Co-occurring substance-related and behavioral addiction problems: A person-centered, lay epidemiology approach

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Background and aims: The aims of this study were (a) to describe the prevalence of single versus multiple addiction problems in a large representative sample and (b) to identify distinct subgroups of people experiencing substance-related and behavioral addiction problems. *Methods:* A random sample of 6,000 respondents from Alberta, Canada, completed survey items assessing self-attributed problems experienced in the past year with four substances (alcohol, tobacco, marijuana, and cocaine) and six behaviors (gambling, eating, shopping, sex, video gaming, and work). Hierarchical cluster analyses were used to classify patterns of co-occurring addiction problems on an analytic subsample of 2,728 respondents (1,696 women and 1032 men; $M_{age} = 45.1$ years, $SD_{age} = 13.5$ years) who reported problems with one or more of the addictive behaviors in the previous year. *Results:* In the total sample, 49.2% of the respondents reported zero, 29.8% reported one, 13.1% reported two, and 7.9% reported three or more addiction problems in the previous year. Cluster-analytic results suggested a 7-group solution. Members of most clusters were characterized by multiple addiction problems; the average number of past year addictive behaviors in cluster members ranged between 1 (Cluster II: excessive eating only) and 2.5 (Cluster VII: excessive video game playing with the frequent co-occurrence of smoking, excessive eating and work). *Discussion and conclusions:* Our findings replicate previous results indicating that about half of the adult population struggles with at least one excessive behavior in a given year; however, our analyses revealed a higher number of co-occurring addiction clusters than typically found in previous studies.

Keywords: substance-related addictions, behavioral addictions, comorbidity, well-being, sociodemographic differences

INTRODUCTION

Addictions are chronic relapsing health conditions associated with many negative consequences at individual and population levels. These include, but are not limited to, higher morbidity and mortality rates for the addicted person, health and financial damages for family or community members, and increased economic and social costs for society as a whole (Effertz & Mann, 2013; McGinnis & Foege, 1999; Single, Robson, Xie, & Rehm, 1998). Addictions are among the most prevalent mental disorders, especially when behavioral addictions are considered (Sussman, Lisha, & Griffiths, 2011). Although conceptualization, criteria, and categories of behavioral addictions have been vigorously debated, there is emerging consensus that they are similar to substance-related addiction problems insofar as they generate short-term rewards that promote behavioral persistence, despite knowledge of adverse consequences (Demetrovics & Griffiths, 2012; Grant, Potenza, Weinstein, & Gorelick, 2010; Karim & Chaudhri, 2012; Mudry et al., 2011).

An increasing number of behaviors have been conceptualized as addictions as the field evolves. These range from behaviors that are now widely viewed as legitimate addictions [e.g., gambling and online gaming addiction (Hellman, Schoenmakers, Nordstrom, & van Holst, 2013; Wong & Hodgins, 2014)] through controversial behaviors [e.g., television, sex, and pornography addictions (Clarkson & Kopaczewski, 2013; Garcia & Thibaut, 2010; Sussman & Moran, 2013)], to highly speculative "addictions" [e.g., love, tanning, or shoplifting addiction (Kourosh, Harrington, & Adinoff, 2010; Shulman, 2003; Sussman, 2010)]. From a clinical perspective, loss of control over these behaviors can lead to neglect of role obligations and health-protective behaviors as well as interpersonal conflict and/or direct physical harm. The phenomenon of reduced self-control despite negative consequences is one of the key characteristics uniting this broader conception, making it plausible to view these different activities as behavioral (or process) addictions (Mudry et al., 2011).

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Addictions do not always occur singly. Clinicians have noted that addictions frequently co-occur in the same individual and that there might be a systematic progression from having difficulties with one excessive behavior to struggling with another (Gossop, 2001; Haylett, Stephenson, & Lefever, 2004). Moreover, compared with people experiencing only a single problematic addictive behavior, individuals with co-occurring addictions are at increased risk for negative outcomes – including victimization, poorer physical health status, or even suicide (Rush, Urbanoski, Bassani, Castel, & Wild, 2010). Furthermore, when addictions co-occur, they can interact with each other, complicating both accurate assessment and effective treatment; for instance, one excessive behavior might mask another addiction or addictions may alternate with each other (Freimuth et al., 2008).

