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Abstract

Purpose: This pilot study was designed to deliberately examine the enhancement effects and experiences of substances used among professionals and students in professional programs. *Methods*: A mixed methods design was implemented, involving ecological momentary assessment (EMA)and interviews. The analysis presents interpretations about the perceived impact of substance use on the performance and experience of everyday activities. *Results*: Caffeine, alcohol, antidepressants, pain suppressant, and cannabis were used by the most participant. Participants reported effects of substances that directly or indirectly enhanced performance (e.g., sleep, socialisation), mood (e.g., manage stress, relax), cognition (e.g., energy and clarity of thought),and the general experience of activities (e.g., enjoyment). Less common effects included impaired work, school, or leisure performance, injury, sleep disruption, and pain or discomfort. Reactivity was an unexpected effect, with almost half of the interviewees reporting changes in their thoughts about their substance use, and 30% of interviewees making active changes. *Conclusion*: This study was novel in population and data collection. Complex perspectives about substance use were offered by recruiting professionals and students outside at-risk populations or addiction-related services. By examining effects of substances, this research offers nuanced understandings of self-reported effects of psychoactive substances on performance, mood, cognition, and quality of experience.

Keywords Substance use, Professionals, Professional students, Performance, Experience, Ecological momentary assessment, Substance effects

1.0 Introduction

Psychoactive substances alter brain function, affecting consciousness, mood, and perceptions. They encompass licit substances (e.g., caffeine, alcohol, over-the-counter medication), prescribed medication (e.g., oxycodone, benzodiazepines), illicit substances (those not socially condoned e.g., marijuana, cocaine, MDMA), and healing plants (e.g., peyote). Substance use as a social concept tends to dichotomise types of substances (e.g., therapeutic; recreational) and effects (e.g., beneficial/desired; harmful) (Author A, 2017). When substances are used according to scientific or medical standards, they tend to be accepted and even promoted. Substances used in other ways or settings are often framed as potentially harmful, morally dubious, and associated with a propensity for physiological and psychological addiction.

This pilot research tested a mixed methods design to examine the effects of psychoactive substances among professionals and students in professional programs. We designed a mixed methods approach that would gather real time reports of anticipated and experienced effects, as well as allow in-depth discussion of participant substance use, contest of use, and the impact on cognition, mood, performance, and experience of daily activities. We explored the desired and undesired effects, and the potential positive and negative effects of substance use from the perspective of the person using the substance, including licit, illicit, and prescribed substances. Employing ecological momentary assessment (EMA) capitalizes on the widespread use of mobile devices among professionals and students, with software designed to easily collect real-time data in situated contexts. The use of an ‘App’ facilitates recruitment into an interview component, which enables enriched understanding of respondent reasoning.

Individuals use a wide range of substances, with decision to use influenced – at least in part – by the anticipated impact of a substance on the performance or experience of valued activities (e.g., caffeine to improve performance at school; ecstasy to enhance enjoyment at a dance club) (Boys et al., 1999; Patrick, Bray, & Berglund, 2016; van Boekel, Brouwers, van Weeghel, & Garretsen, 2014; Witteveen, Van Ameijden, Prins, & Schippers, 2007). Substances that effect mood and cognition are increasingly associated with efforts to perform better at academically or at work (Bloomfield, Brian, Dale, & Karen, 2015; Enck, 2014; Outram, 2010). A study of surgeons found high rates of substance use for both cognitive enhancement and mood enhancement, in attempt to meet expectations and demand of work (Franke et al., 2013). There is an increasing body of literature about methylphenidate (Ritalin) and other substances being used for cognitive enhancement (Brühl & Sahakian, 2016; Racine & Forlini, 2010) and use of prescribed substances for emotion or mood enhancement is relatively common (Conrad & Slodden, 2013). While using substances in sports is more likely perceived as "cheating," cognitive enhancers are more likely to be viewed as necessary performance enhancement in a competitive workforce (Vargo et al., 2014).

Despite evidence suggesting substances can have desired effects, most research focuses on negative effects and potential risks (Author A, 2017). Further complicating research about substance use are issues of social stigma and repercussions that prevent individuals from disclosing personal experiences and/or voicing perspectives that oppose dominant paradigms. Negative consequences that could result from disclosure of the use of some substances include child custody investigation, loss of employment or future opportunities, stigma and ostracism, legal charges, and subpar health care (van Boekel, Brouwers, van Weeghel, & Garretsen, 2013; van Boekel et al., 2014). These consequences may be unrelated to the direct effects of the

substance on the person, their performance, or their capabilities. Moreover, too often research on substance use relies on study samples drawn from addiction treatment programs, tending to over-sample those who have low-income, inadequate social supports, concurrent mental illness, and/or developmental delay and struggle with problematic use, while omitting the experiences of those whose substance use may be non-problematic (Centre for Addiction and Mental Health, 2001; Didden, Embregts, van der Toorn, & Laarhoven, 2009; Granfield & Cloud, 2001). Accordingly, experiences of substance use for many people remain hidden and silenced.

Examining substance use (prescribed, licit, illicit) in terms of effects (e.g., altered perception, consciousness, emotional regulation, cognition, behaviour), facilitates exploration of potential similarities and differences in both use and implications of use. Taking up an insider perspective on decision-making about substance use and assessment of effects challenges pervasive assumptions that demarcate substance use based on social acceptability. Though the majority of existing research is limited to pharmacy, medicine, nursing, and dentistry, it indicates unique patterns of substance use among professionals and students (Author A, 2017). Studies of motivations for use are scant, but reported desired effects include improved sleep, stress management, alleviation of boredom, and improved productivity (D. A. Dabney & Hollinger, 1999; Merlo, Cummings, & Cottler, 2014). These studies tend to be informed by participants involved in treatment programs or those identified by professional regulatory bodies as needing intervention. Students in professional programs have reported using substances to improve concentration, productivity, or grades, to enhance energy, to facilitate weight loss, and to aid in socialization (Aslam et al., 2013; McNiel et al., 2011; Volger, McLendon, Fuller, & Herring, 2014).

