USING THE THEORY OF PLANNED BEHAVIOR TO PREDICT EMPLOYING HARM REDUCTION STRATEGIES AMONG ECSTASY USERS

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ABSTRACT

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I designed two studies to evaluate the Theory of Planned Behavior (TPB; Attitudes, Subjective Norms, Perceived Behavioral Control, Intention) plus Habit Strength (i.e., habitual engagement in a behavior) as a model predicting how often ecstasy users engaged in three specific harm reduction strategies.

In study one I recruited 136 participants from several websites to complete baseline TPB and Habit Strength measures in relation to hydrating (drinking water/electrolyte-rich beverages) and pre/post-loading (consuming vitamins/supplements) while using MDMA/ecstasy. I also included Passionate Attachment to using MDMA/ecstasy as a predictor of Intention to engage in both strategies. After two months, participants reported how often they hydrated and pre/post-loaded during the study. The regression model predicting Intention to pre/post-load was significant, and Attitudes was the only significant predictor. The regression model predicting pre/post-loading at follow-up was also significant, and Intention and Habit Strength were significant predictors. The regression model predicting Intention to hydrate was significant, and Attitudes and Perceived Behavioral Control were significant predictors. However, the regression model predicting hydration during the two-month follow-up was not significant.

In study two I recruited 100 participants from Facebook to complete baseline TPB and Habit Strength measures in relation to pre/post-loading and pill-testing/checking (i.e., attempting to determine chemical composition of ecstasy) while using MDMA/ecstasy. After two months, participants reported how often they pre/post-loaded and pill tested/checked during the study. The regression model predicting Intention to pre/post-load was significant, and Attitudes was the only significant predictor. The regression model predicting pre/post-loading at follow-up was
also significant, and Habit Strength was the only significant predictor. The regression model predicting Intention to pill test/check was significant, and all three TPB variables were significant predictors. The regression model predicting pill testing/checking at follow-up was also significant, and Intention was the only significant predictor.

These findings provide partial support for TPB variables as a model predicting Intention to implement and actual use of three harm reduction strategies by MDMA/ecstasy users. Clinicians, harm reduction workers, and researchers should evaluate whether education regarding the benefits and importance of implementing these strategies increases Intention to implement and actual use of these strategies among MDMA/ecstasy users.

Word Count: 349

Keywords: Harm Reduction, MDMA, Ecstasy, Theory of Planned Behavior
I would like to dedicate this dissertation to the MDMA/ecstasy users who took the time to participate in my studies. I could not have completed this project without their effort.
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INTRODUCTION

MDMA (+/- 3, 4-methylenedioxymethamphetamine), also known as ecstasy, is a popular psychoactive substance taken orally by young adults in clubs or at dance parties, primarily for its euphoric and energizing effects. MDMA is a monoaminergic agonist that both promotes the release and inhibits the reuptake of serotonin in the brain (Green, Cross, & Goodwin, 1995; Rudnick & Wall, 1992; Schmidt, 1987). According to Meyer, Mayerhofer, Kovar, and Schmidt (2002), MDMA is similar to other amphetamines except that it has entactogenic properties. These entactogenic properties include reduced anxiety, increased openness to communication with others, and lowered defensiveness (Nichols, 1986). Although entactogens are chemically similar to other amphetamines, this classification was proposed to distinguish MDMA from hallucinogens and stimulants (Morgan, 2000).

The U.S. Army conducted research on MDMA following the end of World War II, and in 1976 this drug was first used as an adjunct to psychotherapy with individuals who had difficulty being disclosive (Maxwell, 2005). MDMA became popular as a recreational drug in the 1970s and was used mostly by Caucasian “club goers.” Subsequently, it also came to be used by other ethnic groups, such as African Americans and Hispanics, and in non-club settings (Koesters, Rogers, & Rajasingham, 2002; Maxwell, 2005). A recent report by the United Nations Office on Drugs and Crime (2013) estimated that the global prevalence of ecstasy use is .4%, or 19.4 million people, with higher proportions of users in European Countries (2.9%) and the United States (.9%).

In addition to its use as a recreational drug, several studies have demonstrated the efficacy of MDMA-assisted psychotherapy with individuals who have chronic, treatment resistant Posttraumatic Stress Disorder (Mithoefer, Wagner, Mithoefer, Jerome, & Doblin, 2011;
Mithoefer et al., 2013). Nonetheless, the drug continues to be classified under schedule I of the United States Controlled Substance Act, meaning that the Drug Enforcement Administration considers it to have a high potential for abuse and no accepted medical uses.

Studies of the acute subjective effects of ecstasy use suggests that many users enjoy the desirable outcomes of consumption, such as enhanced mood and sensorium, increased energy, sociability, closeness, confidence, and stress reduction (ter Bogt & Engels, 2005; Baylen & Rosenberg, 2006; White et al., 2006; Hunt & Evans, 2008; Singer & Schensul, 2011; Carhart-Harris & Nutt, 2010; Morgan et al., 2013). Other acute desirable outcomes include increases in subjective wellbeing, extraordinary, transcendental, and/or deeply pleasurable experiences, enhanced sexual experiences, and better communication with partners/spouses (Baylen & Rosenberg, 2006; Hunt & Evans, 2008; Singer & Schensul, 2011; Carhart-Harris & Nutt, 2011). More enduring effects include changes in sense of self and interactions with peer groups, integration of new insights gained while under the influence of ecstasy with daily life activities, greater purpose and meaning for life, increased self-confidence, self-esteem, and self-discovery (Hunt & Evans, 2008). Additionally, ecstasy users have reported that recreational use of ecstasy helped alleviate symptoms of anxiety, depression, and post-traumatic stress, and helped facilitate empathic feelings that impacted their relationships by reducing shyness, and increasing social confidence and optimism (Carhart-Harris & Nutt, 2011; Morgan et al., 2013).

The desirable outcomes of consuming this substance are counterbalanced by a substantial body of evidence documenting both acute (0-8 hours post-ingestion) and longer-term (following acute-intoxication) negative physiological and psychological experiences. Examples of acute physiological problems among recreational or chronic users include dehydration, elevations in body temperature, accelerated heartbeat, nausea, teeth clenching/grinding, headache, dizziness,
muscle aches or tightness, dry mouth, numbness/tingling, decreased appetite, sleeplessness, and mental and/or physical fatigue (White et al., 2006; Baylen & Rosenberg, 2006; Singer & Schensul, 2011).

The acute physiological harms of consumption sometimes require medical treatment and/or hospitalization. For example, approximately 22,500 emergency room visits in the United States in 2011 were associated with ecstasy intoxication (SAMHSA, 2013), an increase of 120% since 2004. Although deaths related specifically to MDMA are rare, deaths that do occur are often the outcome of hyperthermic syndromes (Baggott, 2002) characterized by an increase in body temperature (i.e., over 104 degrees) that can lead to convulsions, loss of consciousness, organ failure and/or cerebral edema (brain swelling), which can lead to permanent organ damage or death (Henry & Rella, 2001). This syndrome is more likely to occur when an MDMA user is in an environment (i.e., rave, club, festival) where ambient temperatures reach higher-than-normal levels and he or she engages in strenuous dancing for long periods of time with little rest or fluid replacement.

Examples of acute psychological problems related to ecstasy consumption include feelings of anxiety/nervousness, fear/paranoia, and confused thought (Baylen & Rosenberg, 2006; Singer & Schensul, 2011). Although many of these effects are short-lived, some have been reported to last for days, weeks, or several months following intoxication. Examples of these longer-term effects of regular ecstasy consumption include depressed mood, psychological distress, sleep disturbance, anxiety, noticeable cognitive impairments, and weight loss (Carhart-Harris & Nutt, 2010; Singer & Schensul, 2011; Chinet, Stephan, Zobel, & Halfon, 2007; White et al., 2006; Curran, 2000; Parrott, 2000; Parrott, Sisk, & Turner, 2000; Parrott, 2001).
Although many of the longer-term harms of ecstasy intoxication may remit after a period of abstinence, chronic use of MDMA can result in long-term changes in serotonergic neuronal functioning (Kelly, 2009). For example, animal studies have shown decreases in serotonin levels lasting for up to a year following administration of MDMA (Benningfield & Cowan, 2013; Henry & Rella, 2001). Although these findings could be attributed to giving animals higher and more frequent doses than those consumed by humans, lower levels of serotonin in the brain could account for the acute and long-term depressive symptoms experienced by some regular human users of ecstasy (Jansen, 2001).

In human studies, researchers have found that chronic use of MDMA may cause decreased cerebral blood flow and fewer 5-HT2A receptors (Chang et al., 2000) and reductions in Serotonin Reuptake Transporter (SERT) binding (Renemann et al., 2001). Reductions in SERT binding may be caused by more than just MDMA/ecstasy consumption given that other factors could have led to these changes (e.g., differences in preexisting characteristics of samples, exposure to polydrug use, and various intra-individual differences may account for the interaction between ecstasy users and this substance). In addition, there is some evidence showing SERT recovery in subcortical regions following a long period of abstinence (Renemann et al., 2001; Buchert et al., 2001).

**Harm Reduction for MDMA/Ecstasy Users**

Criminal penalties, fear-based education, and treatment of drug abusers have not eliminated consumption of ecstasy, and millions of individuals start or continue to consume ecstasy each year. Therefore, both recreational and problematic ecstasy users could benefit from implementing strategies designed to reduce the harms associated with ecstasy use. According to Marlatt, Larimer, and Witkiewitz (2012), harm reduction may be defined as “…a set of
compassionate and pragmatic approaches for reducing harm associated with high-risk behaviors and improving quality of life” (pg. 5). Such interventions include protective behavioral strategies that are designed to minimize the harmful physiological, psychological, and/or social effects of consuming licit or illicit substances (e.g., ecstasy, cannabis, opioids, alcohol, tobacco), and of other high-risk behaviors (e.g., high-risk sexual encounters).

It is unclear whether the consumption of MDMA is solely responsible for long-term problems associated with neurotoxicity in recreational users, but the evidence demonstrating the possibility of developing these long-term problems cannot be ignored (Chang et al., 2000; Renemann et al., 2001; Kelly, 2009; Benningfield & Cowan, 2013; Henry & Rella, 2001; Jansen, 2001). One harm reduction strategy aimed at preventing or reducing the impact of neurotoxicity is pre-loading and post-loading (Allot & Redman, 2006; Akram & Galt, 1999; Kelly, 2009; Jacinto et al., 2008, Murphy et al., 2006; de Almeida, Garcia-Mijares, & Silca, 2009). Examples of pre-loading/post-loading include oral preparations of serotonin precursors such as 5-Hydroxytryptophan that may decrease the neurotoxic effects of serotonin depletion during intoxication, prescription medications such as Celexa, Zoloft, and Paxil that are believed to improve serotonergic recovery, herbal supplements such as St John’s wort and Ginko biloba which are believed to decrease the depressive effects of MDMA during post-acute intoxication, and multi-vitamins or other antioxidant supplements that replenish important nutrients and prevent cellular oxidation (Kelly, 2009).

There is little empirical support for the efficacy of pre-loading and post-loading, in part due to ethical considerations and governmental restrictions on human trials of MDMA administration. Nonetheless, the popularity and continued use of these strategies is based, in part, on animal studies suggesting that administration of antioxidants and serotonin precursors prior to
MDMA administration may attenuate possible neurotoxic problems associated with chronic MDMA use (Shankaran, Yamomoto & Gudelsky, 2001; Malberg, Sabol & Seiden, 1996; Sprague, Everman, & Nichols, 1998).

As described earlier, a potential short-term harm of acute MDMA intoxication is hyperthermia – notably elevated body temperature that may lead to organ failure and death – especially while dancing in indoor locations with large groups (Jacinto et al., 2008; Murphy et al., 2006; de Almeida et al., 2009; Akram & Galt, 1999; Allott & Redman, 2006). Although ingesting too much fluid may lead to its own health problems (Baggott, 2002), the likelihood of developing a hyperthermia syndrome can be reduced, and potentially eliminated, by replenishing the body with water and/or electrolyte-rich fluids while using MDMA/ecstasy, and by taking breaks from dancing/exertion, wearing loose clothing, and moderating consumption of ecstasy (Henry & Rella, 2001).

In addition to the strategies outlined above, there are a wide variety of other harm reduction strategies ecstasy users report employing prior to, during, and following acute intoxication (Panagopoulos & Ricciardelli, 2005; Hansen, Maycock, & Lower, 2001; Solowij, Hall, & Lee, 1992; Gamble & Goerge, 1997; Shewan, Dalgarno, & Reith, 2000; Forsyth, 1996; Moore, 1993; Chinet et al., 2007; Jacinto, Duerte, Sales, & Murphy, 2008). In a comprehensive survey of regular ecstasy users, Panagopoulos and Ricciardelli (2005) found that psychological strategies employed during the intoxication episode included using ecstasy only while in a positive mood, telling a trusted peer about negative thoughts that occur, making jokes to calm oneself or others when negative thoughts/emotions arise, reminding oneself that intoxication is transient, and learning how to manage the experience of intoxication and the coming down process. Behavioral strategies that were employed prior to consumption include buying ecstasy
from a trusted source, using smaller amounts and less frequently, testing pills for chemical content, limiting route of administration, and not using ecstasy simultaneously with other drugs. Behavioral strategies that were employed while intoxicated include taking breaks from dancing, not getting into a car with a driver who is intoxicated, carrying a cell phone and money in case of emergencies, calling an ambulance if someone had a convulsion, giving first aid assistance, walking/dancing to cope with negative emotions, removing one’s clothes to cool off, going outside for fresh air, and going home early if problems arise. Peer-related behavioral strategies included using with a sober friend, using with trusted friends, and avoiding troubled people who might increase paranoia.