Despite these considerations, addiction treatment providers and programs often do not explore comorbidity issues (especially comorbid substance-related and behavioral addictions) and as a result do not provide integrated interventions despite their clear advantage over services offered in parallel or successively (Rush et al., 2010). Moreover, although high rates of co-occurring addictions have been discussed in the empirical literature, most of this work emphasizes co-occurring problems with substances and often excludes behavioral addictions.

Only a small body of research has addressed co-occurring substance-related and behavioral addictions. Using a variable-centered (i.e., factor-analytic) approach, Stephenson, Maggi, Lefever, and Morojele (1995) examined co-occurrences among 16 excessive behaviors in a clinical sample. The authors identified a "nurturance" factor (e.g., excessive eating, shopping, exercise, work, or caffeine use) and a "hedonism" factor (e.g., use of alcohol, nicotine, recreational drugs, or gambling and excessive sexual behavior). Haylett et al. (2004) attempted to replicate these findings using the same set of addictive behaviors and reported four groupings: a "self-regarding nurturance" (e.g., excessive eating, shopping, or caffeine use), an "other-regarding nurturance" (e.g., excessive work and compulsive helping), a "sensation-seeking hedonism" (e.g., use of recreational drugs, prescription drugs, and nicotine), and a "dominance-related hedonism" (e.g., excessive sexual behavior and gambling) factor. Lochner et al. (2005) investigated another set of behaviors/disorders in a clinical sample and identified three groups characterized by "reward deficiency" (e.g., trichotillomania, pathological gambling, and hypersexual disorder), "impulsivity" (e.g., compulsive shopping, kleptomania, and excessive eating), and "somatic" problems (including somatoform disorders). Others identified only two groups in a non-clinical sample of youth when analyzing the co-occurrence of 11 excessive behaviors: a "generally non-addicted" and a "work hard, play hard" group (e.g., excessive sexual behavior, exercise, or Internet use) (Sussman et al., 2014).

Extant research in this area is limited because of the use of small and/or age-specific samples (Sussman et al., 2014; Villella et al., 2011; Willoughby, Chalmers, & Busseri, 2004), restricted coverage of substance-related and behavioral addiction problems (Freimuth et al., 2008; Sussman et al., 2011), and variable-centered (i.e., factor-analytic) as opposed to person-centered (e.g., cluster analytic)

approaches. To address these limitations, the first aim of this study was to describe the prevalence of single versus multiple addiction problems using a large, representative sample and a broad range of behaviors and substances. In doing so, we adopted a *lay epidemiology* approach to co-occurring addictive behaviors (Konkolÿ Thege et al., 2015). Lay epidemiology proposes that "… fields of symptomatology, nosology, aetiology, and epidemiology have identifiable counterparts in the thoughts and activities of people outside the formal medical community" (Davison, Smith, & Frankel, 1991, p. 6). From this perspective, systematic investigations of inferences made by the lay public about health conditions can provide important insights into how they construe risks and how to craft intervention strategies (Lawlor, Frankel, Shaw, Ebrahim, & Smith, 2003). The second aim of this study was to identify distinct subgroups of people experiencing one or more substance-related and behavioral addiction problems and to explore whether and how members of separate addiction clusters differ in relation to sociodemographic characteristics and psychological well-being.

METHODS

Participants and procedure

The 2009 Alberta Addiction Survey included two components, each administering identical survey items. First, an online survey of 4,000 Alberta (Canada) adult members (18+ years of age) of an established research panel (Ipsos Canadian Online Panel) were recruited. Target quotas, based on 2006 Canadian Census data, were set for age, gender and region, and a random, representative sample of panel members were sent invitations to take part in the survey. To widen the repertoire of methodology used, and balancing the possible bias resulted from online data collection (Granello & Wheaton, 2004), a computerized assisted telephone survey of an additional population-based sample of 2,000 Alberta adults was also conducted in 2010. Further details of the survey methodology have been described elsewhere (Konkolÿ Thege et al., 2015).