Perhaps because disclosure of substance use risks professional censure or loss of license, previous studies exploring incentives or reasons for use tend use anonymous surveys (Author A, 2017), which draw on sociological and psychological theories to identify "reasons for use." Response options often require meta-cognition and personal insight, including categories such as "peer pressure," "social gesture," "habit," and "financial problems." Surveys are susceptible to retrospective self-report biases, related to personal and subtle external influences, such as social desirability, and are prone to errors resulting from memory deficits and cognitive judgement biases (Voogt et al., 2013).

This is the first study of its kind to elicit data from a broad range of professionals, about a broad range of potential effects from a broad range of substances, reported in real time. The methods enabled the inclusion of participants from higher socioeconomic strata, professionals and students in professional programs – who need not be involved with addiction treatment programs or regulatory bodies. We propose that research about substance use could more deliberately collect data about the enhancement effects and experiences of substances and piloted an EMA instrument that was designed for this purpose. We examine the effectiveness of the data collection instrument to inform understandings about the effects of psychoactive substances on performance, mood, cognition, and quality of experience among professionals and students in professional programs.

2.0 Methods

2.1 The EMA data collection instrument

Informed by the principal applicant's prior research and expertise with respect to substance use (Author A, 2016, 2017), the EMA data collection instrument was designed using MetricWire, a technology specialised to support ecological momentary assessment for Android and iOS

platforms. The instrument enabled users to easily and quickly record substance(s) used, social context, general setting/location, activities engaged in while using or experiencing substance effects, perceived immediate and longer-term effects on performance and quality of experience. An instruction manual was provided by email and posted on the project website. Instructions were also provided in the information section of the App.

EMA data are submitted immediately and not stored directly on the device, thereby maximising security (Runyan et al., 2013). Participants could not revise individual entries after reporting. Each entry was automatically time-stamped. Participants could retrospective report if they were in a situation that prohibited use of their device. The instrument was designed to *not allow* access to the location feature of the device (e.g., GPS). The data were securely uploaded and stored by MetricWire, a Canadian-owned company, with access to data only permitted to the researchers. Participant data are automatically encrypted. Access to MetricWire software is a paid service and the data are owned by the researchers.

2.2 Inclusion criteria

Participants were English-speaking, residing in Canada, 19-years or older, used at least one psychoactive substance, and identified as professionals or students in professional programs. Eligibility criteria included one of the following: i) approximately daily use of a non-prescribed psychoactive substance; ii) approximately weekly non-prescribed use of one or more psychoactive substances, though the type of substance used may vary (e.g., substances used might differ week-to-week), and *some* of the substances may be prescribed, or iii) infrequent (less than weekly) but heavy use (e.g., heavy use over a discrete period in a month; binge use) of a psychoactive substance. Participants needed to have access to a mobile device and WiFi in order to use the App.

Recruitment. Professionals are members of a profession-specific society, association, college, and/or regulatory body; subject to a code of professional ethics or code of conduct; and/or subject to professional licensure or accreditation. Recruitment involved emailing research coordinators at twenty Canadian universities to request they forward the advertisement to students and alumni. Universities were purposively selected to include multiple provinces and regions (e.g., Atlantic region) and those offering a comprehensive range of professional programs, such as law, engineering, business, veterinary science, pharmacy, dentistry, nursing, social work, speech language pathology, audiology, occupational therapy, physical therapy, medicine, and psychology. All eligible volunteers were accepted during a predetermined period for EMA data collection (n=34). When consenting to EMA participation, participants were invited to be contacted for an in-person or phone interview. The intention was not to obtain a representative sample, but to establish a selection process that allows for variety (e.g., sex, profession, types of substances use) to test the methodology. Participants were not compensated.

2.3 EMA data collection

Information collected using the EMA instrument included:

1) Demographics (once at beginning): Age (within a 5-year age range); province/territory of Canadian residence; profession; gender; status (professional or student).
2) Information about substance use (EMA reporting): Substance consumed, amount used, time of use, anticipated and delayed effects, and context.
3) Feedback (once at end): A follow-up survey gathered feedback on ease of use, feasibility, relevance and scope of data collected, and recommendations for design improvement.

Information about substance use was an event-contingent trigger; each time a participant consumed a substance, they completed the substance use survey and indicated the anticipated

effects of the substance. If the participant forgot to enter an event or was in a setting where entering data was inconvenient or impossible (e.g., actively engaged in another activity; no access to WiFi), they were asked to input data retrospectively. To distinguish between these events, participants were selected either *I'm taking a substance now* or *Oops, I forgot to report*. Participants could also report *I'm experiencing a delayed effect*. Respective entries included an additional request of date and time of use, with all entries immediately date and time stamped. Effects were categorised as *feeling* (25 emotion-related changes), *bodily changes* (12 physiological-related changes), *thinking* (10 cognition-related changes), and *doing/performance* (21 changes related to engagement, performance, or experience of activities). Participants could select as many effects as they wanted for each substance. This was not intended as a conceptual model; rather it was a way of intuitive organising a large list of potential effects. Many effects were listed with binary options, such as pain/discomfort increase and pain/discomfort reduced. This provided an intuitive way to organise a large number of effects. Participants could select as multiple effects.