**Theory of Planned Behavior**

Selecting and implementing specific harm reduction strategies is influenced by a variety of intrapersonal, interpersonal, and environmental factors. Understanding specific psychological factors associated with use of ecstasy-related harm reduction strategies could suggest ways to reduce resistance to using such strategies and preserve the health and welfare of ecstasy users. The Theory of Planned Behavior (Ajzen, 1985; Ajzen, 2012) is one model that could be applied to help explain why ecstasy users are more or less likely to employ harm reduction strategies. This theory has been used to predict a diverse set of health-related behaviors including drug and alcohol use (Armitage et al., 1999; Connor, Sherlock & Orbell, 1998; McMillan & Connor, 2003; Orbell, Blair, Sherlock & Conner, 2001) and physical activity (Downs & Hausenblas, 2005). Additionally, several studies have used the TPB to predict use of other harm reduction strategies, including using condoms (Albarracin et al., 2001; Prati, Mazzoni & Zani, 2014), using a new syringe by intravenous drug users (Gagnon & Godin, 2009), less hazardous drinking (Kim
& Hong, 2013), using alcohol-related protective behavioral strategies (Bonnell, 2013), and not riding in a car with an intoxicated driver (Moan, 2013).

According to the TPB (see Figure 1), intention to engage in a behavior is predicted by three motivational antecedents: 1) Attitudes, 2) Subjective Norms, and 3) Perceived Behavioral Control. In this model, Attitudes refer to the positive and/or negative beliefs regarding the outcomes of engaging in a target behavior. Individuals can hold multiple beliefs about a given behavior and these attitudes combine to create a subjective probability that the performance of the target behavior will lead to certain outcomes. For example, if an individual believes that using a condom every time he or she has sexual intercourse is worthwhile, important, and necessary (i.e., positive attitudes about the behavioral act), then he or she should have a stronger intention to use a condom during sexual activities.

The second proposed influence on intention to engage in health-related behaviors, Subjective Norms, refers to a person’s beliefs regarding the probability that a member of their social group, family, and/or significant others are either encouraging or discouraging of engaging in the target behavior. For example, an individual might believe that his or her peers and family would encourage the practice of using a condom, and these normative beliefs about the importance of condom usage to his or her social group would lead to greater intention to use a condom during sexual activities. The influence of normative beliefs can be attenuated if important people in one’s social network have conflicting attitudes regarding the value of the target behavior.

The third element of the model, Perceived Behavioral Control, refers to the extent to which an individual believes that he or she can successfully engage in the target behavior and the confidence that he or she can engage in the behavior in specific contexts. These beliefs
regarding behavioral control are influenced by the accessibility of resources, one’s confidence that they could implement the strategy, and actual environmental barriers. For example, individuals might believe that they have a lot of control over whether they use a condom when presented with the option for sexual activity, they have access to money to purchase a condom, their sexual partner has consented to use of a condom, and they have high self-efficacy about how to use the condom. In this situation, perceived behavioral control should lead to greater intention to use a condom.

According to the TPB, these three types of beliefs predict Intention to implement a behavior and Intention predicts actual engagement in the behavior. Intention in this regard is comprised of specific plans to engage in the behavior at some point in time (i.e., right now, in the next few days, in the next few weeks, etc.). According to the TPB, although Intention directly predicts behavioral implementation, one’s Perceived Behavioral Control over the target behavior (e.g., ease of accessibility, lack of barriers, high self-efficacy, perseverance in the face of obstacles) is also proposed as independent predictor of behavior. For example, an individual might have positive attitudes about using a condom, believe that others approve of condom use, and perceive a high degree of behavioral control over condom usage, but when the opportunity for sexual intercourse occurs he or she might not have a condom and this barrier would directly predict not using a condom.

Much of the research evaluating the TPB has been supportive of predictive validity. For example, McEachan et al. (2011) conducted a meta-analysis using data from 206 published articles (reporting 237 tests of the model) evaluating the predictive validity of the TPB in several health-related domains (e.g., abstaining from/quitting drugs, physical activity, safer sex, dietary behaviors, drinking alcohol, smoking, using drugs). For the following summary of this meta-
analysis, the letter \( k \) refers to the number of tests in the analysis, and the symbol \( \rho \) stands for the magnitude of the mean correlations corrected for measurement and sampling error. According to the authors, Attitudes towards the behavior \((k = 212; \text{mean } \rho = .57, SD = .18)\) and Perceived Behavioral Control \((k = 217; \text{mean } \rho = .54, SD = .22)\) had the strongest association with Intention to engage in the behavior, followed by Subjective Norms \((k = 199; \text{mean } \rho = .40, SD = .21)\). Additionally, as predicted by the TPB, Intention to engage in the target behavior was significantly related to engaging in the target behavior \((k = 237; \text{mean } \rho = .43, SD = .19)\).

The authors of this meta-analysis entered the mean correlation values in a regression analysis to evaluate the contribution of each variable as a predictor of Intention and future behavior. Attitudes, Subjective Norms, and Perceived Behavioral Control accounted for 44% of the variance in Intention scores. Consistent with the significant correlations noted above, the strongest predictors of Intention were Attitudes \((\beta = .35)\) and Perceived Behavioral Control \((\beta = .34)\), followed by Subjective Norms \((\beta = .15)\), and all three were statistically significant. In a subsequent regression analysis with behavior as the dependent variable, the authors found that Perceived Behavioral Control and Intention accounted for 19% of the variance in behavior, with Intention predicting behavior more strongly \((\beta = .37)\) than Perceived Behavioral Control \((\beta = .11)\), although both were statistically significant.

Taken together, these results provide support for the three factors proposed by the TPB as predictors of Intention and that Intention is a significant predictor of actual behavior. Results also suggest that Perceived Behavioral Control is a significant predictor of behavior. However, the strength of the associations between TPB variables and Intention to implement and actual use of health-related behaviors varied depending on factors such as gender, age, length of follow-up assessment, and the target behavior. Furthermore, findings from McEachan et al. (2011) suggest
that the TPB model might be a better fit when used to predict physical activity and dietary behaviors than when it is used to predict condom usage or drug/alcohol abstinence.

In addition to TPB variables, Verplanken & Orbell (2003) proposed Habit Strength (i.e., past habitual engagement in a behavior) as an independent predictor of engaging in that behavior in the future. Verplanken and Faes (1999) wrote that habits are “learned sequences of acts that have become automatic responses to specific cues, and are functional in obtaining certain goals or end-states” pg.104. In terms of predictive validity, McEachan et al. (2011) found that habitual engagement in health-related behaviors was significantly associated with future behavior ($k = 86; \text{mean } \rho = .50, SD = .21$). When past behavior was added as an independent predictor of future behavior in the regression analyses, past habitual behavior emerged as a significant predictor ($\beta = .38$) of future behavior and accounted for an additional 11% of variance in the regression model. Additionally, including past behavior in the equation attenuated the predictive power of Intention ($\beta = .22$) and Perceived Behavioral Control ($\beta = .07$), although both remained statistically significant predictors of behavior.

Another potential predictor of Intention to implement ecstasy-related harm reduction strategies is one’s level of passionate attachment to using ecstasy. Vallerand et al. (2003) defined Passionate attachment to an activity as “a strong inclination toward an activity that people like, that they find important, and in which they invest time and energy” pg.756. In this model, there are two types of passionate attachment: (1) Obsessive Passion and (2) Harmonious Passion. Obsessive Passion refers to a propensity to engage in an activity that an individual feels unable to live without. Additionally, the person continues to engage in the activity even though it has become incompatible with the individual’s values and causes problems in the individual’s life. Conversely, Harmonious Passion refers to an inclination to engage in an activity that fits with an
individual’s personal goals, values and ideals, is compatible with other activities in the person’s life, and reflect positive qualities about the individual.

I believe that passionate attachment to ecstasy use may help us understand why some ecstasy users engage in harm reduction strategies aimed at protecting their health prior to, during and post-consumption. For example, the more an individual believes that his or her ecstasy consumption is a valuable experience, the more time and energy he or she might invest protecting his or her health during this potentially harmful activity. Similarly, the more an individual believes that their use of ecstasy is an obsession that they have difficult time controlling, the more they might implement harm reduction strategies as a means to protect their health and wellbeing.

Understanding which attitudes and beliefs about one’s health, drug use and harm reduction are related to the intention to implement and actual use of harm reduction strategies could suggest ways to increase the use of such strategies among ecstasy users, thereby helping to reduce or ameliorate potential harms associated with acute intoxication. Based on the evidence that the TPB variables are associated with a variety of health-related and substance use-related behaviors (Albarracin et al., 2001; Armitage et al., 1999; Bonnell, 2013; Connor, Sherlock & Orbell, 1998; Downs & Hausenblas, 2005; Gagnon & Godin, 2009; Kim & Hong, 2013; McEachan et al., 2011; McMillan & Connor, 2003; Moan, 2013; Orbell, Blair, Sherlock & Conner, 2001; Prati, Mazzoni & Zani, 2014), I predicted that Attitudes, Subjective Norms, and Perceived Behavioral Control would predict Intention to implement two ecstasy-specific harm reduction strategies: 1) pre-loading/post-loading to decrease physiological harms of ecstasy consumption and 2) drinking water/electrolyte-rich fluids during the intoxication episode to replace lost fluids and avoid developing a hyperthermic syndrome. Additionally, I predicted that
passionate attachment to using ecstasy would also predict Intention to implement each of the two harm reduction strategies. Secondly, I predicted that Intention to implement each harm reduction strategy, Perceived Behavioral Control over implementing both strategies, plus Habit Strength, would predict the proportion of drug use episodes when ecstasy users used each of these two harm reduction strategies during a two-month time period.
STUDY 1

METHOD

Time 1: Procedure

Following approval from the Human Subjects Review Board at Bowling Green State University (see Appendix A), I recruited participants (during October and November 2013) using Internet postings and announcements on the following websites: reddit.com, pillreports.com, bluelight.ru, facebook.com, and dancesafe.org. Additionally, the executive director for dancesafe.org also had an announcement about the study posted on the organization’s Facebook and Twitter webpages. All of the announcements described the study and directed potential participants to the web-based study site hosted by Survey Gizmo (www.surveygizmo.com). Once at the study site and prior to giving consent (see Appendix B for consent document), potential participants were informed that they had to be between 18 and 65 years of age, that they had to read and understand English, and that I would donate $5.00 to Pillreports/Bluelight for each person who completed the study (up to a maximum of $250). To obviate concerns about participants acknowledging use of an illicit substance, I did not require participants to have used MDMA/ecstasy prior to study participation. However, all participants met the inclusion criteria of having consumed ecstasy at least once over the past two months and intending to consume ecstasy at least once in the next two months.

Before they were administered the baseline measures, participants were asked to provide an email address that I would use to send an invitation to participate in the two-month follow-up assessment, and to provide the last two digits of their cell phone number followed by the two digits of their month of birth so I could match their data from both time points. To protect participants’ anonymity, I kept their email addresses separate from their identification number
and from their study responses. Participants were then presented with all study measures (described below) in random order, except that the Intention items were interspersed throughout study materials in an attempt to avoid consistency bias in responding to similar items.

**Time 1: Measures**

**Theory of Planned Behavior Questionnaire – Hydration.** To measure the variables proposed by the TPB as predictors of intention to implement and actual use of the hydration harm reduction strategy (i.e., “…replacing the fluids lost while you are high on MDMA/ecstasy by drinking water or electrolyte-rich fluids.”), I modified 13 of the original 24 items used by Orbell and colleagues (2001), deleted seven items that did not apply, and wrote four new items that applied specifically to implementing this harm reduction strategy (See Appendix C). I measured Attitudes regarding drinking water/electrolyte-rich fluids using four items that reflected the beliefs an individual has about the outcomes of implementing this strategy (e.g., “drinking water/electrolyte-rich fluids when I am using ecstasy is important to me”). I measured perceived Subjective Norms using three items that reflected the beliefs an individual has regarding their social groups’ beliefs about implementing this strategy (e.g., “Most of my ecstasy using friends think that I should drink water/electrolyte-rich fluids when I am using ecstasy.”). I measured Perceived Behavioral Control using five items that reflected the beliefs regarding the sense of control and self-confidence an individual has to implement this strategy (e.g., “I have a lot of control over whether I drink water/electrolyte-rich fluids when I am using ecstasy.”). I measured Intention using three items that reflected current plans to drink water or electrolyte-rich fluids while consuming ecstasy over the next two months (e.g., “I intend to drink water/electrolyte-rich fluids when I am using ecstasy over the next 2 months.”). Participants responded to each of the 15 items using a 7-point scale (i.e., “Strongly agree” = -3, “Moderately
agree” = -2, “Slightly agree” = -1, “Neither agree nor disagree” = 0, “Slightly agree” = 1, “Moderately agree” = 2, “Strongly agree” = 3). Internal consistency reliability was .64 for the Attitudes subscale, .72 for the Subjective Norms subscale, .71 for the Perceived Behavioral Control subscale, and .86 for the Intention subscale.

**Theory of Planned Behavior Questionnaire – Pre/Post-Loading.** To measure the variables proposed by the TPB as predictors of intention to implement and actual use of the pre/post-loading harm reduction strategy (i.e., “…trying to lower the possible negative effects of using MDMA/ecstasy by taking 5-HTP (5-Hydroxytryptophan) or other vitamins/herbal supplements.”), I modified the TPB Questionnaire-Hydration (described above) by replacing the phrase “Drinking water/electrolyte fluids when I am using ecstasy” with “Pre-loading/post-loading” (See Appendix D). Participants responded to each of the 15 items using a 7-point scale (i.e., “Strongly agree” = -3, “Moderately agree” = -2, “Slightly agree” = -1, “Neither agree nor disagree” = 0, “Slightly agree” = 1, “Moderately agree” = 2, “Strongly agree” = 3). Internal consistency reliability was .93 for the Attitudes subscale, .92 for the Subjective Norms subscale, .89 for the Perceived Behavioral Control subscale, and .97 for the Intention subscale.

**Index of Habit Strength - Hydration.** To measure the strength of habit for drinking water or electrolyte-rich fluids when consuming ecstasy, I included five of the original 12 items from the Index of Habit Strength (Verplanken & Orbell, 2003) and deleted seven items I thought had ambiguous or confusing phrasing (e.g., “Behavior X is something…that makes me feel weird if I do not do it.”). The remaining five items asked how frequently and automatically an individual had implemented this harm reduction strategy in the past (e.g., “Drinking water/electrolyte fluids when I am using ecstasy is something I do automatically”; See Appendix E). Participants were asked to rate each item using a 7-point scale (i.e., “Strongly agree” = -3,
“Moderately agree” = -2, “Slightly agree” = -1, “Neither agree nor disagree” = 0, “Slightly agree” = 1, “Moderately agree” = 2, “Strongly agree” = 3). Internal consistency reliability was .68.