To address our first research aim, the combined online and telephone survey dataset ($N = 6,000$) was used. Both original data bases were independently weighted to ensure that regional, age, and gender composition reflected that of the actual Alberta population aged 18 years or older according to 2006 Census data. Although sociodemographic characteristics (with the exception of sex and income) and the occurrence of problem behaviors (with the exception of excessive shopping and work) differed across the two data sets, the effect sizes of these differences fell in the negligible range; the only exception was excessive sexual behavior where Cramer's V (0.11) was just above the border of negligible and small effect size. A more detailed analysis of survey mode differences in these samples has been reported elsewhere (Konkolÿ Thege et al., 2015).

To address our second research aim, we created an analytic subsample consisting of respondents who reported one or more addiction problems in the past year. The total sample ($N = 6,000$) and the subsample used for clustering

($n = 2,728$; 45.5%) differed across almost all sociodemographic characteristics; however, the effect sizes of the differences fell again in the negligible or small range (Table 1). Furthermore, in the analytic sub-subsample, 1,850 individuals (67.8% of the subsample) were recruited as part of the online survey and 878 individuals (32.2% of the subsample) were participants of the telephone survey, which – considering the original sample sizes of the telephone ($n = 2,000$, 33.3%) and online ($n = 4,000$, 66.6%) samples – also indicates that the telephone and online samples were generally comparable in terms of addiction prevalence. Sociodemographic characteristics of the total sample and the analytic subsample used for the cluster analysis are summarized in Table 1.

Measures

The survey included items assessing participants' sex, age, educational level, marital status, employment, and income (Table 1 describes response options for each of these sociodemographic items). In some of the analyses, sociodemographic variables were recoded into fewer categories to improve clarity (Table 3). The survey also included questions regarding four substances (alcohol, tobacco, marijuana, and cocaine use) and six behaviors (problematic gambling, eating, shopping, sexual behavior, video gaming, and work) which were presented in random order for each respondent, regardless of survey mode. Consistent with our emphasis on lay epidemiology, that is, views of the public

Table 1. Sociodemographic characteristics of the samples

	Total sample (weighted) N (%)/M (SD)	Subsample with at least one addiction problem (unweighted) N (%)/M (SD)	
N	6,000 (100.0)	2,728 (100.0)	
Sex			$\chi^2 = 123.6$, $p < .001$, Cramer's $V = 0.12$
Male	2,994 (49.9)	1,032 (37.8)	
Female	3,006 (50.1)	1,696 (62.2)	
Age	44.5 (15.1)	44.1 (13.5)	$U = 8741865.5$, $p = .679$, $r < .01$
Educational attainment			$U = 8468646.5$, $p < .001$, $r = .04$
Grade 9 or less (1)	63 (1.1)	30 (1.1)	
Some high school (2)	309 (5.2)	160 (5.9)	
High school diploma (3)	915 (15.3)	454 (16.6)	
Some university, college or post-secondary trades/technical (4)	1,358 (22.7)	660 (24.2)	
College or post-secondary trades/technical diploma (5)	1,537 (25.6)	731 (26.8)	
Completed university undergraduate degree (6)	1,110 (18.5)	427 (15.7)	
Completed university graduate or professional degree (7)	701 (11.7)	265 (9.7)	
Marital status			$\chi^2 = 25.5$, $p < .001$, Cramer's $V = 0.05$
Married/common law	3,995 (66.9)	1,773 (65.2)	
Separated/divorced	624 (10.5)	378 (13.9)	
Widowed	192 (3.2)	87 (3.2)	
Single/never married	1,155 (19.4)	480 (17.7)	
Employment status			$\chi^2 = 49.4$, $p < .001$, Cramer's $V = 0.07$
Employed 30 hr a week or more	3,285 (55.1)	1,474 (54.2)	
Employed less than 30 hr per week	637 (10.7)	308 (11.3)	
Unemployed	355 (5.9)	187 (6.9)	
Student	246 (4.1)	91 (3.3)	
Retired	782 (13.1)	287 (10.6)	
Not working due to disability	242 (4.1)	184 (6.8)	
Other	417 (7.0)	188 (6.9)	
Yearly household income before taxes			$U = 6340414.5$, $p = .067$, $r = .02$
Under $20,000 (1)	302 (5.9)	148 (6.3)	
$20,000–$29,999 (2)	318 (6.2)	160 (6.8)	
$30,000–$39,999 (3)	421 (8.2)	200 (8.6)	
$40,000–$49,999 (4)	485 (9.4)	230 (9.8)	
$50,000–$59,999 (5)	504 (9.8)	235 (10.1)	
$60,000–$69,999 (6)	416 (8.1)	176 (7.5)	
$70,000–$79,999 (7)	417 (8.1)	185 (7.9)	
$80,000–$89,999 (8)	406 (7.9)	194 (8.3)	
$90,000–$99,999 (9)	406 (7.9)	174 (7.4)	
$100,000 or more (10)	1,459 (28.4)	636 (27.2)	

