand & Todhunter, 2017). Psychology research generally focuses on the negative correlates of gaming, showing links with depressive symptoms, lowered self-esteem, loneliness, sleep disturbance, and poorer academic performance (Andreassen et al., 2016; Brunborg et al., 2014; Lemmens, Valkenburg, & Peter, 2011; Rehbein, Kleimann, & Möβle, 2010; Skoric, Teo, & Neo, 2009). Moreover, relative to young/adolescent women, some negative effects of gaming are more pronounced for young/adolescent men (Li & Wang, 2013; Rehbein et al., 2010). However, past research has predominantly studied the effects of gaming using adolescent samples (e.g. Brunborg et al., 2014; Lemola et al., 2011). The present study analyses data from Wave 8 (2016) of the New Zealand Attitudes and Values Study (NZAVS; N=21,060) to assess whether time spent gaming is associated with body dissatisfaction, psychological distress, and self-esteem among adult men and women. This is the first known study to assess gender differences in the psychological correlates of gaming using a large-scale national probability sample.

Video gaming

Research exploring the links between gaming and psychological well-being produces mixed results. Studies have found that playing games that reward cooperation with other players can increase prosocial behaviours in and outside of the game context (Ewoldsen et al., 2012; Ferguson & Garza, 2011). Additionally, studies have shown causal links between playing preferred video games and improved mood, relaxation, and decreased anxiety (Russoniello, O'Brien, & Parks, 2009; Ryan, Rigby, & Przybylski, 2006). In contrast, studies show that problematic gaming (i.e. gaming to the extent where it interferes with other responsibilities; Ferguson, Coulon, & Barnett, 2011), is associated with negative outcomes. For example, Lemmens et al.'s (2011) longitudinal study with Dutch adolescents showed that pathological gaming increased gamers' feelings of loneliness over time. Similarly, Brunborg et al. (2014) found with Norwegian adolescents that video game addiction was associated with conduct problems, poorer academic achievement, and depression. The mix of positive and negative findings indicates that gaming in itself is not necessarily detrimental to psychological well-being. A large limitation of existing research is the predominance of small, adolescent, or community (e.g. gaming communities) samples, limiting the generalisability of findings.

As video games are often surrounded by moral panic, some people believe that playing frequently necessarily leads to negative outcomes such as addiction and violence (Markey, Markey, & French, 2015). However, empirical research shows that greater time spent gaming is not enough to predict detrimental outcomes (Charlton & Danforth, 2007; Ferguson & Wang, 2019; Király, Tóth, Urbán, Demetrovics, & Maraz, 2017; Kuss & Griffiths, 2012; Lemmens et al., 2011). Charlton and Danforth (2007) proposed that two groups of behaviours comprise the criteria for behavioural addiction: core and peripheral

criteria. Core criteria (i.e. conflict, behavioural salience, withdrawal and relapse, and reinstatement) are typically associated with addiction and detrimental outcomes; whereas peripheral criteria (i.e. euphoria, tolerance, and cognitive salience) are more closely related to high engagement but minimal detrimental outcomes (Billieux, Flayelle, Rumpf, & Stein, 2019; Brunborg et al., 2013; Charlton, 2002; Charlton & Danforth, 2007; Peters & Malesky, 2008). Individuals who endorse all four core criteria are considered 'addicted', while those who endorse all three peripheral criteria but fulfilled none or one of the core criteria are considered 'highly engaged' (Brunborg et al., 2013). This conceptualisation of addiction suggests that individuals can be highly engaged with gaming without being classified as problematic or addicted (Ferguson et al., 2011; Király et al., 2017; Przybylski, Weinstein, & Murayama, 2017; Wood, 2008).

Research shows gender differences in the behaviours and outcomes associated with gaming. Most studies find that men spend more time gaming than women (Brand & Todhunter, 2017; Lucas & Sherry, 2004; Jackson et al., 2010). Adolescent and adult studies also show that men are more likely to be addicted to video games than women (Andreassen et al., 2016; Li & Wang, 2013). Lemmens et al. (2011), for example, found that adolescent boys exhibited a higher level of game addiction than girls. Another study with Chinese adolescents showed that boys scored higher than girls in rumination and overall cognitive distortion as a result of online gaming (Li & Wang, 2013). With regards to psychological outcomes, Rehbein et al. (2010) showed higher levels of sleep disturbance and suicidal thoughts in video game-dependent boys than girls. Collectively, existing literature appears to converge with regards to men exhibiting greater levels of gaming addiction, dependence, and cognitive disturbance than women.