EMA data were collected over a 4-week period for each participant, during February-April, 2016. Previous EMA studies range between 2 to 8 weeks (Collins et al., 1998; Phillips, Phillips, Lalonde, & Dykema, 2014; Stone et al., 2003). A 4-week period was anticipated to adequately capture regular patterns of substance use, particularly given the prevalence of licit (e.g., alcohol, caffeine, over-the-counter medication) and prescribed medication use. Four weeks was also considered sufficient to capture occasional variations in substance use. Optimal duration of EMA data collection was one key feature of feasibility being pilot-tested. Qualitative feedback was possible through the App in an optional survey entitled *More to say* and in the *Feedback* survey.

2.4 Interview data collection

Qualitative interviews took place by phone or in a location selected mutually by the interviewer and research participant. Participants were invited to partake in three 30- to 60-minute semi-structured interviews. An interview guide included open-ended questions intended to explore participants' perspectives about their use of substances, the impact on their daily activities, the nature of professional contexts (social and institutional) with respect to substance use, and the extent to which they discussed their substance use with others. The second and third interviews included questions about participant reflections since the previous interview, non-chemical strategies of managing stress and well-being, and feedback about the EMA instrument. All interviews were conducted by the lead researcher. Ongoing analysis informed the follow up interviews, which is consistent with grounded theory (Glaser, 2017).

With participant consent, interviews were digitally recorded, transcribed verbatim, and checked against the original recording. One audio file proved inaudible, impeding complete transcription; all other data from this participant was retained.

2.5 EMA data analysis

The EMA software reported raw data in a single table format, which was then entered into R statistical software (R core team, 2013) for statistical analysis. The analysis was descriptive, identifying patterns worth pursuing in the full-scale study, and developing preliminary interpretations about the perceived impact of substance use on the performance and experience of everyday activities. The approach to data analysis diverges from most substance use research in its focus on psychoactive substances collectively (licit, illicit, and prescribed) in relation to activities, recognising that substances can enhance and detract from performance in complex ways.

At the end of the study, participants provided feedback about the process of using the App, including ease of use, appropriateness of "effects" included in the checklists, perceived accuracy of data provided, and recommendations for modifications to the instrument. These data will inform modification of the tool and subsequent study design. Analysis attended to evaluation of the quality of data collected, the process of data collection, and participant feedback regarding use of the instrument.

2.6 Interview data analysis

Interview data were analysed using constructivist grounded theory (Charmaz, 2011), which we have reported on elsewhere (Authors, 2018). Constant comparison entailed both immersion in individual accounts and systematic examination across participants, using concept mapping and thematic analysis to integrate quantitative and qualitative data analysis. Concept mapping (Rosas & Kane, 2012) helped clarify interpretations of the relationships between substance use, the effect on performance and experience of activities, and aspects of professional role and identity. For this paper, the analysis focuses on the ways qualitative interviews enriched the EMA data, reasons for participation, and reactions to study participation.

3.0 Results/Findings

3.1 Recruitment and participation

Thirty-four people volunteered for the EMA component, though two participants completed only the demographics. The remaining 32 included ten men and 22 women, from six Canadian provinces. Participant ages ranged from 18-50 years, with 90% aged 21-35. Participants were predominantly graduate students, particularly those who engaged in the interviews. Professions included social work, nursing, psychology, dentistry, law, engineering, speech language pathology, occupational therapy, and physical therapy.

Of the 32 participants, length of participation in EMA data collection ranged from 1 to 29 days (mean: 19 days; median: 21 days), with the total number of substance use entries per participant ranging from 1 to 110 entries (mean: 26; median: 19). The number of entries *per day* per participant ranged from 0.12 to 3.93 entries (mean 1.29; median 1.13).

All participants who were interested were interviewed, for a total of 20 interviewees (14 women, 6 men). Six people engaged in all three interviews, 11 participated in two interviews, and three engaged in one interview (one of whom volunteered after the data collection period had ended). A majority of interviewees were in the health professions and were students.

Interviewees were asked about reasons for participating in the study. Many were interested in supporting research in general, while others found the topic novel and valuable:

> I think it's really cool that you're studying this, because I think it is something that should be talked about. And should be brought to the forefront because I think just because people believe that's the way it should be, that professionals shouldn't be taking substances, doesn't mean that's the case. Just because it hasn't been investigated or talked about doesn't mean it hasn't been occurring. (R)

The focus on use and benefits was also of interest to participant. One person explained, "I think substance use, not necessarily abuse, but use, is more prevalent in students across all disciplines. And it's just an interesting topic" (N). Another person was enticed by the opportunity to discuss "the benefits of using certain things, because all too often a lot of things were sort of vilified" (K).

Overall, the study seemed to appeal to participants as an opportunity to reflect on their own use of substances and to share their perspectives about a contentious topic with others. They were interested in increasing public awareness of substance use by professionals and reducing

stigma. The recruitment advertisement appeared to be perceived as reflecting a non-judgemental and non-punitive understanding of substance use, which appealed to those who felt they were otherwise not able to discuss their substance use. The EMA instrument afforded extra assurance of anonymity to those who desired it; nevertheless, during interviews participants did disclose information that they had not disclosed to family, friends, or colleagues, indicating a level of trust and confidence in the methodology.

3.2 Types of substances used (EMA data)

Table 1 outlines the substances reported, number of people reporting use of each substance, and number of EMA data entries for each substance. Caffeine, alcohol, and pain suppressants were reported by the most participants, while caffeine, alcohol, and antidepressants were most frequently reported.

[INSERT TABLE 1 HERE]

Two-thirds of participants reported that their use was "typical" during the data collection period. Five participants reported their use was more than usual and five reported it was less than usual. Prescribed substances were generally reported as being used as prescribed or indicated. According to interviews, substances reported in the EMA App were generally ones they had previously used.