Table 2. Definition of the problem behaviors provided to respondents

Problem behavior	Definition
Alcohol	An "Alcohol problem" means misuse of beer, wine, and/or hard liquor.
Tobacco	A "Tobacco problem" means misuse of cigarettes, cigars, chew, cigarillos, and any other tobacco products.
Marijuana	A "Marijuana problem" means misuse of cannabis, hashish, hash oil, weed, grass, or pot.
Cocaine	A "Cocaine problem" means misuse of crack, powder cocaine, blow, snow, or snort.
Gambling	A "Gambling problem" means playing slot machines, online gambling, casino games, lotteries, scratch tickets, and any other betting for money that creates problems in life.
Eating	An "Eating problem" means any problems related to eating, whether it is too much or too little.
Shopping	A "Shopping problem" means shopping in a way that creates problems in life.
Sex	A "Problem with sex" means having sex in a way that creates problems in life, and/or inappropriate use of pornography, whether online or offline.
Video gaming	A "Video gaming problem" means playing video games such as X-Box, Wii, PlayStation, and other online or offline video games in a way that creates problems in life.
Work	A "Problem with work" means working in a way that creates problems in life.

about addiction problems rather than expert-derived signs and symptoms (Konkolÿ Thege et al., 2015), a definition was provided for each problem behavior (Table 2), which was intended to broadly define self-attributed "problems" for the substances and behaviors without using the term "addiction" to avoid respondent reactivity. To assess the occurrence of the excessive behaviors included, a single question ("Thinking back over your life, have you ever personally had a problem with [problem behavior]?") was used with three available response categories ("No"; "Yes, but not in the past 12 months"; and "Yes, in the past 12 months"). Since, in this study we focused on the co-occurrence of past-year behaviors only, the first two response options were collapsed.

To assess general well-being of the respondents, the eight-item Personal Wellbeing Index (International Wellbeing Group, 2006) was administered. The scale contains eight areas of satisfaction, each rated on an 11-point scale (0 = completely dissatisfied, 5 = neutral, 10 = completely satisfied): standard of living, health, achieving in life, relationships, safety, community-connectedness, future security, and spirituality. Internal consistency of the scale was very good in the present sample (Cronbach's $\alpha = 0.88$).

Statistical analysis

Statistical analyses were executed using SPSS 23.0 (SPSS, Chicago, IL, USA). Chi-square tests were employed to compare respondents reporting no, one, two, and three or more past-year problem behaviors across categorical sociodemographic variables (e.g., sex and marital status) using Cramer's V to quantify effect size. Ordinal and non-normally distributed continuous sociodemographic characteristics (e.g., age and income) and well-being scores of the groups were compared using the non-parametric Kruskal–Wallis test. A multinomial logistic regression analysis was also run to model associations between sociodemographic variables and well-being scores and cluster membership.