Links with Psychological Well-Being

The theory of compensatory internet use suggests that individuals are likely to engage in online activities (e.g. social media) to cope with psychosocial issues; the stronger the desire to cope, the more time is spent online (Kardefelt-Winther, 2014a). For example, an individual high on social anxiety may be motivated to socialise with others on social networking sites or in online games due to the sense of anonymity (McKenna, Green, & Gleeson, 2002). Such a coping strategy can have positive outcomes like fulfilling the desire to socialise, but poses the risk of relying on the escapism to alleviate negative feelings (Kardefelt-Winther, 2014a). Given that video games are intentionally designed to feel rewarding (Charlton & Danforth, 2007; Hsu, Wen, & Wu, 2009; King & Delfabbro, 2009) and online in-game interactions are becoming increasingly prevalent (Entertainment Software Association, 2018), the tenets of compensatory internet use can apply to gaming as well. Accordingly, a study with Australian adolescents found that after adjusting for demographic factors, frequent gamers (≥45 minutes per day) were more likely than less frequent gamers to report high/very high levels of psychological distress (Mathers et al., 2009). Additionally, a survey study of online gamers found that the relationship between escapism and negative outcomes was strongest for players with low self-esteem and high stress (Kardefelt-Winther, 2014b). Thus, research indicates that high video game engagement may be both a cause and consequence of negative psychological well-being (Charlton & Danforth, 2007; Kardefelt-Winther, 2014a, 2014b; Mathers et al., 2009).

Gaming has been empirically linked with various aspects of psychological well-being. The present research focuses on body satisfaction, psychological distress, and self-esteem in particular. Findings indicate that body satisfaction can be diminished by playing games that depict idealised male and female bodies (Barlett & Harris, 2008), but is not associated with internet gaming disorder symptoms (Kircaburun, Griffiths, & Billieux, 2019). Given the previous finding that body dissatisfaction significantly predicted problematic internet use (Koronczai et al., 2013), body satisfaction may also have a similar relationship with gaming. However, there are currently no population-level studies assessing the link between gaming and body image. Research generally finds that psychological distress is linked with frequent (Mathers et al., 2009) and problematic (Brunborg et al., 2013) gaming. Lastly, there is converging evidence that low self-esteem, either as a cause or consequence, is associated with gaming (Hoare, Milton, Foster, & Allender, 2016; Jackson et al., 2010; Ko, Yen, Chen, Chen, & Yen, 2005; Lemmens et al., 2011; Witt, Massman, & Jackson, 2011). Research has yet to establish whether psychological distress and self-esteem are negatively associated with gaming among adults.

Overview and Hypotheses

The present study analyses data from Wave 8 (2016) of the New Zealand Attitudes and Values Study (NZAVS; N=21,060), a large-scale adult national probability sample. We assess whether time spent gaming reliably associates with body satisfaction, psychological distress, and self-esteem, and whether gender moderates these relationships. This is the first study to assess the negative psychological correlates of gaming with a nationally representative adult sample.

We formulated three hypotheses following the notion that psychosocial problems may motivate higher media engagement (Kardefelt-Winther, 2014a). First, we predicted that habitual gaming would link with lower body satisfaction than casual gaming for men and women (Hypothesis 1). Secondly, informed by Mathers et al.'s (2009) findings, we expected that habitual gaming would link with higher psychological distress than casual gaming for men and women (Hypothesis 2). Thirdly, we predicted that habitual gaming would associate with lower self-esteem than casual gaming for men and women (Hypothesis 3; Hoare et al., 2016). We tested for gender differences in all models, but did not make specific predictions about these.

METHODS

Sampling Procedure

The NZAVS is an ongoing 20-year longitudinal study that began in 2009. Wave 8 was chosen for the present study as it contained the largest available sample at time of analysis. Using national probability samples of New Zealanders sampled from the electoral roll, the NZAVS collects nationally representative data regarding social and political attitudes, personality, and health outcomes. Participants were sent a paper copy of the questionnaire,

or if an email address was provided, they were invited to complete an online version of the questionnaire. Detailed information about the sampling procedures and retention rates are provided by Sibley (2019).

The NZAVS performs relatively well in terms of representativeness, but contains biases such as over-representation of women (62.6% sample; 52.1% census) and under-representation of Māori (11.3% sample; 14.9% census) and Asian (4.6% sample; 5.1% census) individuals. The standard NZAVS post-stratification weighting procedure for gender, ethnicity and region was used to adjust the sample to be representative of the general population.

Participants

The present study analyses data from wave 8 (2016) of the NZAVS survey which contained responses from 21,936 participants. Demographic characteristics of the sample (N=21,060) are presented in Appendix 1.