There was a total of n=890 substance use entries, though some reports for alcohol ranged from 0.5 to 20 standard drinks per entry, which was an option when repeated entry for each use would cause unreasonable participant burden. Of these entries, n=596 (67%) were under the option of "I am taking a substance now" (reporting anticipated effects), n=279 (31.3%) were "Oops, I forgot to report" (retrospective report of effects), and n=15 (1.7%) were "I am noticing a delayed effect" (e.g., hangover or comedown effects). With current EMA capacity, if a person

submitted an entry about taking alcohol in the evening and reported a delayed effect of a headache the next day, these would be reported as two separate entries. The "Oops, I forgot to report" option tended to occur when using alcohol, cannabis, LSD, or cocaine. Although there were insufficient data to compare anticipated, retrospective, and delayed effects of substances, this would be possible to analyse in larger studies.

During the interviews, participants were asked about current use of substances and the substances reported closely mirrored those captured by the EMA tool. Most commonly people described use of caffeine and alcohol, followed by pain and mental health medications (antidepressants, anxiolytics, and antipsychotics) as well as cannabis, with far fewer interviewees reporting use of substances like MDMA, cocaine, and hallucinogens. The triangulation of data suggests the EMA tool was reasonably accurate.

3.3 Context for use

Table 2 depicts who was present when substances were used. Sometimes more than one category was selected (e.g., spouse and friends) so rows do not total 100%. Illicit substances such as cannabis, LSD, methamphetamine, cocaine, and MDMA were commonly taken with friends, whereas prescription medications were typically taken alone. Alcohol is the only substance that was used regularly either alone or with others. Substances were most frequently used at home (see Table 3). Alcohol and cannabis were commonly used in private homes. The EMA tool allowed 'other' and 'no answer' responses, but those were used almost exclusively for instances where people were reporting delayed effects of prior substance use.

[INSERT TABLES 2 & 3 HERE]

3.4 Reporting of effects

Some substances had reported effects across all categories, while some had reported effects primarily in one or two categories. The EMA tool captured a range of reported effects, including those with high social desirability and those with lower social desirability.

The commonly reported effects on performance included enjoyment of activities (e.g., tobacco, caffeine, alcohol, cannabis), enhanced work or school performance (e.g., caffeine, antidepressant), enhanced socialising (e.g., alcohol, antidepressant, cannabis), boredom reduced (e.g., tobacco), and improved sleep (e.g., cannabis, benzodiazepine).

Commonly reported effects on thinking were improved clarity (e.g., caffeine, antidepressant, tobacco), improved concentration and focus (e.g., caffeine, antidepressant, pain suppressant, tobacco), and change in perception or senses (e.g., cannabis).

Bodily effects reported included improved energy (e.g., caffeine, antidepressant, tobacco, antihistamine), reduced energy (e.g., benzodiazepine), increased appetite (e.g., cannabis), pain and discomfort reduced (e.g., pain suppressant) and avoidance of withdrawal symptoms (e.g., antidepressant, benzodiazepine, tobacco).

Finally, substances were reported to affect feelings by increasing happiness and enjoyment (e.g., alcohol, cannabis, tobacco), helping to relax (e.g., alcohol, cannabis, benzodiazepine, tobacco, antihistamine), reducing anxiety or stress (e.g., alcohol, antidepressant, cannabis, benzodiazepine, tobacco), increasing motivation (e.g., alcohol, antidepressant), increasing confidence (e.g., alcohol), increasing disconnectedness (e.g., antidepressants, antihistamines), increasing sleepiness (e.g., antihistamines), creating a sense of spacing out (e.g., cannabis, antihistamines) and numbing emotions (e.g., antihistamines, antidepressants, tobacco).

Less commonly reported effects included work or school performance reduced, sleep disrupted, impaired driving, risk-taking, tardiness, sport or leisure reduced, jumpy or jittery,

hallucinations, accident or injury, pain or discomfort increased, altered sexual arousal, aggressiveness or irritability, increased excitement, overstimulation, or sadness.

These effects were similar for other substances, such as cocaine, MDMA, and LSD, but since there were few reports for these substances, they were not included as examples in this section.

Figure 1 presents the most frequently reported effects of caffeine, alcohol, cannabis, and mental health medications (benzodiazepines and anti-depressants), which were the most commonly reported substances. This type of analysis can be used to explore the variability and commonalities of effects across substances, and can lend to understandings about why people select to use certain types of substances. For instance, the frequency of the substance enhancing a feeling of connectedness was relatively similar across substances, whereas feeling awake was more exclusive reported in relation to caffeine.

[INSERT FIGURE 1 HERE – in colour]

In each category of potential effects, there was the option to select 'none of these' or 'no answer,' which generated some unexpected results. For both benzodiazepines and anti-psychotics 'none of these' or 'no answer' are the responses for all four categories of effects (performance, thinking, bodily changes and feelings). It seems unlikely that people are using those substances with no expected effects, which suggests desired response options may be missing.

In qualitative interviews participants were not directly asked to provide additional detail on substance use effects. In general, the effects described mirrored those reported in the EMA data collection, with a few additional descriptors (e.g., mellow, stamina, digestion, feeling

present, mobility, memory) that will be considered for future iterations of the App. The similarity of descriptors suggests the App response categories are generally adequate.

3.5 Reactivity: Shifts in thinking and acting

It was not the intent of the research to increase awareness of personal substance use or to influence change in use; however, several participants reported these outcomes as a result of their involvement in this study. The interviewer is a motivational interviewing trainer and was cognisant of using techniques to convey a non-judgemental conversational style while refraining from 'therapeutic' responses intended to facilitate change. Nonetheless, participants described changes in awareness and behaviours.