Hierarchical cluster analysis using Ward's method with squared Euclidean distance as the distancing metric was employed to explore the patterns of co-occurring addictions. Input for this analysis were the 10 variables indicating the past-year presence vs. absence of each of the problem behaviors investigated. Number of clusters to retain was based on the approach of seeking for the largest change in agglomeration schedule coefficients [cf. "stopping rules"

Table 3. Sociodemographic characteristics in relation to number of self-reported addiction problems in the previous year ($N = 6,000$)

	None	One	Two	Three or more	
Sex, *N* (%)					
Male	1,306 (48.6)	791 (48.1)	358 (50.6)	228 (55.3)	$\chi^2 = 8.0$, $p = .047$, Cramer's $V = 0.04$
Female	1,382 (51.4)	854 (51.9)	350 (49.4)	184 (44.7)	
Age, *M* (*SD*)	46.7 (15.9)	44.5 (14.3)	41.7 (13.2)	36.9 (12.4)	Kruskal–Wallis $\chi^2 = 195.6$, $p < .001$
Marital status, *N* (%)					
Partnered	1,925 (72.0)	1,071 (65.4)	442 (62.6)	245 (59.5)	$\chi^2 = 60.7$, $p < .001$, Cramer's $V = 0.08$
Separated or divorced	318 (11.9)	257 (15.7)	107 (15.2)	52 (12.6)	
Single	432 (16.1)	309 (18.9)	157 (22.2)	115 (27.9)	
Education, *N* (%)					
High school or less	521 (19.4)	363 (22.1)	157 (22.2)	132 (32.0)	$\chi^2 = 34.7$, $p < .001$, Cramer's $V = 0.08$
College or more	2,167 (80.6)	1,283 (77.9)	551 (77.8)	280 (68.0)	
Employment, *N* (%)					
Full-time or part-time	1,709 (63.8)	1,092 (66.6)	470 (66.6)	297 (71.9)	$\chi^2 = 12.0$, $p = .007$, Cramer's $V = 0.05$
All others	968 (36.2)	547 (33.4)	236 (33.4)	116 (28.1)	
Income, *M* (*SD*)	6.8 (2.9)	6.5 (3.0)	6.2 (3.1)	5.9 (3.2)	Kruskal–Wallis $\chi^2 = 49.1$, $p < .001$
Well-being, *M* (*SD*)	60.8 (11.2)	55.6 (12.4)	52.2 (12.7)	48.0 (14.4)	Kruskal–Wallis $\chi^2 = 623.8$, $p < .001$

([Clatworthy, Buick, Hankins, Weinman, & Horne, 2005](#))]. Cluster members were also compared across sociodemographic and well-being characteristics using the chi-square and Kruskal–Wallis tests.

Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki. The University of Alberta Health Research Ethics Board approved the study. All subjects were informed about the study and all provided informed consent.

RESULTS

Prevalence and correlates of multiple addiction problems

More than half (50.8%) of the participants in the total sample of 6,000 respondents reported experiencing a problem with one or more of the substances and behaviors examined in the 12 months preceding the study (prevalence rates for the individual addictive behaviors in this sample have been described elsewhere, see [Konkolÿ Thege et al., 2015](#)). About one-third (29.8%) reported a problem with only one substance or behavior in the past year, while 13.1% reported two problems, and 7.9% reported problems with three or more substances and behaviors in the year before the study. Members of these groups differed significantly across all sociodemographic characteristics as well as well-being scores (Table 3).

When entering the sociodemographic variables and well-being into a multinomial logistic regression model predicting whether respondents reported one, two, or three or more problems (reference group = respondents reporting no addiction problems in the past year), age and well-being were the only consistently significant predictors (each associated with decreased probability of excessive behaviors); sex, educational attainment, and marital status were associated with group membership only occasionally, while income and employment status did not seem to have a role in distinguishing between the groups of individuals with no, one, two, and three or more addiction problems (Table 4).

Classifying co-occurring addiction problems

The results of the cluster analysis suggested a seven-cluster solution. As shown in Table 5, the first cluster (26.0% of the sample used when conducting the clustering) represented individuals with smoking as their shared problem behavior. The second cluster (21.8%) consisted of participants reporting excessive eating as their only problem behavior. The third cluster (16.2%) represented individuals with work problems, while the fourth cluster (13.0%) consisted of participants characterized by a large number of different addiction problems without a clearly dominant behavior. The fifth cluster (9.5%) represented mainly individuals reporting excessive sexual behavior, while the sixth (8.9%) and seventh (4.7%) clusters consisted of participants with shopping and video gaming as their shared behavioral problem, respectively. Highest average number of past-year addictive behaviors was observed among excessive video game players (Cluster VII), while the lowest was found among excessive eaters (Cluster II). Detailed information on the addiction characteristics of each cluster are described in Table 5.