Measures

Gaming, our focal predictor, was measured using the open-ended item "Please estimate how many hours you spent doing each of the following in the past week… Playing computer games". Preliminary analyses revealed that 77% of participants spent no time gaming. Of those who indicated at least some time spent gaming, the median time reported was 5 hours (see Figure 1). Gaming behaviour was thus modelled using two dummy coded variables: the first represented casual gaming, where 0=no, and 1=casual gaming (i.e. gaming between 0.1-5.0 hours per week). The second represented habitual gaming, where again 0=no, and 1=habitual gaming (i.e. greater than 5 hours per week). The casual gaming variable thus tested whether casual gamers differed significantly on each outcome relative to non-gamers. Similarly, the habitual gaming variable tested whether habitual gamers differed significantly from non-gamers. We thus binned participants in these three groups and modelled them as non-gamers (5,905 men; 10,315 women), casual (1,254 men; 726 women), and habitual gamers (1,990 men; 870 women) given the heavily skewed distribution of these count data for hours of reported gaming (where, as noted above, the median for those who gamed was 5 hours per week, which seemed a reasonable split point for binning participants as casual versus habitual gamers). See Appendix 2 for frequencies of estimated hours spent gaming.

Body satisfaction was measured using responses to the single item "I am satisfied with the appearance, size and shape of my body" devised for the NZAVS (Stronge, 2018), rated on a scale of 1 (very inaccurate) to 7 (very accurate).

Self-esteem was measured using three items from the Rosenberg (1965) Self-Esteem Inventory (α=.70): "I… On the whole am satisfied with myself", "… Take a positive attitude toward myself", "… Am inclined to feel that I am a failure". Each item was rated on a scale of 1 (very inaccurate) to 7 (very accurate).

Psychological distress was measured using the Kessler-6 scale (Kessler et al., 2002; α=.85). Participants were asked to rate items such as "During the last 30 days, how often did… you feel hopeless?", "… you feel so depressed that nothing could cheer you up?", "… you feel exhausted?". Each item was rated on a 5-point scale (0=none of the time, 4=all of the time).

RESULTS

The model was tested using multi-group regressions for men and women, predicting the three outcomes simultaneously (body satisfaction, psychological distress, and self-esteem) and allowing for the residual covariance between them. The use of a multi-group model allowed us to test for significant differences between men and women, and for the psychological correlates of casual and habitual gaming, relative to non-gaming men and women.

Missing data for exogenous variables were estimated using Rubin's (1987) procedure for multiple imputation procedure with parameter estimates averaged over 1000 datasets (thinned using every 200th iteration). The model was estimated using Full Information Maximum Likelihood, which allowed for missing data in the outcome measures, and robust estimation of the standard errors to adjust for possible non-normality in residuals.

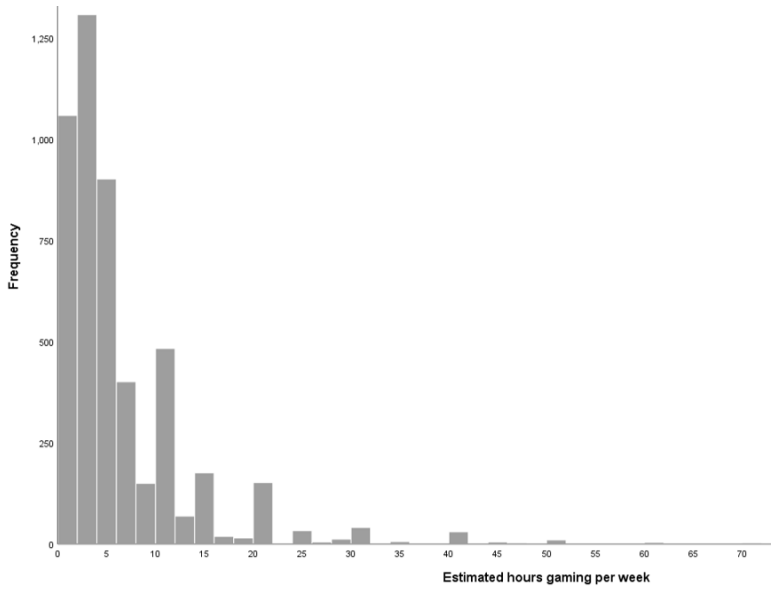

Figure 1. Frequency distribution of estimated hours gaming per week. Note that 0s are not shown.

Regression coefficients assessing the associations between gaming and the three outcomes are presented in Tables 1, 2, and 3. For women, the model accounted for 20.2% of the variance predicting body satisfaction, $F(18,13172) = 183.4$, $p < .001$; 16.4% for psychological distress, $F(18,13172) = 139.8$, $p < .001$; and 9.4% for self-esteem $F(18,13172) = 74.59$, $p < .001$. For men, the model accounted for 17.0% of the variance predicting body satisfaction $F(18,7881) = 89.83$, $p < .001$; 14.1% for psychological distress $F(18,7881) = 69.9$, $p < .001$; and 10.4% for self-esteem $F(18,7881) = 49.52$, $p < .001$).

Table 1. Linear regression predicting body satisfaction.