3.5.1 Change in awareness.

Several interviewees noted an increased awareness of their caffeine use as a result of reporting expectations. As one participant stated, "I'm thinking it helped, because I was logging it and I was like 'whoa wait a second, I'm drinking a lot more tea and coffee'" (B). Others noted that they felt more accountable, given the researchers would see the reports of substance use, even though the data were anonymous:

> Sometimes I felt a little jokey … 'oh my gosh I'm gonna have to report that I had another coffee' … it was very different when I was making the decision subconsciously without accountability versus being accountable to reporting it in the App. That little piece of accountability sort of structures the way I think I made decisions… it really made me question. (F)

It need not affect use, but did make some people think twice: "I've been thinking about making coffee at home, and go 'wait, if I make it I have to report it' … For some reason it makes me pause" (C).

In some cases, having to report the effects reframed personal understandings of substance use. For instance, one participant found the effects of multiple substances related to energy, stating, “I didn’t realise that I used substances as much to moderate my energy levels, so a lot of the time when I’m using a substance it’s either to increase my energy and my alertness or to decrease it and I’m sort of playing this kind of balance game” (M). Recording anticipated effects also encouraged some to question whether they even needed to use substances for those reasons:

> I was entering things morning and night and with such regularity and always for the same reasons and always for the same expectations. And I guess maybe what it has made me question is, are these expectations even real. Do I really need the substances for the reasons that I think I do? (G)

Reporting the effect of substances caused some to question the distinction between choice and dependence, such as, “I’m aware of how reliant I am on them. Like caffeine in particular … one of the questions in the survey was ‘are you taking it to avoid withdrawal’ and that was always checked off” (G).

3.5.2 Change in actions.

Some interviewees reported having made changes as a result of participating in this project. One person had reduced alcohol use. “Knowing that I had to record it to someone, to another body, it was like, ‘oh, ok, well I’m gonna have three beer anyways.’ But maybe I want a fourth beer, but nah maybe that’s a little bit too much alcohol for today. I’m not gonna have it tonight (J). Two people reported integrating other strategies to produce the desired effects of the substances they had been using. For instance, one person engaged in more social outings and exercise to “wind down, and de-stress. As opposed to just pouring cup after cup after cup of coffee” (C). Another

person (R) reported re-engaging in meditation, with enhanced ability to focus and resulting decreased use of marijuana.

One person reporting having collaborated with their family physician to develop a "quit smoking plan." The participant explained:

> I thin using the App had a part to play in that, because it made me a lot more mindful of when I was smoking and why and how much… nine times out of ten my expected benefits didn't really come true. So I'm telling myself that I'm getting one thing from smoking [cigarettes], so for example it will relax me, it will make me more alert at work. And then I'm consuming it and finding that afterward I'm not receiving the benefit that I expected going in. So it kind of ends up looking pretty hollow. (M)

Another participant who was using over-the-counter sleeping medications both reduced use and confided in their partner the extent of use.

> As I was … using the App, I was like, 'Wow. I'm doing this every single night.' And, that kinda made me reflect upon why am I using these? Do I really need them? Is this sort of a dependence on them? Even talked to my boyfriend about it … So, I did stop using them every night. (D)

Finally, one participant (F) decided to continue monitoring caffeine intake and had starting using an App designed for that purpose. After discussing this research with a family member, that person also began tracking caffeine intake, recognizing both dependence and withdrawal symptom.

4.0 Discussion

While it is not possible to know the response rate, recruitment into this study produced a sample diverse in professions and geographic areas, and reported substances used. Collecting information in real-time is a means to collect more accurate data, as it mitigates retrospective bias, as self reports about substance use are prone to recall bias, social desirability bias, and cognitive judgment bias (Berkman, Dickenson, Falk, & Lieberman, 2011; Krumpal, 2013; Mortel, 2008; Voogt et al., 2013).

This study was unique by asking about anticipated and actual effects of substances, whereas many survey about substance use focus solely on prevalence (Author A, 2017). Studies about substance use are frequently designed with a focus on eliciting information about undesired effects or negative consequences of substance, neglecting to include indicators about positive effects or desired consequences (Author A, 2017). Several studies have been undertaken to explore "reasons for use," which are described more fully in a literature review by the first author (2017). However, the available options for reasons for use are generally selected from a list created by the researcher, which may be more closely linked to theory (e.g., peer pressure) than experience (e.g., improve socialisation). Furthermore, identifying personal reasons for use requires high level meta-cognition, which is susceptible to attribution bias and awareness of tacit knowledge.

Fleshing this out with interviews allows exploration of the impact of profession-specific demands and social expectations. While this study was small, it provides novel knowledge about use of substance by professional and students in professional programs, as a previous literature review by the first author (Author A, 2017) found seven article (drawn from five studies) that involved interview methodology. Three of these studies recruited participants from substance use treatment settings, with one study reported in two articles (Alves, Vieira, Laranjeira, Vieira, &

Nogueira Martins, 2012; D. Dabney & Hollinger, 2002; D. A. Dabney & Hollinger, 1999; Lillibridge, Cox, & Cross, 2002). Two studies used focus group methodology with participants recruited from a state monitoring program (Merlo, Cummings, & Cottler, 2012; Merlo, Singhakant, Cummings, & Cottler, 2013). Only two studies that used interview methodology recruited from outside treatment settings or state monitoring programs (Meyers & Perrine, 1996; E. R. Shore, 1997; Elsie R. Shore, 2001).

Exploration of where substances are used and who was present can provide valuable information about how use by professional compares with the general population and current models of addiction, which is currently a gap in the literature. For instance, it appears that participants tended to use substances at home or at a friend's home, either alone or with friends. This may reflect a need to maintain a professional identity in public settings, making some substance use a highly private event. Addiction theories and screenings that ask about substance use when alone might be less sensitive for this population (Keough, Connor, Sherry, & Stewart, 2015).