**Index of Habit Strength – Pre/Post-Loading.** To measure the strength of habit for pre/post-loading, I modified the five revised items on the Index of Habit Strength-Hydration (described above) by replacing the phrase “drinking water/electrolyte fluids when I am using ecstasy” with “pre-loading/post-loading.” Participants were asked to rate each item using a 7-point scale (i.e., “Strongly agree” = -3, “Moderately agree” = -2, “Slightly agree” = -1, “Neither agree nor disagree” = 0, “Slightly agree” = 1, “Moderately agree” = 2, “Strongly agree” = 3). Internal consistency reliability was .95.

**Ecstasy-Harmonious and Obsessive Passion Scale (E-HOPS).** To measure passionate attachment to consuming ecstasy, I used a modified version (Davis & Rosenberg, 2015) of the original 14-item Passion Scale (Vallerand et al., 2003), which was designed to assess passionate attachment to a wide variety of activities. The modified scale substitutes the word “ecstasy” in place of “this activity” in each of the original items (See Appendix F). Participants were asked to rate each item on the E-HOPS using a 7-point scale ranging from “Do not agree at all” to “Completely agree,” and I coded responses from 1 to 7 for data analyses. Based on previous research (e.g., Rousseau, Vallerand, Ratelle, Mageau, & Provencher, 2002; Vallerand et al., 2003; Davis & Rosenberg, 2015) that assigned each item to one of two subscales, I calculated two types of passionate attachment to ecstasy use: (1) Obsessive Passion and (2) Harmonious Passion. Internal consistency reliabilities were .64 for the Obsessive Passion subscale and.70 for the Harmonious Passion subscale.
Demographic and Substance Use History Questionnaires. I administered three questionnaires designed to assess the demographic characteristics, general drug use history, and ecstasy use history of each participant (see Appendices G, H, and I).

Time 2: Procedure

Approximately two months after participants enrolled in the study, I sent an email asking them to complete a follow-up questionnaire. After participants clicked the link to the study website, they were asked to re-consent to participate in the study. Next, participants were asked to provide the code number they provided at Time 1, and to fill out the Ecstasy-Related Harm Reduction Strategy Frequency Questionnaire (described below). Finally, participants were notified that I had donated $250 to Bluelight/Pillreports as a way to “pay it forward” for their participation in the study.

Time 2: Measures

Ecstasy-Related Harm Reduction Strategies – Frequency Questionnaire. To assess use of ecstasy-related harm reduction strategies during the previous two months, I developed a list of 20 strategies (see Appendix J) that ecstasy users could implement in an attempt to minimize the physiological, neurological, or emotional harms associated with ecstasy consumption (Panagopoulos & Ricciardeli, 2005; Hansen, Maycock, & Lower, 2001; Solowij et al., 1992; Gamble & Goerge, 1997; Shewan et al., 2000; Forsyth, 1996; Moore, 1993; Chinet et al., 2007; de Almeida, et al., 2009; Kelly, 2009; Allot & Redman, 2006; Jacinto, et al., 2008; Murphy et al., 2006). Participants were asked to report the proportion of the time they implemented each strategy when they consumed MDMA/ecstasy over the previous two months (from “0%/None of the time” to “100%/All of the time” in increments of 10%).
RESULTS

Participant Characteristics

During the recruitment period (October and November, 2013), 739 people clicked the link and were presented with information about the length of the study and the consent document. Of these individuals, 338 consented to participate, completed all study questionnaires, and provided an email address for the two-month follow-up assessment. In response to the overture to participate in the assessment two months later (January, 2014), 264 participants clicked the link to the web-based study site. Of these, 186 participants had used ecstasy at least once since Time 1, provided a usable 4-digit code for matching data, and completed the dependent measures. However, 50 of these participants provided a code that was either a duplicate code with another participant or a code that could not be matched to a participant’s code at Time 1, and therefore were dropped from analyses. The final sample was comprised of those 136 individuals who had matching codes and who completed all study materials at Time 1 and Time 2 (see Appendix K for flowchart).

First, I conducted a preliminary analysis to evaluate the comparability of those 136 participants in the Time 2 final sample and those 184 Time 1 participants I could identify as not being included in the final sample (the status of 18 Time 1 participants could not be determined). A series of independent samples t-tests comparing mean scores on baseline TPB variables (Attitudes, Subjective Norms, Perceived Behavioral Control, Intention), Habit Strength, and Passionate Attachment between participants in the two samples revealed only two out of 12 comparisons were significant. Specifically, when asked about Hydration, participants in the final sample had higher mean scores ($M = 2.8$, $SD = .4$) on the Attitudes subscale compared to those who were not included in the final sample ($M = 2.6$, $SD = .7$), $t(318) = -2.5$, $p < .05$, and
Participants in the final sample had higher mean scores ($M = 3.9$, $SD = .2$) on the Index of Habit Strength compared to those who were not included in the final sample ($M = 3.8$, $SD = .4$), $t(316) = -2.1, p < .05$.

As examination of Table 1 (Column 2) reveals, 82% of participants were Caucasian, 73% were male, 92% were under 34 years of age, 58% lived in the United States and 25% lived in the United Kingdom. As Table 2 (Column 2) shows, approximately 50% of the sample reported using ecstasy once per month or more, and 77% had used ecstasy between 1 and 50 times over the course of their lifetime. Additionally, 83% of participants indicated that they had last used ecstasy at least one week ago, and 15% indicated that they used ecstasy within the past few days. During the two months since Time 1, 68% had used ecstasy 1-2 times and 32% indicated they had used 3 or more times. These participants also reported having used a variety of other substances over the three months prior to study enrollment, including alcohol (95%), cannabis (81%), and Lysergic acid diethylamide (LSD; 55%). See Table 3 for drug use history characteristics.

**Predicting Intention to Hydrate at Time 1**

As an initial step in this evaluation, I calculated the means, standard deviations, and intercorrelations of TPB subscales (Attitudes, Subjective Norms, and Perceived Behavioral Control). As Table 4 reveals, the mean scores on the Attitudes subscale ($M = 2.8$, $SD = .4$), Subjective Norms subscale ($M = 2.2$, $SD = .9$), and the Perceived Behavioral Control subscale ($M = 2.7$, $SD = .5$) were weakly intercorrelated ($rs$ range from .14 to .21).

Next, based on the TPB model (Ajzen, 1985; Ajzen, 2012), which states that Attitudes, Subjective Norms, and Perceived Behavioral Control are significant predictors of Intention, I conducted a two-step hierarchical linear regression to examine whether mean scores of the TPB
subscales (i.e., Attitudes, Subjective Norms, Perceived Behavioral Control) predicted Intention to drink water/electrolyte-rich fluids while consuming ecstasy. I also included the Passionate Attachment subscales (i.e., Obsessive Passion, Harmonious Passion) as predictors in the model. I entered Attitudes, Subjective Norms, and Perceived Behavioral Control in the first step, and Obsessive and Harmonious Passion in the second step. This step-wise order allowed me to examine whether the Passionate Attachment variables explained any unique variance after accounting for the TPB variables. As Table 5 reveals, the overall model was significant, $F(3,132) = 12.6, p < .001$, and accounted for 21% of the variance in Intention scores. Both Attitudes ($\beta = .41, p < .001$) and Perceived Behavioral Control ($\beta = .18, p < .05$) were significant predictors in the model. Furthermore, including Harmonious and Obsessive Passion in the regression model did not account for additional significant variance.

**Predicting Intention to Pre/Post-load at Time 1**

As an initial step in this evaluation, I calculated the means, standard deviations, and intercorrelations of TPB subscales (Attitudes, Subjective Norms, and Perceived Behavioral Control). As Table 4 reveals, the mean scores on the Attitudes subscale ($M = 1.1, SD = 1.7$), Subjective Norms subscale ($M = -0.4, SD = 1.8$), and the Perceived Behavioral Control subscale ($M = 1.7, SD = 1.3$) were moderately intercorrelated ($rs$ range from .45 to .54).

Next, I conducted a two-step hierarchical linear regression to examine whether mean scores of the TPB subscales and Passionate Attachment subscales predicted Intention to pre/post-load. I entered Attitudes, Subjective Norms, and Perceived Behavioral Control in the first step, and Obsessive and Harmonious Passion in the second step. As Table 5 reveals, the overall model was significant, $F(3,131) = 126.95, p < .001$, and accounted for 74% of the variance in Intention
scores. However, only the Attitudes subscale ($\beta = .75, p < .001$) was a significant predictor. Furthermore, neither Harmonious nor Obsessive Passion were significant predictors of Intention.

**Predicting Hydration at Time 2**

Based on the TPB model, which states that Intention and Perceived Behavioral Control are significant predictors of behavior, I conducted a two-step hierarchical linear regression to examine whether mean scores of these two variables predicted the proportion of drug use episodes when participants drank water/electrolyte-rich fluids while consuming ecstasy during the two-month follow-up period. Based on the evidence that Habit Strength is a significant predictor of behavior (Verplanken & Orbell, 2003), I also included this variable as a predictor in the model. I entered Intention and Perceived Behavioral Control in the first step and Habit Strength in the second step. This step-wise order allowed me to examine whether Habit Strength explained any unique variance in the regression model. As Table 6 reveals, the overall model was not significant, $F(2,129) = ns$. Figure 2 displays the associations between TPB variables and frequency of hydrating during follow up.

**Predicting Pre/Post-loading at Time 2**

Next, I conducted a two-step hierarchical linear regression to examine whether mean scores of Intention, Perceived Behavioral Control and Habit Strength predicted the proportion of drug use episodes when participants pre/post-loaded when they consumed ecstasy over the past two months. I entered Intention and Perceived Behavioral Control in the first step, Habit Strength in the second step, and the proportion of time using this strategy was the dependent variable. As Table 6 reveals, the overall model was significant, $F(2,132) = 41.7, p < .001$, and accounted for 38% of the variance in implementation scores. Intention ($\beta = .53, p < .001$) was a significant predictor in the model and adding Habit Strength ($\beta = .23, p < .05$) to the regression
model explained an additional 2% of the variation in how often participants used this strategy, and this change in $R^2$ was significant ($p < .05$). Additionally, adding Habit Strength attenuated the predictive power of Intention scores, although the latter remained statistically significant.

Figure 3 displays the associations between TPB variables and frequency of pre/post-loading during follow up.

**Proportion of Time Participants Used Each Harm Reduction Strategy**

Finally, I evaluated the proportion of drug-using episodes during which participants used each of the ecstasy-related harm reduction strategies on the Ecstasy Harm Reduction Strategy Frequency Questionnaire. Specifically, I categorized frequency of use into one of three categories: a) Never (0%), b) Minority of occasions (50% or fewer of the times) or c) Majority of occasions (60-100% of the times). Inspection of Table 7 reveals that large majorities (over 80%) of participants implemented 8 specific harm reduction strategies 60-100% of the time they consumed ecstasy during the two-month follow up period. These more frequently used strategies included Item 19 (i.e., “I found a safe way to get home from where I had been using MDMA/ecstasy”), Item 1 (i.e., “I drank water/electrolyte-rich fluids to replace the fluids lost while I was using MDMA/ecstasy”), Item 10 (i.e., “I bought MDMA/ecstasy from a trusted source”), Item 18 (i.e., “I had a trusted friend I could go to for help if troubling events/thoughts occurs while I was on MDMA/ecstasy”), Item 13 (i.e., “I used MDMA/ecstasy only with friends”), Item 11 (i.e., “I got in a good mood prior to using MDMA/ecstasy…”), Item 12 (i.e., “I used MDMA/ecstasy only when in a good mood”), and Item 7 (i.e., “I urinated while intoxicated to avoid the build up of excess fluids I drank during the MDMA/ecstasy session”). In contrast, large proportions of participants reported that they did not use three of the remaining 12 strategies. Specifically, participants reported they did not implement Item 17 (i.e., “I stretched
muscles prior to consuming MDMA/ecstasy”), Item 9 (i.e., “I took a chill-out break because of bad thoughts/emotions…”), and Item 14 (i.e., “I used a new batch of MDMA/ecstasy only after I saw how others reacted to it”).

Following completion of the Ecstasy Harm Reduction Strategy Frequency Questionnaire, I also asked participants whether there were any other strategies not listed on the questionnaire that they had used to minimize potential harms associated with their ecstasy consumption. Although 48 participants listed other strategies, many of their replies overlapped with strategies already listed on the questionnaire. Examples of overlapping strategies included having a “guide/babysitter” in case something went wrong during the session, spacing out their ecstasy consumption to minimize harms and maximize benefits, purchasing ecstasy only from a trusted source, avoiding consuming more than one substance, testing the context of their ecstasy or checked an online pill testing database, and pre/post-loading. However, seven participants indicated that they used harm reduction strategies not currently listed on the questionnaire, including chewing gum, staying at home, eating a proper diet, exercising, not making any important decisions while intoxicated, and charging their phone prior to consuming ecstasy.

Summary and Limitations of Study 1

The results from Study 1 provided partial support for the associations of baseline TPB variables with current Intention to implement two harm reduction strategies (i.e., drinking water/electrolyte-rich fluids and pre-loading/post-loading), and the predictive validity of Intention, Perceived Behavioral Control, and Habit Strength with actual use of those two strategies during a two-month time period. Specifically, both Attitudes regarding drinking water/electrolyte-rich fluids and Perceived Behavioral Control over implementing the strategy were significant predictors of Intention. However, neither Intention to drink water/electrolyte-
rich fluids and Perceived Behavioral Control over implementing this strategy were significantly related to the proportion of drug use episodes when ecstasy users implemented this strategy during the study, possibly due to the frequency with which participants drank fluids when consuming ecstasy \((M = 94\%; \ SD = 17)\). Additionally, only Attitudes regarding pre/post-loading was a significant predictor of Intention. Furthermore, Intention to pre/post-load and Habit Strength were significantly related to the proportion of drug use episodes during which participants used this strategy during the two-month follow up. Lastly, my hypotheses that level of Passionate Attachment to consuming ecstasy would predict Intention to implement both harm reduction strategies was not supported among this sample of ecstasy users.