	Men					Women				
	b	*SE*	*95% CI*	*β*	*t*	*b*	*SE*	*95% CI*	*β*	*t*
Age	.010	.002	.007, .013	.091	6.796***	.018	.001	.015, .020	.142	15.090***
Regional deprivation	.017	.006	.005, .028	.030	2.719**	.013	.005	-.002, -.023	.020	2.383
Qualification	.010	.007	-.005, .024	.017	1.318	.014	.006	.001, .026	.022	2.140
Maori	.189	.060	.071, .307	.036	3.139**	.166	.045	.078, .254	.032	3.684***
Pacific	.337	.122	.097, .577	.033	2.775**	.631	.100	.434, .827	.061	6.294***
Asian	.017	.091	-.162, .195	.002	.181	.082	.068	-.052, .215	.010	1.163
Religious	.068	.035	-.001, .136	.021	1.944*	.076	.028	.021, .131	.022	2.699**
Parent	.144	.047	.051, .236	.041	3.050**	-.003	.035	.073, .066	-.001	-.090
Partner	.107	.048	.012, .201	.028	2.213*	.061	.033	-.003, .125	.016	1.878
Employed	-.049	.047	-.141, .043	-.012	-1.047	-.028	.034	-.095, .039	-.007	-.825
Urban	-.068	.036	-.139, .003	-.021	-1.888	-.038	.029	-.095, .019	-.011	-1.295
Born in New Zealand	-.044	.041	-.124, .036	-.012	-1.082	-.098	.036	-.169, -.027	-.023	-2.707**
Sexual orientation	-.438	.076	-.587, -.289	-.071	-5.763***	.112	.060	-.005, .229	.017	1.874
Smoker	.063	.064	-.062, .188	.011	.986	-.009	.053	-.113,.096	-.001	-.161
Disability	-.230	.041	-.311, -.150	-.062	-5.612***	-.300	.034	-.367, -.232	-.074	-8.698***
BMI	-.112	.004	-.120, -.104	-.374	-26.764***	-.110	.003	-.115, -.104	-.424	-41.470***
Casual	**-.244**	**.044**	**-.331, -.157**	**-.057**	**-5.502*** **	**-.111**	**.037**	**-.184, -.038**	**-.023**	**-2.962****
Habitual	**-.382**	**.061**	**-.501, -.283**	**-.071**	**-6.315*** **	**-.223**	**.057**	**-.334, -.111**	**-.032**	**-3.926*** **

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Gaming behaviours with significant effects are bolded. Model fit statistics: men $R^2 = 17.0\%$, women $R^2 = 20.2\%$

Table 2. Linear regression predicting psychological distress.

	Men					Women				
	b	*SE*	*95% CI*	*β*	*t*	*b*	*SE*	*95% CI*	*β*	*t*
Age	-.012	.001	-.014, -.011	-.263	-19.611***	-.015	.000	-0.016, -0.014	-.308	-32.016***
Regional deprivation	.008	.003	.003, .014	.035	3.004**	.009	.002	.005, .013	.036	4.141***
Qualification	-.002	.003	-.008, .005	-.007	-.543	-.008	.003	-.013, -.004	-.032	-3.079**
Maori	-.043	.025	-.092, -.001	-.019	-1.697	-.041	.018	-.077, -.005	-.020	-2.209*
Pacific	.014	.057	-.098, .107	.003	.242	-.018	.040	-.097, .061	-.004	-.0458
Asian	.069	.040	-.011, .148	.020	1.698	.085	.030	.026, .143	.026	2.842**
Religious	.003	.015	-.027, .032	.002	.183	-.012	.011	-.034, .010	-.009	-1.058
Parent	-.020	.021	-.061, .021	-.013	-.954	-.058	.015	-.087, -.034	-.038	-3.951***
Partner	-.157	.022	-.200, -.113	-.096	-6.990***	-.114	.014	-.141, -.087	-.074	-8.157***
Employed	-.111	.021	-.152, -.070	-.066	-5.275***	-.096	.014	-.125, -.068	-.060	-6.702***
Urban	.035	.015	.005, .065	.025	2.285*	-.024	.012	.001, .047	.017	2.053*
Born in NZ	-.024	.017	-.058, .010	-.015	-1.399	-.038	.015	-.067, -.009	-.022	-2.598*
Sexual orientation	.098	.034	.030, .165	.037	2.839**	.126	.025	.077, .176	.047	4.974***
Smoker	.123	.030	.063, .182	.051	4.037***	.170	.024	.123, .217	.069	7.102***
Disability	.259	.018	.223, .295	.165	14.144***	.273	.015	.244, .302	.168	18.427***
BMI	.008	.002	.005, .012	.066	5.048***	.004	.001	.002, .005	.034	3.619***
Casual	.031	.019	-.006, .068	.017	1.640	.024	.015	-.006, .054	.013	1.590
Habitual	**.095**	**.027**	**.043, .147**	**.042**	**3.563*** **	**.115**	**.025**	**.067, .163**	**.042**	**4.694*** **

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Gaming behaviours with significant effects are bolded. Model fit statistics: men $R^2 = 14.1\%$, women $R^2 = 16.4\%$.