Participants using EMA reported a wide variety of substances expected to directly or indirectly enhance performance, mood, and cognition (e.g., energy and clarity of thought, reduce pain, enhance socialisation, manage stress, improve sleep, and to relax) and to enhance the general experience of activities. Experiences of risk-taking, overstimulation, higher anxiety, and agitation were less common. This suggests participants may be engaging in substance use in ways that mitigate against potential undesired consequences frequently associated with substance misuse (Panagopoulos & Ricciardelli, 2005). This study design seems able to capture some of how decision-making is influenced by evaluating anticipated impact of substance use on the performance of valued activities (e.g., work, studying, sleep), quality of experience (e.g. stress

relief), and social and institutional contexts (e.g., legal status). These findings may lend to understanding about benefit and non-problematic use (First Nations Health Authority, Province of British Columbia, & Government of Canada, 2013) that builds on theories of controlled use (Decorte, 2001) and expands on notions on 'use' and 'user' beyond illicit substances. Examining anticipated and experienced effects of substances equivalently, regardless of whether they are viewed as socially acceptable, legal, or healthy, illustrates similarities in reported effects across a range of substances. This is an important move toward better understanding how people choose to use various substances and the longer-term implications.

Professional positions and education programs are very demanding, and it is therefore not surprising that participants used substances to increase productivity, and to increase relaxation and aid with sleep. Substance use often requires relatively few resources and little time commitment, which makes it an appealing means to achieve a desired outcome. It is notable that the EMA data shows certain substance use to be largely confined to private spaces (except for caffeine and alcohol), which may be partly related to the limited amount of time professionals have available for social engagement, or the need to maintain professional image in public settings.

Reactivity, or reactance, refers to the potential for repetitive exposure to a particular factor to alter a person's relationship to that factor (Dunton, 2011). A literature review about reactivity found overall limited evidence of reactivity in EMA studies that analysed this factor (Author A, 2017), though one study reported approximately 30% of people who responded to EMA assessment reported increased self-awareness about thoughts, feelings, and actions, which influenced their subsequent decisions (Freedman, Lester, McNamara, Milby, & Schumacher, 2006). In this project, almost half of the interviewees reported increased awareness and changes

in their thoughts about their substance use, with many of those making active changes. The fact that people were surprised by their use patterns suggests the real-time data capture possible through EMA is less subject to social desirability and recall bias than are standard surveys about substance use. As participants became more aware of their use of substances to achieve desired effects, they began to consider alternatives to achieve desired outcomes. EMA instruments have high responsiveness and can effectively detect change over time (Voogt et al., 2013). Changes in use and/or effects could be evaluated. This was an unexpected effect of the study, with implications for future research and potentially for behaviour change. It may or may not be replicated in a sample containing fewer health professionals (Authors, 2018). Though it was not intended to alter substance use, the potential for the App to be used to as a self-change instrument warrants further investigation.

4.1 Limitations

It was not possible to calculate the response rate, as invitations were forwarded at the discretion of gatekeepers, limiting interpretations of selection bias and generalisability; however, given this was a pilot study, generalisability was not an anticipated outcome. While the pilot study did not ensure representativeness or theoretical saturation, a wealth of novel, rich data was collected to guide future study design at a larger scale. The results suggest some common experiences regarding the effects of substances, but given the small sample in this pilot study, it is too soon to confidently exclude potential effects that were seldom used. It may be that additional effects are needed.

Event-contingent reporting about substance use effects poses an interesting challenge, as the effects are not immediate and therefore the reported effects are in fact anticipatory. If the reporting is delayed, there is a challenge of retrospection, with perception and memory being

impacted by some substances. Prompted surveys, 1-hour and 8-hours following each substance use event, would be optimal to analyse shifting substance effects over time. This option depends on by the versatility of the EMA software and cost of developing project-specific software.

Reporting of expected effects did not distinguish desirability of effects, leaving open to interpretation which effects are incentives for use and which are tolerated effects. For instance, we might assume that improved concentration is desired and hangovers are tolerated but undesired. Such distinctions were discussed in more depth during interviews, but including this explicitly in the EMA instrument would require strategies to minimize participant burden

Future studies require a representative sample within and across professional groups. A response bias may have existed within this participant group, as professionals and students in professional programs who were currently using illicit substances, or using substances in ways that were problematic, may not have volunteered for the study. While professionals and students in professional programs may have many personal, social, and economic resources to mitigate negative consequences, this does not preclude them developing problems associated with substance use. This study suggests participants were choosing to use certain substances in certain ways, yet how these patterns were learned (e.g., personal experience, social modelling) requires more study. A larger sample would enhance the power to analyse the effects of less frequently used substances, and enable more nuanced multivariate analyses.

4.2 Conclusions

Knowledge about substance use has important implications for service design, legal decisions, and policy development, yet a significant segment of the population has been absent from research on substance use. The intent of this research was not to uncover the extent of use for the purpose of justifying measures for increased surveillance or monitoring of individual use. We

concur with participants that it is time to acknowledge that substances are being used among professionals, and to create opportunities to examine the circumstances contributing to use. Documenting not only individual use but also social and professional context may facilitate systems-level approaches to intervention. For example, if substances are used primarily for improved work performance and reduced stress, perhaps dominant professional norms and expectations need to be addressed. By understanding why people use substances, we can begin to construct social environments in ways that are most conducive to people's desired outcomes without relying on substances. If reduced anxiety, increased energy, enjoyment, and happiness, and improved performance are frequently anticipated effects, across all psychoactive substances, we may need to look deeper into what current circumstances are inhibiting those outcomes, and what non-substance alternatives might contribute to those desired effects.