Several methodological limitations of Study 1 led me to design a second study to further evaluate the relation of TPB variables and harm reduction. Firstly, two of the recruitment locations (i.e., pillreports.org, dancesafe.org) promote the use of ecstasy-related harm reduction strategies both directly on their website as well as through the mission of their organization, and it is possible that ecstasy users who do not access these websites may use harm reduction strategies less frequently. As a counter-balancing advantage, seeking participants using ecstasy-specific websites and online forums (e.g., pillreports, reddit, dancesafe, bluelight) helped me to recruit a sample of regular MDMA/ecstasy users from multiple geographic locations, possibly increasing the representativeness of the sample. Secondly, the frequency with which this sample of ecstasy users drank water/electrolyte-rich fluids during the study \((94\%)\) indicates that ecstasy users are familiar with and typically employ this harm reduction strategy, and this attenuated the predictive validity of TPB variables. Thirdly, at the conclusion of the study, 50 participants provided codes that were either identical with other codes or did not match any baseline code, thus eliminating many participants from data analyses and reducing the power of the analyses.
STUDY 2

INTRODUCTION

In light of the limitations outlined above, I designed Study 2 as a partial replication and extension of Study 1. Specifically, I decided to replace “drinking water/electrolyte-rich fluids” because over 90% indicated that they hydrated when they consumed ecstasy and thus there was almost no variance to predict on the dependent measure. Based on the findings from Study 1, I replaced this strategy with using a pill testing kit to check for the presence of MDMA or other common 'ecstasy' substances or checking the contents of their ecstasy by looking at an online pill testing database. Pill testing/checking is a less frequently employed strategy that can reduce the potential neurotoxic and biomedical complications of acute ecstasy intoxication by decreasing the likelihood that one will consume a contaminated and more dangerous combination of chemicals.

Pill testing kits and organizations that conduct pill testing for ecstasy users were created following several well-publicized deaths in the late 1990’s. Although initial media reports linked these deaths specifically to MDMA/ecstasy intoxication, the deaths were eventually attributed to the toxic effects of three different compounds that had been misattributed to MDMA: 4-methylthioamphetamine (De Letter, Coopman, Cordonnier, & Piette, 2001), paramethoxyamphetamine (Byard, Gilbert, James, & Lokan, 1998; Refstad, 2003), and paramethoxymethamphetamine (Refstad, 2003). Although seemingly innocuous adulterants are also found in ecstasy (e.g., caffeine), knowing whether their pills contain more unhealthy substances (e.g., heroin, cocaine, methamphetamine, LSD), and MDMA analogues (e.g., MDE, MDA, MTA, 2-CB, MBDB), could help ecstasy users make informed decisions about the dosage and quantity of ecstasy pills they choose to consume. Therefore, determining whether one’s
ecstasy pill contained these and other potentially harmful adulterants became a form of harm reduction and harm prevention among ecstasy users.

In addition to the change outlined above, I modified the recruitment strategy for the second study and recruited participants using targeted Facebook advertisements. I did this because the first sample was composed of ecstasy users who visited one or more MDMA/ecstasy-related websites, or were recruited from advertisements from administrators of those websites. By using Facebook advertisements, I hoped to decrease the possibility of recruiting individuals who sought information about ecstasy use or ecstasy-specific harm reduction strategies on the Internet. Next, I increased the complexity of the participant coding system in order to decrease the number of duplicate codes among study participants. In addition, I did not assess Obsessive or Harmonious Passion in Study 2 because these variables were not associated with Intention to use either harm reduction strategies in Study 1.

Based on the evidence from Study 1 that some TPB variables were associated with intention and actual use of ecstasy-specific harm reduction strategies, I predicted that Attitudes, Subjective Norms, and Perceived Behavioral Control would predict Intention to pre-load/post-load and Intention to use a pill testing kit or checking the contents of their ecstasy by looking at an online pill testing database. Additionally, I predicted that Intention to use harm reduction strategies, Perceived Behavioral Control over implementing both strategies, plus Habit Strength, would predict the proportion of drug use episodes when ecstasy users implemented these two harm reduction strategies during a two-month time period.
METHOD

Time 3: Procedure

During May and June 2014, I recruited participants using targeted Internet advertisements on Facebook (www.facebook.com; see Appendix L). For the targeted advertisement on this website, I specified the demographic (e.g., English-speaking, between 18 and 65 years old) and online user characteristics (e.g., “liked” Facebook pages related to club drug use, MDMA, ecstasy, electronic dance communities/events) of individuals to whom my advertisements were directed. These advertisements asked whether an individual was interested in participating in MDMA/ecstasy harm reduction research. After potential participants clicked on the advertisement, they were directed to the web-based study site hosted by Survey Gizmo (www.surveygizmo.com). Prior to giving consent, potential participants were informed that they had to be at least 18 years old and no older than 65, had to read and understand English, and that I would provide a $10 electronic Starbucks gift card to each of the first 160 participants who completed the study. To obviate concerns about participants acknowledging use of an illicit substance, I did not require participants to have used MDMA/ecstasy prior to study participation. However, all participants met the inclusion criteria of having consumed ecstasy at least once over the past two months and intending to consume ecstasy at least once in the next two months.

To evaluate participants’ use of harm reduction strategies during the two-month follow-up period, I asked participants to provide an email address that I would use to send an invitation to participate in the follow-up. Next, participants were asked a series of five questions (i.e., how many vowels are in your first name; how many vowels are in your last name; how many sisters do you have; how many brothers do you have; what is the last digit of your primary telephone number), which resulted in a five-digit code to match their data from both time points. To protect
participants’ anonymity, I kept their email addresses separate from their numerical code and their study responses. Participants were then presented with all study measures (described below) in random order, except that the Intention questions were interspersed throughout study materials to reduce consistency bias in responding to similar items.

**Time 3: Measures**

**Theory of Planned Behavior Questionnaire – Pre/Post-Loading.** I administered this questionnaire to measure the variables proposed by the TPB as predictors of Intention to implement and actual use of the pre/post-loading strategy during follow up (described in Study 1 measures; See Appendix D). Participants responded to each of the 15 items using a 7-point scale (i.e., “Strongly agree” = -3, “Moderately agree” = -2, “Slightly agree” = -1, “Neither agree nor disagree” = 0, “Slightly agree” = 1, “Moderately agree” = 2, “Strongly agree” = 3). Internal consistency reliability was .93 for the Attitudes subscale, .92 for the Subjective Norms subscale, .93 for the Perceived Behavioral Control subscale, and .99 for the Intention subscale.

**Theory of Planned Behavior Questionnaire – Pill Testing/Checking.** To measure the variables proposed by the TPB as predictors of Intention to implement and actual use of the pill testing/checking strategy during follow up, I modified the questionnaire described above by replacing the word “Pre-loading/post-loading” with “Pill testing/checking before I use ecstasy” (See Appendix M). Participants responded to each of the 15 items using a 7-point scale (i.e., “Strongly agree” = -3, “Moderately agree” = -2, “Slightly agree” = -1, “Neither agree nor disagree” = 0, “Slightly agree” = 1, “Moderately agree” = 2, “Strongly agree” = 3). Internal consistency reliability was .89 for the Attitudes subscale, .84 for the Subjective Norms subscale, .91 for the Perceived Behavioral Control subscale, and .97 for the Intention subscale.
Index of Habit Strength – Pre/Post-Loading. I administered this measure (described in Study 1 measures; See Appendix E) to assess the past habitual use of the pre/post-loading strategy. Participants were asked to rate each item using a 7-point scale (i.e., “Strongly agree” = 3, “Moderately agree” = 2, “Slightly agree” = 1, “Neither agree nor disagree” = 0, “Slightly agree” = 1, “Moderately agree” = 2, “Strongly agree” = 3). Internal consistency reliability was .96.

Index of Habit Strength – Pill Testing/Checking. To measure the past habitual use of the pill testing/checking strategy, I modified the questionnaire described above by replacing the word “Pre-loading/post-loading” with “Pill testing/checking” (See Appendix E). Participants were asked to rate each item using a 7-point scale (i.e., “Strongly agree” = 3, “Moderately agree” = 2, “Slightly agree” = 1, “Neither agree nor disagree” = 0, “Slightly agree” = 1, “Moderately agree” = 2, “Strongly agree” = 3). Internal consistency reliability was .98.

Demographic and Substance Use History Questionnaires. I administered three questionnaires designed to assess the demographic characteristics, general drug use history, and ecstasy use history of each participant (see Appendices G, H, and I). Additionally, I asked participants whether they participated in Study 1 (no participants indicated they had participated in my previous study).

Time 4: Procedure

Approximately two months after they had completed the baseline assessment, I sent each participant an email asking them to participate in the follow-up assessment. After participants clicked the link to the study website, they were asked to re-consent to participate in the study. Next, participants were asked the same five questions used to generate the same identification code they provided at Time 3, and to fill out the Ecstasy-Related Harm Reduction Strategy
Frequency Questionnaire (described below). Finally, I emailed a $10 electronic Starbucks gift card to the first 160 participants who completed the study.

**Time 4: Measures**

**Ecstasy-Related Harm Reduction Strategies – Frequency Questionnaire.** To assess percent of drug use occasions during which participants had used specific ecstasy-related harm reduction strategies during the previous two months, I modified the Frequency Questionnaire described in Study 1 (see Appendix J). Specifically, I combined two similar items (i.e., “I used a test kit to test for the presence of MDMA and adulterants,” and “I checked an online database or MDMA testing service for the presence of MDMA and adulterants”), resulting in a list of 19 ecstasy-specific harm reduction strategies. The other 18 harm reduction strategies were identical to those listed on this questionnaire in Study 1. Participants were asked to report the proportion of drug use episodes when they implemented each strategy when they consumed MDMA/ecstasy over the previous two months (from “0%/None of the time” to “100%/All of the time” in increments of 10%).

**Demographic Questionnaire.** Participants were asked to provide their age, gender, and country of residence.
RESULTS

Participant Characteristics

During the recruitment period (May and June, 2014), 3,982 people clicked one of the Facebook advertisements and were presented with information about the study and 1,950 people viewed the consent document. Of these individuals, 858 consented to participate and provided an email address for the two-month follow-up assessment. However, only 417 of these participants completed all study questionnaires and provided a usable code for matching data at Time 4. At the two-month follow-up (July and August, 2014), 335 of these 417 participants clicked the link to the web-based study site. Of these, 218 participants had used ecstasy at least once since Time 3, provided a usable code for matching data, and completed the dependent measures. However, 118 of these participants provided a code that was either a duplicate code with another participant or a code that could not be matched to a participant’s code at Time 3, and therefore were dropped from analyses. The final sample was comprised of 100 individuals who provided a matching code and completed all study materials at Time 3 and Time 4 (see Appendix N for flowchart).

First, I conducted a preliminary analysis to evaluate the comparability of those 100 participants in the Time 2 final sample and those 302 Time 1 participants I could identify as not being included in the final sample (the status of 15 Time 1 participants could not be determined). A series of independent samples t-tests comparing mean scores on baseline TPB variables (Attitudes, Subjective Norms, Perceived Behavioral Control, Intention), and Habit Strength between participants in the two samples revealed only one out of 12 comparisons was significant. Specifically, when asked about Pre/Post-loading, participants in the final sample had
higher mean scores ($M = 0.8$, $SD = 1.8$) on the Perceived Behavioral Control subscale compared to those who were not included in the final sample ($M = 0.2$, $SD = 2.0$), $t(400) = -2.6$, $p < .05$.

As examination of Table 1 (Column 3) reveals, 86% of participants were Caucasian, 85% were male, 99% were under 34 years of age, 48% lived in the United Kingdom and 27% lived in the United States. As Table 2 (Column 3) shows, 56% of the sample reported using ecstasy once per month or more, and 65% had used ecstasy between 1 and 50 times over the course of their lifetime. Regarding most recent use, 29% had used ecstasy within the previous week and 70% had last used ecstasy more than one week prior to completing the baseline measures. During the two-months since study enrollment, 60% of participants had used ecstasy 3 or more times, and 40% indicated they had used 1-2 times. These participants also reported having used a variety of other substances over the three months prior to study enrollment, including alcohol (96%), cannabis (85%), and prescription amphetamines (62%). See table 3 for further drug use characteristics.

**Predicting Intention to Pre/Post-load at Time 3**

As an initial step in this evaluation, I calculated the means, standard deviations, and intercorrelations of TPB subscales (Attitudes, Subjective Norms, and Perceived Behavioral Control). As Table 4 reveals, the mean scores on the Attitudes subscale ($M = 0.1$, $SD = 1.8$), Subjective Norms subscale ($M = -0.9$, $SD = 1.8$), and the Perceived Behavioral Control subscale ($M = 0.8$, $SD = 1.8$) were strongly intercorrelated ($rs$ range from .56 to .64).

Based on the TPB model, which states that Attitudes, Subjective Norms, and Perceived Behavioral Control are predictors of Intention, I conducted a multiple linear regression to examine whether mean scores on these variables at baseline predicted concurrent Intention to pre/post-load. As Table 8 reveals, the overall model was significant, $F(3,96) = 56.1$, $p < .001$,
and accounted for 63% of variance in Intention scores, and the Attitudes subscale ($\beta = .63, p < .001$) was the only significant predictor in the model.

**Predicting Intention to Pill Test/Check at Time 3**

As an initial step in this evaluation, I calculated the means, standard deviations, and intercorrelations of TPB subscales (Attitudes, Subjective Norms, and Perceived Behavioral Control). As Table 4 reveals, the mean scores on the Attitudes subscale ($M = 0.1, SD = 1.8$), Subjective Norms subscale ($M = -1.5, SD = 1.6$), and the Perceived Behavioral Control subscale ($M = -0.4, SD = 1.9$) were strongly intercorrelated ($rs$ range from $.59$ to $.70$).