Wald's Chi-Squared test was used to assess whether the links between casual and habitual gaming and each outcome differed significantly between men and women. Casual and habitual gaming were significantly associated with lower body satisfaction for both men and women. Men's body satisfaction was more adversely linked with casual gaming than women's, Wald's $\chi2(1) = 5.26$, $p = .022$; but no gender difference was found for habitual gaming, Wald's $\chi2(1) = 3.706$, $p = .054$. Men and women's levels of psychological distress were not associated with casual gaming. Habitual gaming was reliably associated with higher psychological distress for men and women, with no significant gender difference, Wald's $\chi2(1) = 0.317$, $p = .573$. Casual gaming was weakly associated with lower self-esteem for men but not for women, Wald's $\chi2(1) = 1.622$, $p = .203$. Habitual gaming was associated with significantly lower self-esteem for both men and women, with no significant

Table 2. Linear regression predicting psychological distress.

	Men					Women				
	b	*SE*	*95% CI*	*β*	*t*	*b*	*SE*	*95% CI*	*β*	*t*
Age	-.012	.001	-.014, -.011	-.263	-19.611***	-.015	.000	-0.016, -0.014	-.308	-32.016***
Regional deprivation	.008	.003	.003, .014	.035	3.004**	.009	.002	.005, .013	.036	4.141***
Qualification	-.002	.003	-.008, .005	-.007	-.543	-.008	.003	-.013, -.004	-.032	-3.079**
Maori	-.043	.025	-.092, -.001	-.019	-1.697	-.041	.018	-.077, -.005	-.020	-2.209*
Pacific	.014	.057	-.098, .107	.003	.242	-.018	.040	-.097, .061	-.004	-.0458
Asian	.069	.040	-.011, .148	.020	1.698	.085	.030	.026, .143	.026	2.842**
Religious	.003	.015	-.027, .032	.002	.183	-.012	.011	-.034, .010	-.009	-1.058
Parent	-.020	.021	-.061, .021	-.013	-.954	-.058	.015	-.087, -.034	-.038	-3.951***
Partner	-.157	.022	-.200, -.113	-.096	-6.990***	-.114	.014	-.141, -.087	-.074	-8.157***
Employed	-.111	.021	-.152, -.070	-.066	-5.275***	-.096	.014	-.125, -.068	-.060	-6.702***
Urban	.035	.015	.005, .065	.025	2.285*	-.024	.012	.001, .047	.017	2.053*
Born in NZ	-.024	.017	-.058, .010	-.015	-1.399	-.038	.015	-.067, -.009	-.022	-2.598*
Sexual orientation	.098	.034	.030, .165	.037	2.839**	.126	.025	.077, .176	.047	4.974***
Smoker	.123	.030	.063, .182	.051	4.037***	.170	.024	.123, .217	.069	7.102***
Disability	.259	.018	.223, .295	.165	14.144***	.273	.015	.244, .302	.168	18.427***
BMI	.008	.002	.005, .012	.066	5.048***	.004	.001	.002, .005	.034	3.619***
Casual	.031	.019	-.006, .068	.017	1.640	.024	.015	-.006, .054	.013	1.590
Habitual	**.095**	**.027**	**.043, .147**	**.042**	**3.563*** **	**.115**	**.025**	**.067, .163**	**.042**	**4.694*** **

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Gaming behaviours with significant effects are bolded. Model fit statistics: men $R^2 = 14.1\%$, women $R^2 = 16.4\%$.

gender difference, Wald's $\chi2(1) = 1.50$, $p = .221$. These results indicate that habitual gaming is reliably associated with lower body satisfaction, higher psychological distress, and lower self-esteem at similar rates for men and women. Finally, the focal results held while controlling for a range of covariates (see Appendix 1).

DISCUSSION

Using a large, national probability sample of New Zealanders (N=21,060), we tested whether casual and habitual gaming reliably associated with body satisfaction, psychological distress, and self-esteem, and whether gender moderated these links. First, gamers were categorised according to a median split at 5 hours. Figure 1 (and Appendix 2) shows that a large cluster of participants indicated having spent up to 5 hours gaming in the past week; this constitutes a significant proportion of gamers, who we binned as casual gamers. Past this cluster, there is a large drop in frequency of participants who indicated gaming more than 5 hours in the past week. Cutting off this tail past the cluster thus looked to be a reasonable split point from which to categorise participants who gamed more frequently, who we labelled as habitual gamers. Then, our primary analyses compared whether these two groups differed from each other, and from non-gamers, on the three psychological outcomes.