Sociodemographic and well-being characteristics of cluster members

Detailed sociodemographic characteristics of each cluster are described in Table 6. Cluster membership was significantly associated with sex: the proportion of males was

Table 4. Results of the multinomial logistic regression investigating correlates of reporting no versus one, two, or three or more addiction problems (odds ratios with 95% confidence intervals)

	One addiction problem	Two addiction problems	Three or more addiction problems
Sex			
Male	0.97 (0.84–1.12)[a]	1.17 (0.97–1.41)[a]	1.34 (0.97–1.41)*
Female	1.00	1.00	1.00
Age	0.99 (0.99–1.00)***	0.98 (0.97–0.99)***	0.95 (0.94–0.96)***
Marital status			
Partnered	1.09 (0.88–1.34)[a]	1.07 (0.82–1.39)[a]	1.30 (0.95–1.78)[a]
Separated or divorced	1.50 (1.14–1.96)**	1.32 (0.93–1.87)[a]	1.36 (0.86–2.14)[a]
Single	1.00	1.00	1.00
Education			
High school or less	1.04 (0.87–1.25)[a]	1.10 (0.87–1.38)[a]	1.67 (1.28–2.19)***
College or more	1.00	1.00	1.00
Employment			
Full-time or part-time	1.10 (0.94–1.29)[a]	1.05 (0.85–1.30)[a]	1.25 (0.95–1.64)[a]
All others	1.00	1.00	1.00
Income	1.00 (0.97–1.03)[a]	0.98 (0.95–1.02)[a]	0.98 (0.93–1.02)[a]
Well-being	0.96 (0.96–0.97)***	0.94 (0.94–0.95)***	0.92 (0.91–0.93)***

[a]Non-significant.
*$p < .05$, **$p < .01$, ***$p < .001$.

Table 5. Prevalence (%) of each problem behavior in the addiction clusters (*n* = 2,728)

	Alc	Tob	Mar	Coc	Gamble	Shop	Video	Eat	Sex	Work	Number of addictive behaviors[a]
Cluster I (*n* = 708)	0.0	100.0	0.0	0.0	0.0	0.0	0.0	19.1	0.0	17.7	1.4 (0.6)
Cluster II (*n* = 596)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	1.0 (0.0)
Cluster III (*n* = 441)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.3	0.0	100.0	1.3 (0.4)
Cluster IV (*n* = 354)	54.7	42.2	28.9	7.8	23.2	9.4	4.9	26.0	6.2	24.5	2.3 (1.1)
Cluster V (*n* = 259)	13.6	22.9	5.8	4.4	5.8	15.3	4.4	35.4	99.7	38.6	2.3 (1.6)
Cluster VI (*n* = 243)	0.9	20.3	0.0	0.0	6.0	100.0	7.3	50.9	2.2	31.9	2.1 (1.0)
Cluster VII (*n* = 127)	1.2	31.1	13.5	0.6	12.3	4.9	100.0	36.6	14.0	37.2	2.5 (1.3)

Note. Alc: problematic alcohol use, Tob: tobacco use problems, Mar: problems with marijuana use, Coc: problematic cocaine use, Gamble: gambling problems, Shop: excessive shopping, Video: problematic video gaming, Eat: problematic eating, Sex: excessive sexual behavior, and Work: excessive work.
[a]Number of past-year addictive behaviors is given as *M* (*SD*).

34.9%, 27.7%, 40.6%, 47.7%, 64.1%, 20.6%, and 44.1% in the seven clusters, respectively. Employment and marital status were also related to cluster membership. All of the ordinal level (educational attainment) or non-normally distributed continuous sociodemographic variables (age and income) were also associated with cluster membership. Finally, cluster members significantly differed in terms of well-being as well: members of the "excessive buyer," "smoker," "sex addict," and "polyaddict" clusters showed clearly (indicated by non-overlapping confidence intervals) lower well-being scores than "workaholics" and "excessive eaters" (Figure 1).