Next, I conducted a multiple linear regression to examine whether mean scores on the Attitudes, Subjective Norms, Perceived Behavioral Control subscales predicted Intention to pill test/check. As Table 8 reveals, the overall model was significant, $F(3,96) = 93.2, p < .001$, and accounted for 74% of the variance in Intention scores. All three predictors – Attitudes ($\beta = .25, p < .001$), Subjective Norms ($\beta = .20, p < .05$), and Perceived Behavioral Control ($\beta = .52, p < .001$) – were significant predictors of Intention to pill test/check.

**Predicting Pre/Post-loading at Time 4**

Based on the TPB model, which states that Intention and Perceived Behavioral are significant predictors of behavior, I conducted a two-step hierarchical linear regression to examine whether mean scores of these two variables predicted the proportion of drug use episodes when participants pre/post-loaded when they consumed ecstasy during the two month follow up period. Similarly to Study 1, I also included Habit Strength (i.e., past automatic engagement in this harm reduction strategy) as a predictor in the model. I entered Intention and Perceived Behavioral Control in the first step and Habit Strength in the second step. This step-wise order allowed me to examine whether Habit Strength explained any additional variance in
the regression model. As Table 9 reveals, the overall model was significant, $F(2,97) = 21.2, p < .001$, and accounted for 29% of the variance in strategy implementation scores. Intention ($\beta = .45, p < .001$) was as a significant predictor in the model. Although adding Habit Strength ($\beta = .45, p < .01$) explained an additional 1% of the variation in implementation scores, and this change in $R^2$ was significant ($p < .01$), including Habit Strength attenuated the predictive power of Intention ($\beta = .45$ to $\beta = .13$), and Intention was no longer a significant predictor in the regression model. Figure 4 displays the associations between TPB variables and frequency of pre/post-loading during the follow-up.

**Predicting Pill Testing/Checking at Time 4**

Next, I conducted a two-step hierarchical linear regression to examine whether mean scores of two selected TPB variables (i.e., Intention and Perceived Behavioral Control) and Habit Strength at baseline predicted the proportion of drug use episodes when participants tested their pills or checked an Internet pill testing results database when they consumed ecstasy during the two month follow up. I entered Intention and Perceived Behavioral Control in the first step and Habit Strength in the second step. As Table 9 reveals, the overall model was significant, $F(2,97) = 6.8, p < .01$, and accounted for 10% of the variance in strategy implementation scores. Only Intention ($\beta = .36, p < .01$) was as a significant predictor, and adding Habit Strength ($\beta = .12, \text{ns}$) did not account for more variance in the prediction of pill testing/checking. Figure 5 displays the associations between TPB variables and frequency of pill testing/checking during the follow-up.

**Proportion of the Time Participants Used Each Harm Reduction Strategy**

I then evaluated participants’ self-reported proportion of drug use episodes when they used each of the ecstasy harm reduction strategies listed on the Ecstasy Harm Reduction Strategy Frequency Questionnaire. Specifically, I categorized frequency of use into one of three
categories: a) Never (0%), b) Minority of occasions (50% or fewer of the times) or c) Majority of occasions (60-100% of the times). Inspection of Table 7 reveals that over 80% of participants used three of the harm reduction strategies the majority (60-100%) of the time they consumed ecstasy during study enrollment. Specifically, the strategies used most often were Item 13 (i.e., “I used MDMA/ecstasy only with friends”), Item 19 (i.e., “I found a safe way to get home from where I had been using MDMA/ecstasy”), and Item 1 (i.e., “I drank water/electrolyte-rich fluids to replace the fluids lost while I was using MDMA/ecstasy”). In contrast, six of the remaining 16 strategies were implemented relatively infrequently. Specifically, over 40% of participants reported they did not use Item 3 (i.e., “I used a test kit to test for the presence of MDMA and adulterants or checked on online database of MDMA testing service”), Item 17 (i.e., “I stretched muscles prior to consuming MDMA/ecstasy”), Item 2 (i.e., “I pre-loaded/post-loaded…in an attempt to decrease physiological, psychological, or neurological effects of MDMA/ecstasy intoxication”), Item 9 (i.e., “I took a chill-out break because of bad thoughts/emotions”), Item 14 (i.e., “I used a new batch of MDMA/ecstasy only after I saw how others reacted to it”), and Item 4 (i.e., “I reduced how much MDMA/ecstasy I consumed during a session.

Following completion of the Ecstasy Harm Reduction Strategy Frequency Questionnaire, I also asked participants whether there were any other strategies not listed on the questionnaire that they had used to minimize potential harms associated with their ecstasy consumption. Although 16 participants listed other strategies, many of their replies overlapped with strategies already listed on the questionnaire. Examples of overlapping strategies included having a “guide/babysitter” in case something went wrong during the session, spacing-out their ecstasy consumption to minimize harms and maximize benefits, testing the context of their ecstasy or checking an online pill-testing database to avoid toxicity of unknown substances, and pre/post-
loading. However, six participants indicated that they used harm reduction strategies not currently listed on the questionnaire, including chewing ice, eating a proper diet, evaluating the color of the powder or crystals of MDMA, and making sure their phone was charged prior to consuming ecstasy.
DISCUSSION

I conducted these two studies to evaluate the Theory of Planned Behavior as a model of the motivational antecedents of intention to implement and actual use of selected harm reduction strategies among MDMA/ecstasy users. The evaluation of my first question revealed that testing/checking one’s pills was the only harm reduction strategy for which all baseline TPB variables (Attitudes, Subjective Norms, and Perceived Behavioral Control) predicted concurrent Intention to implement the strategy. For pre/post-loading and hydrating, only the Attitudes subscale consistently predicted current Intention to implement these strategies.

The evaluation of my second question regarding the predictive validity of the TPB revealed that baseline Intention was the only consistently significant predictor of pre/post-loading and testing/checking one’s pills during the follow-up period. Although Habit Strength did not predict either the frequency with which hydrating was employed in Study 1 or pill testing/checking was employed in Study 2, it was a significant predictor of how often participants employed pre/post-loading strategy in both studies.

My dissertation is one of several studies that have examined the relation between TPB variables and use of alcohol and drug-related harm reduction strategies. Consistent with my results, Bonnell (2013) found that her Attitudes subscale was the only significant predictor of Intention to use alcohol reduction strategies (e.g., setting a limit on the number of drinks one will consume before starting to drink, alternating alcohol and non-alcoholic beverages, avoiding drinking games) to reduce binge drinking among college students, and Intention was the only significant predictor of actual use of those strategies at follow-up. Also consistent with my results, Gagnon and Godin (2009) found that their Attitudes and Perceived Behavioral Control subscales, but not their Subjective Norms subscale, were associated with Intention to use a new
syringe when injecting opioids, although they did not measure actual syringe use in their evaluation of the model. Partially consistent with my results, Kim and Hong (2013) found that all three of their TPB subscales predicted Intention to control hazardous alcohol consumption among male employees in South Korean automobile, construction, electronics, and banking companies. Additionally, both Intention and Perceived Behavioral Control predicted less hazardous drinking during a two-week period.

In addition to substance-related harm reduction, several studies have evaluated the relation between the TPB and use of strategies to prevent harm from other types of potentially unsafe behavior. For example, consistent with my results, Prati et al. (2014) found that their Attitudes subscale was the only significant predictor of Intention to use a condom among a large sample of randomly selected adults in Italy, and that their Intention subscale was the only variable that predicted condom use. Also consistent with my results, Moan (2013) found that all three of their TPB variables predicted Intention not to ride in a car with an intoxicated driver among a random sample of Norwegian women. Among men, however, the only significant predictor of Intention was their Perceived Behavioral Control subscale.

There are several factors that could explain why TPB variables did not uniformly predict use of harm reduction strategies in my studies. First, some of my participants may not have believed that ecstasy is harmful and so had no motivation to employ harm reduction strategies after using the drug. Relatedly, judgments about the likelihood of experiencing harms during or following ecstasy consumption could alter the relation between TPB variables and use of harm reduction strategies. Specifically, if a drug user believes there is only a small likelihood of experiencing harm after consuming ecstasy, harm reduction strategies may not be used even if
the one’s social network approves of and the person perceives having control over use of the strategy.

A second possible factor is that intoxication and substance-induced cognitive impairment could interfere with participants’ ability to employ harm reduction strategies, most of which are designed to be used during a drug use session. As an example, a problem with prospective memory (i.e., remembering that one wants to do something) has been associated with acute MDMA intoxication (Ramaekers, Kuypers, Wingen, Heinecke & Formisano, 2009). To the degree that ecstasy users forget their intention to employ one or more harm reduction strategies when they are intoxicated, Intention may be a weak or inconsistent predictor of their use of harm reduction strategies.

Third, the availability and accessibility of harm reduction-related products or services might limit one’s ability to use the strategy regardless of his or her beliefs or intention to do so. For example, ecstasy users must have access to vitamins and/or other supplements in order to pre/post-load, a pill-testing kit to check their pill for the presence of MDMA and possible adulterants, or an internet-connected phone or other device to check an online database for pill testing results. Not being able to afford these products could also interfere with use of these strategies, regardless of one’s intention.

Based in part on the environmental and cognitive barriers noted above, future investigations designed to evaluate the relation between TPB variables and use of harm reduction strategies would benefit from several improvements. First, because TPB variables will have limited predictive validity if drug users do not have access to harm reduction resources, researchers should assess participants’ access to these products and services as part of any evaluation of the TPB. Researchers might also evaluate whether participants believe ecstasy use
is harmful, whether they have experienced harms associated with their substance use, and/or whether use of a harm reduction strategy is likely to minimize any harm associated with consumption of the substance. Again, TPB variables will have limited predictive validity if drug users do not see ecstasy as dangerous and themselves as benefiting from use of harm reduction strategies.

Researchers should also consider assessing the subjective level of intoxication experienced in each ecstasy use episode to evaluate whether intoxication level is associated with use of harm reduction strategies. However, assessing intoxication level might be challenging given the differences in perceived subjective effects of intoxication, tolerance, and differences in ingredients of ecstasy. Additionally, researchers should evaluate other forms of impairment (e.g., deficits in prospective and short-term memory due to ecstasy consumption) that could influence one’s ability to employ a harm reduction strategy. Such deficits could explain why some participants do not report using that strategy during follow-up even if they intended to do so.

It is possible that one’s past habitual use of harm reduction strategies has a stronger relation to concurrent intention to implement a strategy when compared to their attitudes, beliefs about subjective norms, and their perceived control over the behavior. Therefore, I also recommend evaluating the relation between Habit Strength and Intention to implement specific harm reduction strategies, in addition to predicting actual use of those strategies during a follow-up period. If Habit Strength is a stronger predictor of Intention and actual use of harm reduction strategies among ecstasy users when compared to other TPB variables, it could lead to greater understanding of the psychology of harm reduction strategy implementation among MDMA/ecstasy users.
My final recommendation is for researchers to evaluate the relation between TPB variables and use of harm reduction strategies among problematic/abusive ecstasy users. Although harm reduction strategies could be used by infrequent and novice users, individuals who consume ecstasy more frequently, and who may have developed problems associated with ecstasy use, might have an increased risk of experiencing harms associated with consumption. Therefore, researchers might find stronger relations between TPB variables and use of harm reduction strategies among problematic users than among the recreational users I recruited for the present study.

Had I included some of the variables noted above, I might have found a stronger relation between TPB variables and use of harm reduction strategies in my studies. In addition, several methodological limitations might have also influenced my findings. First, I used a web-based recruitment and data collection procedure and ecstasy users who do not access the websites used in this study, or who do not participate in online research, might have more or less favorable beliefs about the use of harm reduction strategies. However, there are many practical and methodological advantages of web-based studies, and evidence supports the reliability and validity of anonymous reports of drug use provided via the Internet (Ramo et al., 2012).

Another advantage of using the web to recruit participants is that I obtained a sample of ecstasy users from multiple locations in the United States and from other countries. If I had recruited and assessed attitudes and harm reduction practices face-to-face, I would have been limited geographically. Additionally, using the web reduced the time and money required to recruit participants and collect data. Not having to meet with me personally, and being able to complete the materials at a time and place of one’s choosing, probably increased the likelihood
that ecstasy users agreed to participate in a study that required completing materials at baseline and at the two-month follow-up.

A second limitation is that duplicate and unmatchable codes led me to eliminate many potential participants from the analyses. I do not know whether those participants who were excluded differed in their use of harm reduction strategies compared to those who were included in the study. However, using a coding system rather than using names or unique identification numbers was required for both ethical and practical reasons, and may have increased participants’ perceptions of anonymity when reporting use of an illicit substance.

Third, there was little variability in the frequency of MDMA/ecstasy consumption during the two-month follow-up assessment and this may have attenuated any association there might otherwise be between use of these harm reduction strategies and TPB variables and Habit Strength. However, including participants who used ecstasy only once or twice per month allowed me to enroll participants across a wider range of ecstasy use histories, possibly increasing the representativeness of the samples.

Fourth, that I asked participants to report their attitudes and beliefs regarding two different harm reduction strategies could have created carryover effects. Specifically, answering items about the first harm reduction strategy in each study may have influenced participants’ responses to items about the second strategy, and subsequently influenced their intention to implement and actual use of both strategies in each study. Despite this limitation, the within-subjects design allowed me to assess TPB variables associated with multiple harm reduction strategies without having to enroll more participants.

Fifth, the response options I utilized to measure how often participants implemented each of the harm reduction strategies (i.e., 0%-100% of the time one used ecstasy over the previous
two months) did not assess whether participants made repeated use of strategies (e.g., hydration; chill-out breaks) that can be employed multiple times within a drug use episode. For example, ambient temperature, level of activity, and quantity of drug consumption could influence the amount and frequency of hydrating within a session. Therefore, although some ecstasy users might hydrate only once during an ecstasy use session, others might have hydrated on several occasions within a session – but my response option would not capture these different patterns.