Casual gaming was significantly associated with lower body satisfaction for both men and women, and this relationship was more adverse for men. Habitual gaming showed a stronger, more adverse association with body satisfaction than casual gaming, supporting Hypothesis 1; there was no gender difference for this association (as much as one can predict the null). Supporting Hypothesis 2, higher psychological distress was observed in men and women who gamed habitually, with no significant gender difference. Casual gaming was not linked with psychological distress, and was significantly associated with lower self-esteem for men only. Supporting Hypothesis 3, and relative to casual gaming, habitual gaming was associated with lower self-esteem for men and women, with no significant gender difference. In sum, the present research demonstrated that among adults, (a) poorer psychological well-being was consistently observed among those who gamed habitually, and (b) gender played only a small role in moderating these associations.

With a nationally representative adult sample, we documented that men and women who gamed habitually reported markedly poorer psychological well-being than casual gamers and non-gamers. We build on a large body of existing literature regarding the antecedents of psychological well-being. It is well-established that idealistic media portrayals of men's and women's bodies can undermine body satisfaction (e.g. Blond, 2008; Griffiths et al., 2018), belonging to minority ethnic groups is associated with higher psychological distress (Krynen, Osborne, Duck, Houkamau, & Sibley, 2013; Lee, Duck, & Sibley, 2017), and being unemployed is associated with lower self-esteem (de Witte, Rothmann, & Jackson, 2012; Goldsmith, Veum, & Darity, 1997). By demonstrating that habitual gaming is also linked with these aspects of psychological well-being, we highlight the importance of acknowledging the potential ramifications of habitual behaviours. Additionally, our findings contribute to public health research given that body dissatisfaction is linked with eating disorders (see Stice, 2002), psychological distress predicts the development of mental illness (see Kessler et al., 2002), and low self-esteem is a risk factor for depression (e.g. Orth, Robins, Meier, & Conger, 2016). Overall, the population-level estimates presented provide reliable foundations for forthcoming research to conduct more detailed analyses on adults' gaming behaviours and outcomes.

Our focal findings must be interpreted with caution as each significant association produced a standardised effect size of less than .1. They do not necessarily imply

that all habitual gamers experience poorer psychological well-being than casual gamers and non-gamers; in fact, considering the effect sizes, our results indicate that these differences may be too small to be practically meaningful. However, in our view, these small effect sizes are appropriate given the broad nature of the sample—they appear small because we sampled the general adult population in New Zealand rather than gamers specifically. Because there is little research regarding the links between gaming and psychological well-being among adults, we believe it is important to first document broad, descriptive findings showing these patterns among adult gamers.

That we were able to identify a) a sizeable population of gamers in this general sample and b) conceptually consistent links between gaming and psychological well-being within this group is noteworthy. Achieving these shows that the small effect sizes \ do not necessarily imply a practically negligible difference between habitual gamers and casual and non-gamers. They instead warrant a closer look at the individuals who contributed to the adverse association between habitual gaming and psychological well-being—what drives this link? Would these effects remain similar or appear stronger if a study were to sample adult gamers specifically? How do adult gamers compare to gamers of other age groups? This is an important line of research to undertake that our findings will hopefully spur.

The significant covariate effects in our model may also be of specific interest to other researchers. Identifying with a non-heterosexual sexual orientation was linked with higher psychological distress and self-esteem for men and women, and lower body satisfaction for men only. This is in line with a large body of research showing that gay men tend to experience particularly low levels of body satisfaction (e.g. Basabas, Greaves, Barlow, & Sibley, 2019; Peplau et al., 2009). Consistent with another area of research (e.g. Boman et al., 2013; Chalk, 2016; Rai et al., 2012), having a disability was associated with lower body satisfaction, higher psychological distress, and lower self-esteem for both men and women. Lastly, identifying with a Māori ethnicity was linked with higher body satisfaction and higher self-esteem for men and women, supporting previous research indicating that affiliating with a Māori ethnic identity is associated with positive outcomes (e.g. Matika, Manuela, Muriwai, Houkamau, &Sibley, 2017; Talwar, Carter, & Gleaves, 2012). The effects of these (and other) covariates were very small, with all but disability, age, and BMI having standardised associations of less than .1 (see Appendix 2, Tables 1 and 2). These demographic covariates may be of interest of researchers who may want to examine these patterns further with more fine-grained approaches.

The NZAVS sample we analysed here performs relatively well in terms of representing the New Zealand adult population, but contains some biases including the over-representation of women, under- and over-representation of people for whom English is their primary or first language (see Satherley et al., 2015). Crucially, the fact that women are over-represented in the NZAVS (being about 60% of the sample) is adjusted for in our analyses because we explicitly estimated parameters for men and women in our multi-group models and tested for differences between them (and generally found consistent patterns for men and women). Our analyses only pertain to the gaming population who are over 18 years of age (as our sample only contained those over 18). Other samples are needed to examine rates of gaming in younger cohorts. The fact that the NZAVS is a general survey, rather than one specifically about gaming or framed in terms of being about a special interest or topic, is key because it removes the risk of people being more likely to participate because they have a particular interest or option about the specific topic (i.e., people interested in gaming responding to a survey about gaming). Our findings thus provide broad, population-level estimates regarding the links between casual and habitual gaming and the rates of psychological well-being among New Zealand adults in general.