Ethics Approval

[Institution Blinded] Social Sciences & Humanities Research Ethics Board REB #: 2015-3671

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References

Alves, H. N. P., Vieira, D. L., Laranjeira, R. R., Vieira, J. E., & Nogueira Martins, L. A. (2012). Clinical and demographic profile of anesthesiologists using alcohol and other drugs under

treatment in a pioneering program in Brazil. *Brazilian Journal of Anesthesiology, 62*(3), 356-364. doi:10.1016/S0034-7094(12)70136-8

Aslam, H. M., Mughal, A., Edhi, M. M., Saleem, S., Rao, M. H., Aftab, A., . . . Khan, A. M. H. (2013). Assessment of pattern for consumption and awareness regarding energy drinks among medical students. *Archives of Public Health, 71*(1), 31. doi:10.1186/2049-3258-71-31

Author A. (2016).

Author A. (2017).

Authors. (2018).

Berkman, E. T., Dickenson, J., Falk, E. B., & Lieberman, M. D. (2011). Using SMS text messaging to assess moderators of smoking reduction: Validating a new tool for ecological measurement of health behaviors. *Health Psychology, 30*(2), 186-194. doi:10.1037/a0022201

Bloomfield, Brian, Dale, & Karen. (2015). Fit for work? Redefining 'Normal' and 'Extreme' through human enhancement technologies. *Organization, 22*(4), 552-569. doi:10.1177/1350508415572507

Boys, A., Marsden, J., Fountain, J., Griffiths, P., Stillwell, G., & Strang, J. (1999). What influences young people's use of drugs? A qualitative study of decision-making. *Drugs: education, prevention and policy, 6*(3), 373-387.

Brühl, A. B., & Sahakian, B. J. (2016). Drugs, games, and devices for enhancing cognition: Implications for work and society. *Annals of the New York Academy of Sciences, 13691*(1), 195-217. doi:10.1111/nyas.13040

Centre for Addiction and Mental Health. (2001). *Best practices: Concurrent mental health and substance use disorders*. Ottawa, ON: Publications Health Canada.

Charmaz, K. (2011). Grounded theory methods in social justice research. In N. K. Denzin & Y. S. Lincoln (Eds.), *The SAGE handbook of qualitative research* (4th ed., pp. 359-380). Thousand Oaks, CA: SAGE Publications, Inc.

Collins, R. L., Morsheimer, E. T., Shiffman, S., Paty, J. A., Gnys, M., & Papandonatos, G. D. (1998). Ecological Momentary Assessment in a behavioral drinking moderation training program. *Experimental and Clinical Psychopharmacology, 6*(3), 306-315. doi:10.1037/1064-1297.6.3.306

Conrad, P., & Slodden, C. (2013). The Medicalization of Mental Disorder. In C. S. Aneshensel, J. C. Phelan, & A. Biermann (Eds.), *Handbook of the Sociology of Mental Health. Handbooks of Sociology and Social Research* (pp. 61-73). Dordrecht: Springer.

Dabney, D., & Hollinger, R. C. (2002). Drugged druggists: The convergence of two criminal career trajectories. *Justice Quarterly, 19*(1), 181-213. doi:10.1080/07418820200095211

Dabney, D. A., & Hollinger, R. C. (1999). Illicit prescription drug use among pharmacists. Evidence of a paradox of familiarity. *Work and Occupations, 26*(1), 77-106.

Decorte, T. (2001). Drug users' perceptions of 'controlled' and 'uncontrolled' use. *International Journal of Drug Policy, 12*, 297-320.

Didden, R., Embregts, P., van der Toorn, M., & Laarhoven, N. (2009). Substance abuse, coping strategies, adaptive skills and behavioral and emotional problems in clients with mild to borderline intellectual disability admitted to a treatment facility: A pilot study. *Research in Developmental Disabilities, 30*, 927-932. doi:10.1016/j.ridd.2009.01.002

Dunton, G. F. (2011). Using real-time data capture methods to investigate children's physical activity and eating behaviors. In C. M. Segel (Ed.), *Childhood obesity risk factors, health effects, and prevention* (pp. 105-114). New York, NY: Nova Science Publishers.

Enck, G. G. (2014). Pharmaceutical enhancement and medical professionals. *Medicine, health care, and philosophy, 17*(1), 23-28. doi:10.1007/s11019-013-9507-z

First Nations Health Authority, Province of British Columbia, & Government of Canada. (2013). A path forward: BC First Nations and Aboriginal People's mental wellness and substance use – 10 year plan. Retrieved from http://www.fnha.ca/documents/fnha_mwsu.pdf

Franke, A., Bagusat, C., Dietz, P., Hoffmann, I., Simon, P., Ulrich, R., & Lieb, K. (2013). Use of illicit and prescription drugs for cognitive or mood enhancement among surgeons. *BMC Medicine, 11*, 102. doi:10.1186/1741-7015-11-102

Freedman, M. J., Lester, K. M., McNamara, C., Milby, J. B., & Schumacher, J. E. (2006). Cell phones for ecological momentary assessment with cocaine-addicted homeless patients in treatment. *Journal of Substance Abuse Treatment, 30*, 105-111.

Glaser, B. (2017). *Discovery of grounded theory: Strategies for qualitative research*: Routledge.

Granfield, R., & Cloud, W. (2001). Social content and "natural recovery": The role of social capital in the resolution of drug-associated problems. *Substance Use & Misuse, 36*(11), 1543-1570.

Keough, M., Connor, R., Sherry, S., & Stewart, S. (2015). Context counts: Solitary drinking explains the association between depressive symptoms and alcohol-related problems in undergraduates. *Addictive Behaviors, 42*, 216.

Krumpal, I. (2013). Determinants of social desirability bias in sensitive surveys: a literature review. *International Journal of Methodology, 47*(4), 2025-2047. doi:10.1007/s11135-011-9640-9

Lillibridge, J., Cox, M., & Cross, W. (2002). Uncovering the secret: Giving voice to the experiences of nurses who misuse substances. *Journal of Advanced Nursing, 39*(3), 219-229.