These limitations notwithstanding, results from both of these studies support, at least in part, predictions made by the TPB and therefore extend the application of the TPB to the use of harm reduction strategies among ecstasy users. These findings also have clinical and educational implications. For example, my findings revealed that Attitudes significantly predicted concurrent Intention to implement, and Intention significantly predicted actual use of, the pre/post-loading and pill testing/checking strategies. Therefore, I suggest that clinicians, harm reduction workers, and public health officials evaluate whether education and prevention materials noting the importance, benefits, and necessity of employing the pre/post-loading and pill testing/checking strategies increases use of these strategies among both regular and novice ecstasy users. Not only could increased use of harm reduction strategies by ecstasy users help preserve their personal health and wellbeing, it could potentially decrease the costs associated with emergency room visits and hospitalizations.
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APPENDIX A: APPROVAL LETTER FROM HUMAN SUBJECTS REVIEW BOARD

DATE: October 21, 2013
TO: Alan Davis, M.A.
FROM: Bowling Green State University Human Subjects Review Board
PROJECT TITLE: [525295-2] Using the theory of planned behavior to use health promotion strategies by ecstasy users
SUBMISSION TYPE: Revision
ACTION: APPROVED
APPROVAL DATE: October 20, 2013
EXPIRATION DATE: October 16, 2014
REVIEW TYPE: Expedited Review
REVIEW CATEGORY: Expedited review category # 7

Thank you for your submission of Revision materials for this project. The Bowling Green State University Human Subjects Review Board has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

The final approved version of the consent document(s) is available as a published Board Document in the Review Details page. You must use the approved version of the consent document when obtaining consent from participants. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require that each participant receives a copy of the consent document.

Please add the text equivalent of the HSRB IRBNet approval/expiration date stamp to the "footer" area of the electronic consent document.

Please note that you are responsible to conduct the study as approved by the HSRB. If you seek to make any changes in your project activities or procedures, those modifications must be approved by this committee prior to initiation. Please use the modification request form for this procedure.

You have been approved to enroll 2,000 participants. If you wish to enroll additional participants you must seek approval from the HSRB.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. All NON-COMPLIANCE issues or COMPLAINTS regarding this project must also be reported promptly to this office.

This approval expires on October 16, 2014. You will receive a continuing review notice before your project expires. If you wish to continue your work after the expiration date, your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date.

Good luck with your work. If you have any questions, please contact the Office of Research Compliance at 419-372-7716 or hsrb@bgsu.edu. Please include your project title and reference number in all correspondence regarding this project.
APPENDIX B: CONSENT DOCUMENT

Information Sheet will be incorporated in SurveyGizmo with BGSU information at top

- You are invited to participate in a research project -- studying the ways that ecstasy users keep themselves safe and healthy while using this substance -- which I am conducting as part of my doctoral dissertation in the Psychology Department at Bowling Green State University.

- Your participation will involve answering questions at two different times. At Time One, I will ask you about your attitudes and beliefs about strategies you employ to keep yourself healthy and safe while using ecstasy and a few background characteristics. At Time Two, approximately two months later, I will ask you about your ACTUAL use of these strategies since participation at Time One.

- In order to contact you the second time, I will ask you to provide your email address SEPARATELY from your responses. This way, your responses about your use of ecstasy CANNOT be connected to your email address. Therefore, your responses will be completely anonymous.

- Although your email address will not be connected to your responses, I will keep your contact information confidential. To do so, I will keep your email address in a password-protected file, on a password-protected computer, in a locked office in the Psychology Building on Bowling Green State University’s campus. Only my research advisor and I will have access to this file. After the study is complete, I will destroy this file using a secure destroy function on my computer. I will not use your email address for any other form of contact or disclose your email address to any other person or organization.

- You are eligible to participate if you are at least 18 years old and no older than 65. Also, you must be able to read and understand English.

- As compensation, and as a way to “pay it forward,” I will donate $5.00 to Dance Safe (an organization that promotes harm reduction and MDMA pill testing) for each person who completes all study materials (up to $250).

- We anticipate that your participation will take approximately 15 minutes at Time One and less than 5 minutes at Time Two.

- The benefits of participating include helping us understand what factors influence use of health promotion strategies among ecstasy users. This research could provide useful information to help design harm reduction programs.

- The anticipated risks of filling out the questionnaires are no greater than those normally encountered in daily life.

- Please note that you are free to change your mind and stop participating at any time, even if you begin to complete the online survey. You may click on the X at the top right hand
corner of your computer window to exit the survey at any time. You can visit this web address again if you exit and then decide later that you would like to participate.

- Please note that your participation is completely voluntary and you are free to skip any questions you do not want to answer. Deciding not to participate will not have any impact on your relationship with the researchers or the university where they work (Bowling Green State University).

- Please note that your questionnaire answers are anonymous. We will not ask you to provide your name or any unique information that is connected to your responses. Also, although we hope to publish an article summarizing the overall results of this study, no one person’s answers will be presented – only a summary of responses from many participants.

- Because the Internet is not 100% secure in terms of privacy, please do not leave the partially completed survey open or unattended if completing it on a public computer. You may want to clear the browser page history and cache when finished with the survey.

- In addition, if you have any questions about the study, you may contact the primary investigator, Alan Davis, M.A., Doctoral Candidate, Psychology Department, (419) 372-4503, akdavis@bgsu.edu. You may also contact my research advisor, Harold Rosenberg, Ph.D., Professor of Psychology, Psychology Department, (419) 372-7255, hrosenb@bgsu.edu.

- You may also contact the Chair, Human Subjects Review Board, Bowling Green State University, (419) 372-7716 (hsrb@bgsu.edu), if any problems or concerns arise during the course of the study.

Your completion of this online survey indicates your voluntary consent to participate in this research investigation. You may refuse to participate in this investigation or withdraw your consent and discontinue participation in this study without penalty. If you choose not to participate, please exit this site by clicking the X in the upper right hand corner of this screen.

By clicking the "Next" button, you agree that you have been informed of the above statements of risks and benefits of participating in this project and you agree to participate.
APPENDIX C: THEORY OF PLANNED BEHAVIOR VARIABLES - HYDRATION

Description provided to participants:

“Staying hydrated. What I mean is, replacing the fluids lost while you are high on MDMA/ecstasy by drinking water or electrolyte-rich fluids. Staying hydrated while you’re using MDMA/ecstasy lowers the chances of overheating and other health-related problems.”

Participants are asked to rate their agreement with each item on a 7 point scale from -3=Completely Disagree to +3=Completely agree.

Attitudes (Higher scores = positive attitudes)
1. Drinking water/electrolyte-rich fluids while I am using ecstasy is important to me
2. Drinking water/electrolyte-rich fluids while I am using ecstasy is beneficial for me
3. Drinking water/electrolyte-rich fluids while I am using ecstasy is worth the effort
4. Drinking water/electrolyte-rich fluids while I am using ecstasy is necessary for me

Subjective Norm (high scores = positive norms)
1. Most of my ecstasy-using friends tell me that I should drink water/electrolyte-rich fluids while I am using ecstasy
2. Most of my ecstasy-using friends drink water/electrolyte-rich fluids while they are using ecstasy
3. I see other people drinking water/electrolyte-rich fluids when they are using ecstasy

Perceived Behavioral Control (higher scores = more control and confidence)
1. I have a lot of control over whether I drink water/electrolyte-rich fluids while I am using ecstasy
2. I can drink water/electrolyte-rich fluids while I am using ecstasy if I choose to
3. Drinking water/electrolyte-rich fluids while I am using ecstasy is easy for me
4. I am confident that I could drink water/electrolyte-rich fluids while I am using ecstasy over the next 2 months
5. I am confident that I could drink water/electrolyte-rich fluids when I am in the environment that I typically consume ecstasy

Intention (Higher scores = more intention)
1. It is likely that I will drink water/electrolyte-rich fluids while I am using ecstasy over the next 2 months
2. I intend to drink water/electrolyte-rich fluids while I am using ecstasy in the next 2 months
3. Chances are that I will drink water/electrolyte-rich fluids while I am using ecstasy in the next 2 months
APPENDIX D: THEORY OF PLANNED BEHAVIOR VARIABLES – PRE/POST-LOADING

Description provided to participants:

“Pre-loading/Post-loading. What I mean is, trying to lower the possible negative effects of using MDMA/ecstasy by taking 5-HTP (5-Hydroxytryptophan) or other vitamins/herbal supplements.”

Participants are asked to rate their agreement with each item on a 7 point scale from -3=Completely Disagree to +3=Completely agree.

**Attitudes** (Higher scores = positive attitudes)
1. Pre-loading/Post-loading is important to me
2. Pre-loading/Post-loading is beneficial for me
3. Pre-loading/Post-loading is worth the effort
4. Pre-loading/Post-loading is necessary for me

**Subjective Norm** (high scores = positive norms)
1. Most of my ecstasy-using friends tell me that I should pre-load/post-load when I use ecstasy
2. Most of my ecstasy-using friends pre-load/post-load when they use ecstasy
3. I see other people pre-load/post-load when I use ecstasy when they are using ecstasy

**Perceived Behavioral Control** (higher scores = more control and confidence)
1. I have a lot of control over whether I pre-load/post-load when I use ecstasy
2. I can pre-load/post-load when I use ecstasy if I choose to
3. Pre-loading/post-loading when I use ecstasy is easy for me
4. I am confident that I could pre-load/post-load when I use ecstasy over the next 2 months
5. I am confident that I could pre-load/post-load when I am in the environment that I typically consume ecstasy

**Intention** (Higher scores = more intention)
1. It is likely that I will pre-load/post-load when I use ecstasy over the next 2 months
2. I intend to pre-load/post-load when I use ecstasy in the next 2 months
3. Chances are that I will pre-load/post-load when I use ecstasy in the next 2 months
APPENDIX E: INDEX OF HABIT STRENGTH

Participants are asked to rate their agreement with each of the following statements on a 5-point scale from 0=Disagree to 4=Agree.

Drinking water/electrolyte-rich fluid is something…
1. I do frequently
2. I do automatically
3. I do without having to consciously remember
4. That belongs to my typical ecstasy use-related routine
5. I have been doing for a long time

Pre-loading/Post-loading is something …
1. I do frequently
2. I do automatically
3. I do without having to consciously remember
4. That belongs to my typical ecstasy use-related routine
5. I have been doing for a long time

Pill testing/checking is something …
1. I do frequently
2. I do automatically
3. I do without having to consciously remember
4. That belongs to my typical ecstasy use-related routine
5. I have been doing for a long time
APPENDIX F: ECSTASY – HARMONIOUS AND OBSESSIVE PASSION SCALE

Participants will be asked to rate each item on a 7-point Likert scale ranging from 1 = *do not agree at all* to 7 = *completely agree.*

1. Using ecstasy allows me to live a variety of experiences
2. The new things that I discover while using ecstasy allow me to appreciate it even more
3. Using ecstasy allows me to live memorable experiences
4. Using ecstasy reflects the qualities I like about myself
5. Using ecstasy is in harmony with the other activities in my life
6. For me, using ecstasy is a passion that I still manage to control
7. I am completely taken with using ecstasy
8. I cannot live without using ecstasy
9. The urge is so strong, I can’t help myself from using ecstasy
10. I have difficulty imagining my life without using ecstasy
11. I am emotionally dependent on using ecstasy
12. I have a tough time controlling my need to use ecstasy
13. I have almost an obsessive feeling for using ecstasy
14. My mood depends on me being able to use ecstasy

Harmonious Subscale – Items 1-7

Obsessive Subscale – Items 8-14
APPENDIX G: SUBSTANCE USE HISTORY QUESTIONNAIRE

In the past 3 months have you used each of the following substances? (Select yes or no)

- Alcohol
- Cannabis/Marijuana
- Synthetic Cannabinoids
- Heroin
- Prescription Opioids (painkillers; e.g., oxycontin, vicodin, dilaudid)
- Cocaine
- Benzodiazepines (e.g., xanax, valium)
- Barbiturates
- Methamphetamine
- Prescription Amphetamines
- LSD
- Mushrooms
- Ayahuasca
- DMT
- Ketamine
- GHB
- Inhalants
- Salvia
- Spice/K2
- Research Chemicals
- Synthetic Cathinones (e.g., MDPV, or 'Bath Salts')

Please write in the box any other substance(s) that you have consumed in the past 3 months

____________________
APPENDIX H: BACKGROUND QUESTIONNAIRE

What is your age?
- Under 18
- 18-24
- 25-34
- 35-54
- 55-65
- Over 65

What is your gender?
- Male
- Female
- Other
- Decline to respond

What is your sexual orientation?
- Homosexual
- Bisexual
- Heterosexual
- Other
- Decline to respond

What is your ethnicity?
- Asian/Pacific Islander
- Black/African-American
- Caucasian
- Hispanic
- Native American/Alaska Native
- Other/Multi-Racial
- Decline to Respond

Which country do you live in?
List of all countries in the world

If you live in the United States, which state do you live in?
List of all US states

What level of education have you completed?
- 12th grade or less
- Graduated high school or equivalent
- Some college, no degree
- Associate degree
- Bachelor’s degree
- Graduate degree

What is your relationship status?
- Single
- Married/Partnered
APPENDIX I: ECSTASY USE HISTORY QUESTIONNAIRE

1. **How many times have you used ecstasy in the past three months?**
   - [Single numerical values between 1 and 24]
   - 25 or more

2. **How many times have you used ecstasy over the course or your lifetime?**
   - 0, 1-10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, 81-90, 91-100, 100 or more

3. **How frequently do you use ecstasy?**
   - Never
   - Less than monthly
   - Once per month
   - Every other week
   - Weekly
   - Two times per week
   - More than two times per week

4. **In which environment do you typically consume ecstasy?**
   - Home
   - Festival
   - Club
   - Rave
   - Friend’s home
   - Other

5. **When was the last time you consumed ecstasy?**
   - I am currently intoxicated on MDMA/ecstasy
   - Earlier today
   - Yesterday
   - A few days ago
   - About a week ago
   - More than a week ago

6. **On average, how many pills do you take each time you use ecstasy?**
   - [Single numerical values between 1 and 10]
   - 11 or more

7. **Do you plan to consume MDMA/ecstasy in the next two months?**
   - Yes
   - No

*Added question in Study 2*

1. **On average, how many pills do you purchase when you get ecstasy?**
   - [Single numerical values between 1 and 100]
   - 100 or more
APPENDIX J: ECSTASY-RELATED HARM REDUCTION STRATEGIES FREQUENCY QUESTIONNAIRE

“What percent of the time did you use each of the following harm reduction strategies while using MDMA/ecstasy over the past 2 months?”