DISCUSSION AND CONCLUSIONS

Integrated treatment for multiple addictive disorders is important because failure to identify and treat comorbid addiction problems is associated with poorer outcomes (Substance Abuse and Mental Health Services Administration, 2009). Unfortunately, treatment providers are most prone to recognize disorders that fit the focus of their training, which rarely includes behavioral addictions (Freimuth et al., 2008). Therefore, the aim of the present study was to provide further information on how a relatively large number of substance and behavioral addictions co-occur to help inform treatment providers and service planners about typical combinations of addictions.

Our findings regarding the overall prevalence of addictive problems were consistent with US data indicating that about half of the adult population struggles with at least one excessive behavior in a given year (Sussman et al., 2011). Results of the present study also demonstrated that about 30 percent of the adult population had difficulties with one addictive behavior, while an additional 21% reported problems with two or more behaviors and/or substances. While many argue that the frequent co-occurrence of some forms of addiction suggests the presence of an underlying non-addiction specific proneness responsible for dependence (Shaffer et al., 2004), the present data – showing that almost 60% of those reporting addictive problems have difficulties only with one behavior – does not provide a clear support for this syndrome model of addictions. However, it is also possible that many individuals reporting only one excessive

behavior in the past year have had or will have problems in other areas but successively instead of simultaneously (cf. addiction substitution/cross-addiction/switching addiction; Johnson, 1999).

In addition, our data revealed that the patterning of the excessive behaviors studied fitted best with a seven-cluster solution, which is greater than the number of groups or dimensions (2–4) typically reported in previous studies (Haylett et al., 2004; Lochner et al., 2005; MacLaren & Best, 2010; Stephenson et al., 1995; Sussman et al., 2014). Worthy of note, however, that direct comparison of the results across the investigations is problematic because of the large variability in study methodology including the number and type of addictions examined and the statistical methods employed (factor analysis, cluster analysis, latent class analysis, and correlations among scales measuring addictions).

One strength of this study is the use of two independent, relatively large Canadian samples' representative of the adult Alberta population across sex, age group, and region. A further strength is the simultaneous assessment of a relatively large number of both substance-related and behavioral addictions, providing the opportunity of taking a broader look at the whole addiction field. On the other hand, there were several limitations of the present research that deserve to be highlighted. First, response rates were relatively low in both survey modes, which weakens the generalizability of our findings (Konkolÿ Thege et al., 2015). In addition, although the single question method for assessing problematic addictive behaviors is often employed in epidemiological surveys (Bowling, 2005; Cook, 1987), the reliability of single-item scales is generally weaker than that of multi-item scales. Also, although previous research indicated that self-identification through a single question for an excessive behavior is a reliable and clinically meaningful tool in identifying persons with addictive disorders, these studies concentrated on substance addictions, pathological gambling, and video gaming (Cook, 1987; King, Delfabbro, & Griffiths, 2013; Widyanto, Griffiths, & Brunsden, 2011). The generalizability of the methodological appropriateness of this assessment method to all behavioral addictions is, therefore, questionable.

The validity of the wording of single items is also unclear. Our aim was to provide a brief behavioral

Table 6. Sociodemographic characteristics in relation to cluster membership ($n = 2,728$)