McNiel, A. D., Muzzin, K. B., DeWald, J. P., McCann, A. L., Schneiderman, E. D., Scofield, J., & Campbell, P. R. (2011). The nonmedical use of prescription stimulants among dental and dental hygiene students. *Journal of Dental Education, 75*(3), 365-376.

Merlo, L. J., Cummings, S. M., & Cottler, L. B. (2012). Recovering substance-impaired pharmacists' views regarding occupational risks for addiction. *Journal of the American Pharmacists Association, 52*(4), 480-491.

Merlo, L. J., Cummings, S. M., & Cottler, L. B. (2014). Prescription drug diversion among substance-impaired pharmacists. *American Journal on Addictions, 23*(2), 123-128.

Merlo, L. J., Singhakant, S., Cummings, S. M., & Cottler, L. B. (2013). Reasons for misuse of prescription medication among physicians undergoing monitoring by a physician health program. *Journal of Addiction Medicine, 7*(5), 349-353.

Meyers, A. R., & Perrine, M. W. (1996). Drinking by police officers, general drivers and late-night drivers. *Journal of Studies on Alcohol, 57*(2), 187-192.

Mortel, T. (2008). Faking it: Social desirability response bias in self-report research. *Australian Journal of Advanced Nursing (Online), 25*(4), 40-42,45-48.

Outram, S. M. (2010). The use of methylphenidate among students: the future of enhancement? *Journal of Medical Ethics, 36*(4), 198-202. doi:10.1136/jme.2009.034421

Panagopoulos, I., & Ricciardelli, L. A. (2005). Harm reduction and decision making among recreational ecstasy users. *International Journal of Drug Policy, 16*(1), 54-64. doi:https://doi.org/10.1016/j.drugpo.2004.09.001

Patrick, M. E., Bray, B. C., & Berglund, P. A. (2016). Reasons for marijuana use among young adults and long-term associations with marijuana use and problems. *Journal of studies on alcohol and drugs, 77*(6), 881-888.

Phillips, M. M., Phillips, K. T., Lalonde, T. L., & Dykema, K. R. (2014). Feasibility of text messaging for ecological momentary assessment of marijuana use in college students. *Psychological Assessment, 26*(3), 947-957. doi:10.1037/a0036612

Racine, E., & Forlini, C. (2010). Cognitive enhancement, lifestyle choice or misuse of prescription drugs?: Ethics blind spots in current debates. *Neuroethics, 3*(1), 1-4.

Rosas, S. R., & Kane, M. (2012). Quality and rigor of the concept mapping methodology: A pooled study analysis. *Evaluation and Program Planning, 35*, 236-245. doi:10.1016/j.evalprogplan.2011.10.003

Runyan, J. D., Steenbergh, T. A., Bainbridge, C., Daugherty, D. A., Oke, L., & Fry, B. N. (2013). A smartphone ecological momentary assessment/intervention "app" for collecting real-time data and promoting self-awareness. *PloS one, 8*(8), e71325. doi:10.1371/journal.pone.0071325

Shore, E. R. (1997). The relationship of gender balance at work, family responsibilities and workplace characteristics to drinking among male and female attorneys. *Journal of Studies on Alcohol, 58*(3), 297-302.

Shore, E. R. (2001). Relationships between drinking and type of practice among U.S. female and male attorneys. *The Journal of Social Psychology, 141*(5), 650-659.

Stone, A. A., Broderick, J. E., Schwartz, J. E., Shiffman, S., Litcher-Kelly, L., & Calvanese, P. (2003). Intensive momentary reporting of pain with an electronic diary: reactivity, compliance, and patient satisfaction. *Pain, 104*(1), 343-351. doi:10.1016/S0304-3959(03)00040-X

van Boekel, L. C., Brouwers, E. P. M., van Weeghel, J., & Garretsen, H. F. L. (2013). Stigma among health professionals towards patients with substance use disorders and its consequences for healthcare delivery: Systematic review. *Drug and Alcohol Dependence, 131*(1-2), 23-35. doi:10.1016/j.drugalcdep.2013.02.018

van Boekel, L. C., Brouwers, E. P. M., van Weeghel, J., & Garretsen, H. F. L. (2014). Healthcare professionals' regard towards working with patients with substance use disorders: Comparison of primary care, general psychiatry and specialist addiction services. *Drug and Alcohol Dependence, 134*(Supplement C), 92-98. doi:https://doi.org/10.1016/j.drugalcdep.2013.09.012

Vargo, E. J., James, R. A., Agyeman, K., Macphee, T., McIntyre, R., Ronca, F., & Petróczi, A. (2014). Perceptions of assisted cognitive and sport performance enhancement among university students in England. *Performance Enhancement & Health, 3*(2), 66-77. doi:10.1016/j.peh.2015.02.001

Volger, E. J., McLendon, A. N., Fuller, S. H., & Herring, C. T. (2014). Prevalence of self-reported nonmedical use of prescription stimulants in North Carolina Doctor of Pharmacy students. *Journal of Pharmacy Practice, 27*(2), 158-168. doi:10.1177/0897190013508139

Voogt, C. V., Kuntsche, E., Kleinjan, M., Poelen, E. A. P., Lemmers, L. A. C. J., & Engels, R. C. M. E. (2013). Using ecological momentary assessment in testing the effectiveness of an

alcohol intervention: A two-arm parallel group randomized controlled trial. *PloS one, 8*(11), e78436. doi:10.1371/journal.pone.0078436

Witteveen, E., Van Ameijden, E. J., Prins, M., & Schippers, G. M. (2007). Factors associated with the initiation of cocaine and heroin among problem drug users—Reflections on interventions. *Substance use & misuse, 42*(6), 933-947.