Participants are asked to provide a proportion of the time that they used a specific harm-reduction strategy from Never/0% of the time to Always/100% of the time (in increments of 10%).

1. I Pre-loaded/Post-loaded (by consuming herbal or other supplements prior to and/or after using ecstasy) to try and lower the possible negative effects of MDMA/ecstasy use
2. I drank water/electrolyte-rich fluids to replace the fluids lost while you are using MDMA/ecstasy.
3. I used a test kit to test for the presence of MDMA and/or adulterants
4. I checked an online MDMA testing services to see if the pill I was taking contained MDMA and/or adulterants
5. I reduced how much MDMA/ecstasy I consumed during a session
6. I reduced how much I used substances other than MDMA/ecstasy during a session
7. I avoided frequent and heavy MDMA/ecstasy use
8. I urinated while intoxicated to avoid the build up of excess fluids I drank during the MDMA/ecstasy session
9. I took a chill-out break to control my body temperature
10. I took a chill-out break because of bad thoughts/emotions (e.g., found a quiet corner, talked to a trusted friend, listened to music, engaged in mindfulness exercises)
11. I bought MDMA/ecstasy from a trusted source
12. I got in a good mood prior to using MDMA/ecstasy (e.g., drank a small amount of wine, smoked a little bit of cannabis, rested, ate some food, listened to music)
13. I used MDMA/ecstasy only when in a good mood
14. I used MDMA/ecstasy only with friends
15. I used a new batch of MDMA/ecstasy only after I saw how others reacted to it
16. I did not get into cars with others who were intoxicated
17. I carried money for an emergency exit plan
18. I stretched muscles prior to consuming MDMA/ecstasy
19. I had a trusted friend I could go to for help if troubling events/thoughts occurred while I was on MDMA/ecstasy
20. I found a safe way to get home from where I had been using MDMA/ecstasy

Please list any other strategies that you have used to protect your health and safety while using MDMA/ecstasy in the last 2 months.

*Items 3 and 4 were combined in Study 2 due to similarity of the target behaviors.*
APPENDIX K. STUDY 1 PARTICIPANT RECRUITMENT FLOW CHART

Study link posted on MDMA-related websites

739 clicked hyperlink

419 consented to participate

338 participants at Time 1

264 clicked study link at two-month follow-up

186 eligible at Time 2

136 in final sample

81 excluded for not completing study questionnaires

78 excluded because they did not consume MDMA during study enrollment

50 excluded because I was unable to match their code at Time 1 and Time 2

739 clicked hyperlink

419 consented to participate

338 participants at Time 1

264 clicked study link at two-month follow-up

186 eligible at Time 2

136 in final sample

81 excluded for not completing study questionnaires

78 excluded because they did not consume MDMA during study enrollment

50 excluded because I was unable to match their code at Time 1 and Time 2
APPENDIX M: THEORY OF PLANNED BEHAVIOR VARIABLES – PILL TESTING/CHECKING

Description provided to participants:

“Pill Testing/Pill Checking. What I mean is, using a pill testing kit to check for the presence of MDMA or other common 'ecstasy' substances; or checking the contents of your ecstasy by looking at an online pill testing database (e.g., pillreports).”

Participants are asked to rate their agreement with each item on a 7 point scale from 
-3=Completely Disagree to +3=Completely agree.

**Attitudes** (Higher scores = positive attitudes)
1. Pill testing/checking before I use ecstasy is important to me
2. Pill testing/checking before I use ecstasy is beneficial for me
3. Pill testing/checking before I use ecstasy is worth the effort
4. Pill testing/checking before I use ecstasy is necessary for me

**Subjective Norm** (high scores = positive norms)
1. Most of my ecstasy-using friends tell me that I should test/check the content of my pill before I use ecstasy
2. Most of my ecstasy-using friends test/check the content of their pills before they use ecstasy
3. I see other people testing/checking the content of their pills before I use ecstasy

**Perceived Behavioral Control** (higher scores = more control and confidence)
1. I have a lot of control over whether I test/check the content of my pill before I use ecstasy
2. I can test/check the content of my pill before I use ecstasy if I choose to
3. Testing/checking the content of my pill before I use ecstasy is easy for me
4. I am confident that I could test/check the content of my pill before I use ecstasy over the next 2 months
5. I am confident that I could test/check the content of my pill before I am in the environment that I typically consume ecstasy

**Intention** (Higher scores = more intention)
1. It is likely that I will test/check the content of my pill before I use ecstasy over the next 2 months
2. I intend to test/check the content of my pill before I use ecstasy in the next 2 months
3. Chances are that I will test/check the content of my pill before I use ecstasy in the next 2 months
Study link posted using targeted Facebook advertisements

3982 clicked advertisement

2808 viewed the consent document

858 consented to participate

441 excluded for not completing study questionnaires

417 participants at Time 1

417 participants at Time 1

335 clicked study link at two-month follow-up

117 excluded because they did not consume MDMA during study enrollment, did not provide a code, or complete study questionnaires

218 eligible at Time 2

118 excluded because I was unable to match their code at Time 1 and Time 2

100 in final sample
Figure 1. *Theory of Planned Behavior Model*
Figure 2. *Associations Among Theory of Planned Behavior Subscales and the Hydration Harm Reduction Strategy in Study 1*

Legend:

*** $p < .001$, ** $p < .01$, * $p < .05$
Figure 3. *Associations Among Theory of Planned Behavior Subscales and the Pre/Post-loading Harm Reduction Strategy in Study 1*

Legend:

*** $p < .001$, ** $p < .01$, * $p < .05$
Figure 4. Associations Among Theory of Planned Behavior Subscales and the Pre/Post-loading Harm Reduction Strategy in Study 2

Legend:

*** $p < .001$,  ** $p < .01$,  * $p < .05$
Figure 5. Associations Among Theory of Planned Behavior Subscales and the Pill Testing/Checking Harm Reduction Strategy in Study 2

Legend:
*** $p < .001$, ** $p < .01$, * $p < .05$
Table 1. Demographic Characteristics of Participants by Study Sample

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Study 1 Sample ((n=136))</th>
<th>Study 2 Sample ((ns) range from 99 to 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>26</td>
<td>14</td>
</tr>
<tr>
<td>Male</td>
<td>73</td>
<td>85</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-24</td>
<td>68</td>
<td>78</td>
</tr>
<tr>
<td>25-34</td>
<td>24</td>
<td>21</td>
</tr>
<tr>
<td>35-54</td>
<td>7</td>
<td>1</td>
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<tr>
<td>Sexual Orientation</td>
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<td></td>
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<tr>
<td>Heterosexual</td>
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<td>83</td>
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<tr>
<td>Homosexual/Bisexual</td>
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<td>13</td>
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<tr>
<td>Other</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Decline to respond</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Ethnicity</td>
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<td>White/Caucasian</td>
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<td>86</td>
</tr>
<tr>
<td>Hispanic/Latino/a</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Other (Asian, African, Native)</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>Decline to respond</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Country of Residence</td>
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<td></td>
</tr>
<tr>
<td>United States</td>
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<td>27</td>
</tr>
<tr>
<td>United Kingdom</td>
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<td>48</td>
</tr>
<tr>
<td>Canada</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>New Zealand</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Education Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12(^{th}) grade or less</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>High school graduate or equivalent</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Some college, no degree</td>
<td>44</td>
<td>41</td>
</tr>
<tr>
<td>Associates degree</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>Graduate degree</td>
<td>8</td>
<td>4</td>
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<tr>
<td>Relationship Status</td>
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<td></td>
</tr>
<tr>
<td>Single</td>
<td>69</td>
<td>77</td>
</tr>
<tr>
<td>Married/Partnered</td>
<td>31</td>
<td>23</td>
</tr>
</tbody>
</table>
Table 2. *Ecstasy Use History by Study Sample*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Study 1 (n=136) %</th>
<th>Study 2 (ns range from 99 to 100) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecstasy Use History</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General frequency of use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than monthly</td>
<td>50</td>
<td>43</td>
</tr>
<tr>
<td>Once per month</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>Every other week</td>
<td>16</td>
<td>21</td>
</tr>
<tr>
<td>Weekly</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Two times per week</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>More than two times per week</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Past three month frequency of use at Time 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One time</td>
<td>28</td>
<td>30</td>
</tr>
<tr>
<td>Two times</td>
<td>24</td>
<td>13</td>
</tr>
<tr>
<td>Three times</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Four times or more</td>
<td>32</td>
<td>40</td>
</tr>
<tr>
<td>Frequency of use since Time 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td>68</td>
<td>40</td>
</tr>
<tr>
<td>3-4</td>
<td>18</td>
<td>29</td>
</tr>
<tr>
<td>5 or more</td>
<td>14</td>
<td>31</td>
</tr>
<tr>
<td>Number of times used - lifetime</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-20</td>
<td>55</td>
<td>35</td>
</tr>
<tr>
<td>21-50</td>
<td>22</td>
<td>30</td>
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<tr>
<td>51-100</td>
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<td>14</td>
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<tr>
<td>100 or more</td>
<td>11</td>
<td>21</td>
</tr>
<tr>
<td>Typical consumption environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>Rave</td>
<td>27</td>
<td>38</td>
</tr>
<tr>
<td>Club</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Festival</td>
<td>21</td>
<td>17</td>
</tr>
<tr>
<td>Other (e.g., Friend’s House)</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Last time consumed ecstasy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than one week ago</td>
<td>61</td>
<td>51</td>
</tr>
<tr>
<td>Approximately one week ago</td>
<td>22</td>
<td>19</td>
</tr>
<tr>
<td>A few days ago</td>
<td>10</td>
<td>22</td>
</tr>
<tr>
<td>Yesterday</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Currently intoxicated</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Number of pills consumed per occasion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>One</td>
<td>26</td>
<td>19</td>
</tr>
<tr>
<td>Two</td>
<td>52</td>
<td>39</td>
</tr>
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<td>Three</td>
<td>10</td>
<td>24</td>
</tr>
<tr>
<td>Four or more</td>
<td>12</td>
<td>17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of pills/capsules purchased per transaction</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>-</td>
<td>54</td>
</tr>
<tr>
<td>4-9</td>
<td>-</td>
<td>20</td>
</tr>
<tr>
<td>10 or more</td>
<td>-</td>
<td>26</td>
</tr>
</tbody>
</table>

Note. Numbers of participants by condition varied for the variables above; specifically, as participants declined to answer questions or quit the study prematurely the numbers of participants decreased.
Table 3. Proportions of Participants Who Had Used Various Drugs over the Past Three Months at Time 1 by Study Sample

<table>
<thead>
<tr>
<th>Substance (Past three months)</th>
<th>Study 1 Sample (n=136) %</th>
<th>Study 2 Sample (n=100) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>95</td>
<td>96</td>
</tr>
<tr>
<td>Cannabis</td>
<td>81</td>
<td>85</td>
</tr>
<tr>
<td>LSD</td>
<td>55</td>
<td>25</td>
</tr>
<tr>
<td>Mushrooms</td>
<td>41</td>
<td>28</td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>Spice/K2</td>
<td>37</td>
<td>1</td>
</tr>
<tr>
<td>Research Chemicals</td>
<td>37</td>
<td>9</td>
</tr>
<tr>
<td>Ketamine</td>
<td>28</td>
<td>26</td>
</tr>
<tr>
<td>Prescription Amphetamines</td>
<td>26</td>
<td>15</td>
</tr>
<tr>
<td>Cocaine</td>
<td>26</td>
<td>62</td>
</tr>
<tr>
<td>Prescription Opiates</td>
<td>24</td>
<td>19</td>
</tr>
<tr>
<td>Inhalants</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>DMT</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>Methamphetamine</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Synthetic Cathinones</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>GHB</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Salvia</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Synthetic Cannabis</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Barbiturates</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Ayahuasca</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Heroin</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Other(^a)</td>
<td>33</td>
<td>16</td>
</tr>
</tbody>
</table>

\(^a\) Types of “other drugs” varied considerably and included research chemicals (2C-x family), modafinil, DMT-family, designer steroids, kratom, san pedro cactus, mescaline, tobacco, Suboxone, and 25b/c-NBOME.
Table 4. Means, Standard Deviations, and Intercorrelations of Baseline TPB subscales by condition in Study 1 and Study 2.

<table>
<thead>
<tr>
<th>TPB Subscale by Condition and Study</th>
<th></th>
<th>Intercorrelations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M(SD)</td>
<td>ATT</td>
</tr>
<tr>
<td><strong>Study 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitudes</td>
<td>2.8(0.4)</td>
<td>1</td>
</tr>
<tr>
<td>Subjective Norms</td>
<td>2.2(0.9)</td>
<td>-</td>
</tr>
<tr>
<td>Perceived Behavioral Control</td>
<td>2.7(0.5)</td>
<td>-</td>
</tr>
<tr>
<td>Pre/Post-Loading</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitudes</td>
<td>1.1(1.7)</td>
<td>1</td>
</tr>
<tr>
<td>Subjective Norms</td>
<td>-0.4(1.8)</td>
<td>-</td>
</tr>
<tr>
<td>Perceived Behavioral Control</td>
<td>1.7(1.3)</td>
<td>-</td>
</tr>
<tr>
<td><strong>Study 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pill Testing/Checking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitudes</td>
<td>0.1(1.8)</td>
<td>1</td>
</tr>
<tr>
<td>Subjective Norms</td>
<td>-1.5(1.6)</td>
<td>-</td>
</tr>
<tr>
<td>Perceived Behavioral Control</td>
<td>-0.4(1.9)</td>
<td>-</td>
</tr>
<tr>
<td>Pre/Post-Loading</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitudes</td>
<td>0.1(1.8)</td>
<td>1</td>
</tr>
<tr>
<td>Subjective Norms</td>
<td>-0.9(1.8)</td>
<td>-</td>
</tr>
<tr>
<td>Perceived Behavioral Control</td>
<td>0.8(1.8)</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. ***p < .001, **p < .01, *p < .05;  
Abbreviations: ATT – Attitudes; SN – Subjective Norms; PBC – Perceived Behavioral Control
Table 5. Summary of Hierarchical Linear Regression Analyses Assessing Associations of Theory of Planned Behavior Variables and Intention to Implement Specific Ecstasy Harm Reduction Strategies in Study 1 at Time 1.