Caveats and Future Directions

Although being a strength in one regard, the general and broad nature of the NZAVS is a weakness in another. Our analyses of gaming-related behaviours were limited to the single self-reported hours-of-gaming measure included in the questionnaire. By only measuring time spent gaming per week, other aspects of gaming behaviours such as genre (e.g. first-person shooter, role-playing, puzzle), content (e.g. general, mature), platforms (e.g. Xbox, mobile), motives (e.g. achievement, escape), and interference with everyday life were not captured. Here, more specific surveys focused on gaming are needed, which balances the risk of response bias due to special interest with providing more in-depth and detailed information about gaming. Men and women's body satisfaction, for example, may be more negatively correlated with playing mature games where characters are more likely to be sexualised for older audiences (Blond, 2008; Downs & Smith, 2010; Griffiths et al., 2018). Alternatively, perhaps gamers with low body satisfaction are more motivated to play games when they are able to customise the appearance of their characters/avatars (Koronczai et al., 2013). Our analyses cannot speak to these more specific and subtle potential effects. By establishing population-level findings about adult gamers' psychological well-being, we complement forthcoming research that conduct more detailed analyses on gaming behaviours and outcomes with smaller samples.

Obviously, our results are also correlational in nature. Although our models statistically adjust for a diverse range of covariates and hence, third variable explanations, inferences about the causal direction of effects should be conducted with extreme caution. The theory of compensatory internet use, for example, proposes that individuals may use gaming as a coping strategy to alleviate negative feelings stemming from psychosocial issues such as low self-esteem and stress (Kardefelt-Winther, 2014a, 2014b). Thus, for some people, poor psychological well-being might drive increased gaming.

Our findings are consistent with this possibility, as we simply show that individuals with poor body satisfaction, higher psychological distress, and low self-esteem were more likely to game habitually. According to this perspective, poor psychological well-being is not necessarily a direct cause of increased gaming time; rather, individuals with psychosocial issues who are

motivated to escape from life or gain a sense of achievement use games to fulfil these goals, thereby indirectly alleviating their negative feelings (Kardefelt-Winther, 2014c). In our view, we suspect that excessive gaming and negative psychological outcomes may exist, at least for some people, in a mutually reinforcing feedback loop. Our current analyses cannot test this possibility directly, but this is something we plan to investigate in future longitudinal work using the New Zealand Attitudes and Values Study. Before pursuing this line of future research we thought it important to conduct the current research to document the base rates for gaming in the population, and associations between casual and habitual gaming and a range of outcomes more generally.

Furthermore, we did not measure whether participants were addicted to gaming. It is difficult to imagine how one could do this directly, as asking a question like 'are you addicted to computer gaming?' might not necessarily yield reliable results. Far better, in our view, to use an indirect measure of the frequency of gaming over time, as we do. Previous research has shown that higher engagement can (but does not necessarily) predict problematic gaming (Charlton, 2002; Ferguson et al., 2011; Király et al., 2017; Yee, 2007). Therefore, there may have been participants in our sample who were genuinely addicted, which could have negatively skewed the results. To illustrate, previous studies have shown that problematic and addicted gamers tend to experience more negative outcomes such as lower life satisfaction, poorer school performance, and higher levels of depression and anxiety than highly engaged gamers (Mentzoni et al., 2011; Skoric et al., 2009). If our subsample of habitual gamers included a substantial proportion of addicted gamers, then the negative links we found may have been more adverse than they actually are. This is not a substantial concern, however, as researchers have previously established that only a minority of the general population experience behavioural addiction (see Kuss & Griffiths, 2012).

Some readers may also wonder about the time frame specified by some of our measures. We sampled reports of psychological distress using the Kessler-6 which, as is standard for this measure, asks participants about experiences of psychological distress over the last 30-day period. The Kessler-6 specifies this time frame because it is a reasonable period of time for detecting population variability in psychological distress (rather than, for example, the past day, or past hour, which would be too fine a resolution and risk missing more general patterns). Our gaming measure, in contrast, asked about hours spent over the last 7 days and was nested within a more general hours measure (also including hours working, commuting, internet use, etc). Given that most people tend to operate on weekly cycles in terms of habitual activity, the questionnaire samples hours spent on each activity over the last meaningful cycle. Additionally, informal pilot testing conducted when initially designing the NZAVS in 2008 indicated that reported hours from the past week were more reliable than those based on the last month. We also note that the measures for self-esteem and body satisfaction did not specify a time period. However, because comparable conceptual links were found between gaming and the three outcomes, the differences in time frames across the measures used is not a substantial concern and would not have unduly impacted our findings.