	Cluster I	Cluster II	Cluster III	Cluster IV	Cluster V	Cluster VI	Cluster VII	
Sex, N (%)								$\chi^2 = 153.7$, $p < .001$, Cramer's $V = 0.24$
Male	247 (34.9)	165 (27.7)	179 (40.6)	169 (47.7)	166 (64.1)	50 (20.6)	56 (44.1)	
Female	461 (65.1)	431 (72.3)	262 (59.4)	185 (52.3)	93 (35.9)	193 (79.4)	71 (55.9)	
Age, M (SD)	45.9 (12.5)	49.4 (13.4)	42.9 (12.1)	42.8 (13.8)	46.9 (13.6)	41.1 (14.1)	38.1 (14.3)	Kruskal–Wallis $\chi^2 = 130.0$, $p < .001$
Marital status, N (%)								$\chi^2 = 50.6$, $p < .001$, Cramer's $V = 0.10$
Partnered	465 (65.9)	413 (69.5)	283 (64.5)	197 (56.1)	181 (69.9)	157 (64.6)	77 (61.1)	
Separated or divorced	138 (19.5)	99 (16.7)	77 (17.5)	72 (20.5)	37 (14.3)	30 (12.3)	12 (9.5)	
Single	103 (14.6)	82 (13.8)	79 (18.0)	82 (23.4)	41 (15.8)	56 (23.0)	37 (29.4)	
Education, N (%)								$\chi^2 = 50.2$, $p < .001$, Cramer's $V = 0.14$
High school or less	204 (28.8)	128 (21.5)	66 (15.0)	114 (32.2)	55 (21.2)	44 (18.1)	33 (26.0)	
College or more	504 (71.2)	468 (78.5)	375 (85.0)	240 (67.8)	204 (78.8)	199 (81.9)	94 (74.0)	
Employment, N (%)								$\chi^2 = 72.3$, $p < .001$, Cramer's $V = 0.16$
Full-time or part-time	459 (64.9)	350 (59.0)	354 (80.8)	239 (67.5)	171 (66.0)	145 (59.7)	64 (51.2)	
All others	248 (35.1)	243 (41.0)	84 (19.2)	115 (32.5)	88 (34.0)	98 (40.3)	61 (48.8)	
Income, M (SD)[a]	6.1 (2.9)	6.6 (3.0)	7.0 (3.0)	6.2 (3.2)	6.5 (2.9)	6.4 (3.2)	5.6 (3.0)	Kruskal–Wallis $\chi^2 = 33.8$, $p < .001$
Well-being, M (SD)	52.7 (12.8)	56.7 (13.1)	55.5 (11.8)	49.7 (13.9)	52.0 (14.6)	50.9 (14.9)	52.4 (12.5)	Kruskal–Wallis $\chi^2 = 96.0$, $p < .001$

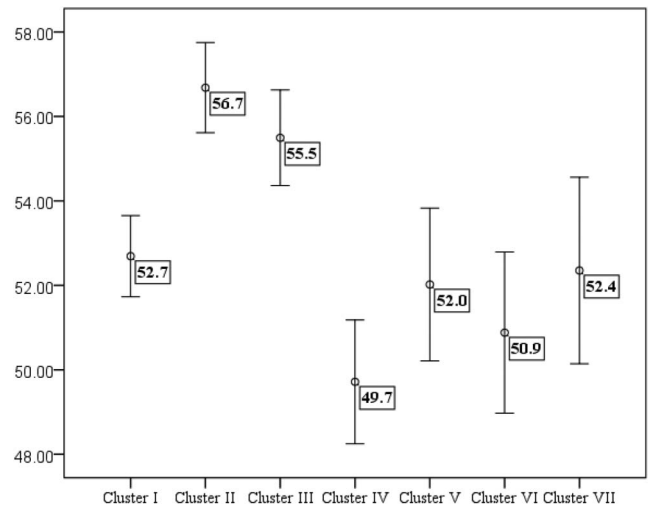[a]Details on the measurement of income can be found in Table 1.

Figure 1. Means and 95% confidence intervals of the Personal Wellbeing Index in the seven clusters

description of each behavior that emphasized impairment and to avoid the use of terms such as addiction to minimize respondent reactivity. How exactly participants interpreted these items was not examined in this study, and it is possible that impairment was defined broadly in some instances. For example, "problematic eating" as defined for the respondents, can incorporate not only excessive eating of food addicts but also the restrictive behavioral patterns of anorexics, which despite its destructive nature is not classified as an addiction in the current nosological systems.

Despite these limitations, this study calls our attention to the considerable large number of individuals experiencing several addictive disorders simultaneously who thus need special consideration and the use of integrated treatment approaches when receiving mental health services. We hope that this work will assist in the accurate assessment and treatment of patients presenting addiction symptoms, encouraging professionals to consider the possibility of likely co-occurring substance and behavioral addictions above those emphasized initially by their clients.

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