<table>
<thead>
<tr>
<th>DV</th>
<th>IV</th>
<th>β</th>
<th>S.E.</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention to Hydrate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Attitudes</td>
<td>.41</td>
<td>.08</td>
<td>5.09***</td>
</tr>
<tr>
<td></td>
<td>Subjective Norms</td>
<td>-.00</td>
<td>.04</td>
<td>-0.1</td>
</tr>
<tr>
<td></td>
<td>Perceived Behavioral Control</td>
<td>.18</td>
<td>.07</td>
<td>2.22*</td>
</tr>
<tr>
<td>Step 2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Attitudes</td>
<td>.40</td>
<td>.08</td>
<td>4.93***</td>
</tr>
<tr>
<td></td>
<td>Subjective Norms</td>
<td>-.01</td>
<td>.04</td>
<td>-.10</td>
</tr>
<tr>
<td></td>
<td>Perceived Behavioral Control</td>
<td>.18</td>
<td>.07</td>
<td>2.26*</td>
</tr>
<tr>
<td></td>
<td>Obsessive Passion</td>
<td>-.09</td>
<td>.05</td>
<td>-1.13</td>
</tr>
<tr>
<td></td>
<td>Harmonious Passion</td>
<td>.06</td>
<td>.03</td>
<td>.79</td>
</tr>
<tr>
<td>Intention to Pre/Post-load</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Attitudes</td>
<td>.75</td>
<td>.07</td>
<td>13.72***</td>
</tr>
<tr>
<td></td>
<td>Subjective Norms</td>
<td>.09</td>
<td>.06</td>
<td>1.68</td>
</tr>
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<td></td>
<td>Perceived Behavioral Control</td>
<td>.11</td>
<td>.09</td>
<td>1.96</td>
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<tr>
<td>Step 2&lt;sup&gt;d&lt;/sup&gt;</td>
<td>Attitudes</td>
<td>.76</td>
<td>.07</td>
<td>13.66***</td>
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<td></td>
<td>Subjective Norms</td>
<td>.09</td>
<td>.06</td>
<td>1.63</td>
</tr>
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<td></td>
<td>Perceived Behavioral Control</td>
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<td>.09</td>
<td>1.80</td>
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<td></td>
<td>Obsessive Passion</td>
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<td>.14</td>
<td>-1.05</td>
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<tr>
<td></td>
<td>Harmonious Passion</td>
<td>.01</td>
<td>.10</td>
<td>.18</td>
</tr>
</tbody>
</table>

Note. ***p < .001, **p < .01, p < .05;
<sup>a</sup>Intention to Hydrate Step 1 - Overall Model $F(3,132) = 12.6, p < .001, \Delta R^2 = .21$;
<sup>b</sup>Intention to Hydration Step 2 - Change in $R^2 = .01, ns.$;
<sup>c</sup>Intention to Pre/Post-load Step 1 - Overall Model $F(3,131) = 127.0, p < .001, \Delta R^2 = .74$;
<sup>d</sup>Intention to Pre/Post-load Step 2 – Change in $R^2 = .00, ns.$;
Abbreviations: DV – Dependent Variable; IV – Independent Variable;
Table 6. Summary of Hierarchical Linear Regression Analyses Assessing Associations of Theory of Planned Behavior Variables and Actual Use of Specific Ecstasy Harm Reduction Strategies in Study 1 at Time 2.

<table>
<thead>
<tr>
<th>DV</th>
<th>IV</th>
<th>β</th>
<th>S.E.</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hydration at T2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Intention</td>
<td>.03</td>
<td>3.78</td>
<td>.22</td>
</tr>
<tr>
<td></td>
<td>Perceived Behavioral Control</td>
<td>.02</td>
<td>3.32</td>
<td>.32</td>
</tr>
<tr>
<td>Step 2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Intention</td>
<td>-.02</td>
<td>3.83</td>
<td>-.17</td>
</tr>
<tr>
<td></td>
<td>Perceived Behavioral Control</td>
<td>-.04</td>
<td>3.43</td>
<td>-.41</td>
</tr>
<tr>
<td></td>
<td>Habit Strength</td>
<td>.20</td>
<td>6.65</td>
<td>2.13*</td>
</tr>
<tr>
<td><strong>Pre/Post-load at T2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Intention</td>
<td>.53</td>
<td>1.75</td>
<td>6.42***</td>
</tr>
<tr>
<td></td>
<td>Perceived Behavioral Control</td>
<td>.14</td>
<td>2.72</td>
<td>1.74</td>
</tr>
<tr>
<td>Step 2&lt;sup&gt;d&lt;/sup&gt;</td>
<td>Intention</td>
<td>.39</td>
<td>2.29</td>
<td>3.57**</td>
</tr>
<tr>
<td></td>
<td>Perceived Behavioral Control</td>
<td>.08</td>
<td>2.91</td>
<td>.86</td>
</tr>
<tr>
<td></td>
<td>Habit Strength</td>
<td>.23</td>
<td>4.50</td>
<td>2.00*</td>
</tr>
</tbody>
</table>

Note. ***p < .001, **p < .01, *p < .05;
<sup>a</sup> Hydration Step 1 - Overall Model F(2,129) = ns.;
<sup>b</sup> Hydration Step 2 - Change in $R^2 = .03$, p < .05;
<sup>c</sup> Pre/Post-load Step 1 - Overall Model F(2,132) = 41.7, p < .001, $\Delta R^2 = .38$;
<sup>d</sup> Pre/Post-load Step 2 – Change in $R^2 = .02$, p < .05;
Abbreviations: DV – Dependent Variable; IV – Independent Variable;
Table 7. Proportion of the Time Each Ecstasy-Related Harm Reduction Strategy was Employed When Participants Consumed Ecstasy During Study Participation (i.e., at Time 2) by Study Sample

<table>
<thead>
<tr>
<th>Strategy (in the order items were presented to participants)</th>
<th>Study 1 Sample (n=136)</th>
<th>Study 2 Sample (n=100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I drank water/electrolyte-rich fluids to replace the fluids lost while I was using MDMA/ecstasy.</td>
<td>0%  8%  92%  94(17)</td>
<td>3%  13%  84%  86(27)</td>
</tr>
<tr>
<td>2. I pre-loaded/post-loaded (by consuming herbal and/or pharmacological products) in an attempt to decrease physiological, psychological, or neurological effects of MDMA/ecstasy intoxication</td>
<td>38%  17%  45%  49(44)</td>
<td>60%  16%  24%  27(39)</td>
</tr>
<tr>
<td>3. I used a test kit to test for the presence of MDMA and adulterants or checked an online database or MDMA testing service</td>
<td>26%  9%  65%  61(45)</td>
<td>--  --  --  ------</td>
</tr>
<tr>
<td>4. I reduced how much MDMA/ecstasy I consumed during a session</td>
<td>29%  25%  46%  45(40)</td>
<td>43%  41%  16%  29(34)</td>
</tr>
<tr>
<td>5. I reduced how much I used substances other than MDMA/ecstasy during a session</td>
<td>18%  26%  57%  61(40)</td>
<td>39%  38%  22%  33(35)</td>
</tr>
<tr>
<td>6. I avoided frequent and heavy MDMA/ecstasy use</td>
<td>7%  21%  23%  78(33)</td>
<td>11%  39%  50%  59(34)</td>
</tr>
<tr>
<td>7. I urinated while intoxicated to avoid the build up of excess fluids I drank during the MDMA/ecstasy session</td>
<td>3%  14%  83%  87(26)</td>
<td>9%  21%  70%  71(35)</td>
</tr>
<tr>
<td>8. I took a chill-out break to control my body temperature</td>
<td>12%  16%  72%  73(36)</td>
<td>19%  27%  54%  60(39)</td>
</tr>
<tr>
<td>9. I took a chill-out break because of bad thoughts/emotions (e.g., found a quiet corner, talked to a trusted friend, listened to music, engaged in mindfulness exercises)</td>
<td>41%  15%  43%  30(40)</td>
<td>49%  36%  15%  23(30)</td>
</tr>
</tbody>
</table>
10. I bought MDMA/ecstasy from a trusted source | 2% 9% 90% 90(21) | 6% 26% 68% 73(31)
11. I got in a good mood prior to using MDMA/ecstasy (e.g., drank a small amount of wine, smoked a little bit of cannabis, rested, ate some food, listened to music) | 4% 10% 86% 86(27) | 5% 22% 73% 78(31)
12. I used MDMA/ecstasy only when in a good mood | 4% 12% 84% 85(27) | 3% 20% 77% 78(27)
13. I used MDMA/ecstasy only with friends | 6% 7% 87% 88(28) | 3% 8% 88% 88(25)
14. I used a new batch of MDMA/ecstasy only after I saw how others reacted to it | 40% 14% 46% 36(42) | 47% 28% 25% 31(36)
15. I did not get into cars with others who were intoxicated | 6% 15% 79% 83(30) | 16% 19% 65% 68(41)
16. I carried money for an emergency exit plan | 11% 10% 79% 80(34) | 20% 21% 60% 64(41)
17. I stretched muscles prior to consuming MDMA/ecstasy | 42% 17% 41% 27(38) | 70% 14% 16% 16(28)
18. I had a trusted friend I could go to for help if troubling events/thoughts occurred while I was on MDMA/ecstasy | 5% 5% 90% 90(26) | 9% 13% 77% 77(33)
19. I found a safe way to get home from where I had been using MDMA/ecstasy | 2% 5% 93% 92(20) | 4% 10% 86% 87(26)

Note. Numbers of participants by condition varied for the variables above; specifically, as participants declined to answer questions or quit the study prematurely the numbers of participants decreased.

a This variable was assessed using two items in Study 1 and was combined into one item in Study 2
Table 8. Summary of Hierarchical Linear Regression Analyses Assessing Associations of Theory of Planned Behavior Variables and Intention to Implement Specific Ecstasy Harm Reduction Strategies in Study 2 at Time 1.

<table>
<thead>
<tr>
<th>DV</th>
<th>IV</th>
<th>β</th>
<th>S.E.</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention to</td>
<td>Pre/Post-Load</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attitudes</td>
<td>.63</td>
<td>.11</td>
<td>7.21***</td>
</tr>
<tr>
<td></td>
<td>Subjective Norms</td>
<td>.09</td>
<td>.10</td>
<td>1.13</td>
</tr>
<tr>
<td></td>
<td>Perceived Behavioral Control</td>
<td>.15</td>
<td>.10</td>
<td>1.90</td>
</tr>
<tr>
<td>Intention to</td>
<td>Pill Test/Check</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attitudes</td>
<td>.25</td>
<td>.07</td>
<td>3.74***</td>
</tr>
<tr>
<td></td>
<td>Subjective Norms</td>
<td>.20</td>
<td>.10</td>
<td>2.63*</td>
</tr>
<tr>
<td></td>
<td>Perceived Behavioral Control</td>
<td>.52</td>
<td>.09</td>
<td>6.90***</td>
</tr>
</tbody>
</table>

Note. ***p < .001, **p < .01, *p < .05;
Intention to Pre/Post-load - Overall Model $F(3,96) = 56.1, p < .001, \Delta R^2 = .63$;
Intention to Pill Test/Check - Overall Model $F(3,96) = 93.2, p < .001, \Delta R^2 = .74$;
Abbreviations: DV – Dependent Variable; IV – Independent Variable;
Table 9. Summary of Hierarchical Linear Regression Analyses Assessing Associations of Theory of Planned Behavior Variables and Actual Use of Specific Ecstasy Harm Reduction Strategies in Study 2 at Time 2.

<table>
<thead>
<tr>
<th>DV</th>
<th>IV</th>
<th>β</th>
<th>S.E.</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre/Post-Load at T2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Intention</td>
<td>.45</td>
<td>.18</td>
<td>4.25***</td>
</tr>
<tr>
<td></td>
<td>Perceived Behavioral Control</td>
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<td>.22</td>
<td>1.46</td>
</tr>
<tr>
<td>Step 2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Intention</td>
<td>.13</td>
<td>.23</td>
<td>.95</td>
</tr>
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<td>Perceived Behavioral Control</td>
<td>.11</td>
<td>.21</td>
<td>1.08</td>
</tr>
<tr>
<td></td>
<td>Habit Strength</td>
<td>.45</td>
<td>.47</td>
<td>3.55**</td>
</tr>
<tr>
<td><strong>Pill Test/Check at T2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Intention</td>
<td>.36</td>
<td>.21</td>
<td>2.79**</td>
</tr>
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<td>Perceived Behavioral Control</td>
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<td>.22</td>
<td>-.15</td>
</tr>
<tr>
<td>Step 2&lt;sup&gt;d&lt;/sup&gt;</td>
<td>Intention</td>
<td>.29</td>
<td>.26</td>
<td>3.57**</td>
</tr>
<tr>
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<td>Perceived Behavioral Control</td>
<td>-.05</td>
<td>.24</td>
<td>.86</td>
</tr>
<tr>
<td></td>
<td>Habit Strength</td>
<td>.12</td>
<td>.51</td>
<td>.68</td>
</tr>
</tbody>
</table>

Note. ***p < .001, **p < .01, *p < .05;
<sup>a</sup> Pre/Post-load Step 1 - Overall Model F(2,97) = 21.2, p < .001, ΔR² = .29;
<sup>b</sup> Pre/Post-load Step 2 – Change in R² = .08, p < .01;
<sup>c</sup> Pill Test/Check Step 1 - Overall Model F(2,97) = 6.8, p < .01, ΔR² = .10;
<sup>d</sup> Pill Test/Check Step 2 – Change in R² = .00, ns.;
Abbreviations: DV – Dependent Variable; IV – Independent Variable;