Conclusion

As video games grow in popularity, there is a corresponding need for estimates of the effects of gaming and its dose-response relationship, so to speak, with psychological and health-related outcomes in the general population. We aimed to provide this information by contrasting the effects observed in casual gamers (operationalised as less than 5 hours per week), habitual gamers (more than 5 hours per week), and non-gamers. Our results indicate that on average, men and women who gamed habitually reported lower body satisfaction, higher psychological distress, and lower self-esteem relative to those who gamed casually and did not game at all. Habitual gamers reported similar outcomes regardless of gender, while there were weak gender differences for casual gamers: men who gamed casually reported lower body satisfaction and self-esteem than women who gamed casually. Our results indicate—unsurprisingly—that habitual gaming is correlated with negative psychological outcomes in the population. We hope these findings might pave the way for more detailed dose-response analyses of gaming behaviours and outcomes; whether there is an inflexion point at which hours of gaming starts to increase negative outcomes, and the possible trade-offs that men relative to women may be making when they choose to play video games. As game mediums, genres, and rates of game play evolve, so too should research adapt and expand to study gaming and its possible links with psychological well-being.

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Appendix 1. Descriptive statistics and measurement details for all outcome, predictor, and covariate variables, split by gender.

	Men (*n* = 7,885)	Women (*n* = 13,175)	
Variable	M (SD)	M (SD)	Item content
Body satisfaction (1 to 7)	4.52 (1.56)	4.09 (1.70)	I am satisfied with the appearance, size and shape of my body.
Psychological distress (0 to 4)	0.83 (.66)	0.90 (0.69)	e.g. During the last 30 days, how often did... you feel hopeless?
Self-esteem (1 to 7)	5.25 (1.20)	5.16 (1.25)	e.g. I... On the whole am satisfied with myself.
Age	51.33 (13.90)	48.42 (13.74)	What is your date of birth?
Regional deprivation index (1 low, 10 high)	4.55 (2.72)	4.71 (2.75)	Deprivation of respective neighbourhood region (meshblock) based on 2013 census data (Atkinson, Salmond, and Crampton, 2014)
Qualification (0 low, 10 high)	5.10 (2.76)	5.41 (2.72)	What is your highest level of qualification?
BMI	27.82 (5.20)	27.34 (6.80)	What is your height? (metres)—What is your weight? (kgs)
	N (%)	N (%)	
Heterosexual (0 no, 1 yes)	7,357 (93.3%)	12,266 (93.1%)	How would you describe your sexual orientation?
Māori (0 no, 1 yes)	773 (9.8%)	1,581 (12.0%)	Which ethnic groups do you belong to?
Pacific (0 no, 1 yes)	182 (2.3%)	356 (2.7%)	
Asian (0 no, 1 yes)	316 (4.0%)	620 (4.7%)	
Religious (0 no, 1 yes)	2,776 (35.2%)	5,230 (39.7%)	Do you identify with a religion and/or spiritual group?
Parent (0 no, 1 yes)	5,812 (73.7%)	9,658 (73.3%)	How many children have you given birth to, fathered, or adopted?
Partner (0 no, 1 yes)	6,253 (79.4%)	9,658 (73.3%)	What is your relationship status?
Employed (0 no, 1 yes)	6,372 (80.8%)	10,172 (77.2%)	What is your current occupation?
Urban (0 no, 1 yes)	5,173 (65.6%)	8,525 (64.7%)	Urban vs rural residential location coded from meshblock data (Statistics NZ, 2016)
Born in NZ (0 no, 1 yes)	6,159 (78.1%)	10,580 (80.3%)	Where were you born? (please be specific, e.g., which town/city?)
Smoker (0 no, 1 yes)	647 (8.2%)	1,094 (8.3%)	Do you currently smoke?
Disability or illness (0 no, 1 yes)	1,822 (23.1%)	2,952 (22.4%)	Do you have a health condition or disability that limits you, and that has lasted for 6+ months?
Casual gamer (0.1-5.0 hours)	1,254 (15.9%)	1,990 (15.1%)	Please estimate how many hours you spent... Playing computer games.
Habitual gamer (≥5.0 hours)	726 (9.2%)	870 (6.6%)	

Appendix 2. Distribution of estimated hours spent gaming in the past week.

Hours gamed	Frequency
0	16315
0 ≤ 1	1058
1 ≤ 2	852
2 ≤ 3	455
3 ≤ 4	405
4 ≤ 5	496
5 ≤ 6	171
6 ≤ 7	229
7 ≤ 8	131
8 ≤ 9	18
9 ≤ 10	476
10 ≤ 11	6
11 ≤ 12	62
12 ≤ 13	6
13 ≤ 14	80
14 ≤ 15	95
15 ≤ 16	13
16 ≤ 17	5
17 ≤ 18	14
18 ≤ 19	0
19 ≤ 20	142
20+	159
Total	21,188

Note. Frequency count exceeds sample size of primary analyses because the analyses excluded participants who did not respond to all items (gender, gaming, outcomes, and covariates) measured in the model.

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