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# **Has the Damage Been Done?**

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## **Examining the effects of Legal Synthetic Cannabis and Subsequent Effects of Prohibition on Synthetic Cannabis and Other Illicit Drug Use**

**A thesis presented in partial fulfilment of the requirements for the degree of**

**Master of Arts**

**in**

**Psychology**

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**New Zealand.**

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## Abstract

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Synthetic cannabinoids are chemically produced psychoactive substances, which are the most recent trend in designer drugs in New Zealand, and until the 8th of May 2014, were purchased freely in retail stores throughout New Zealand. Synthetic cannabis was marketed as a “safe” alternative to natural cannabis; however, its harm profile has been considered greater than other illicit substances. The objectives of the current study were to examine the prevalence of synthetic cannabis use and how previous users have responded to prohibition, and to assess the physiological and psychological harms associated with consumption. Participants ( $N = 94$ ) self-selected to participate in the study and were recruited from the community. They completed a computerised structured questionnaire that was designed for the study and incorporated two measures, the Severity of Dependence Scale and Brief Symptom Inventory. Results indicated that there was a significant decrease in the frequency of synthetic cannabis use following prohibition, although 40% of participants reported that they would continue to source synthetic cannabis illegally. While most participants reported fairly minor issues from use, some respondents noted more serious physiological and psychological problems, including coma, chest pain, breathlessness, seizures, and psychosis. Nearly one-quarter of participants (25%) reported that they required emergency care following synthetic cannabis use. High rates of dependency (72%) were detected in the sample and participants’ average psychological symptom profile was of a magnitude to be considered in the clinical range for psychological distress, although there were no significant differences in psychological well-being between current synthetic cannabis users and current non-drug users. Following synthetic cannabis prohibition, there was a significant decrease in illicit substance use across all drug categories and only a small number of participants (3%) had started using legal synthetic cannabis and progressed to using other illicit drugs. Of concern is that 32% of participants reported using methamphetamine and not using this substance in the past, with 14% of the sample going on to use methamphetamine regularly as an alternative to synthetic cannabis. Findings are interpreted in relation to previous research and limitations of the study are highlighted. Recommendations are made for future research, including examining the long-term effects and chronic exposure to the adverse toxicities of synthetic cannabis.

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*This project has been reviewed and approved by the Massey University Northern Region Human Ethics Committee.*

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## Introduction

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Over the last 10 years, we have witnessed an increase in legal psychoactive substances made available on the New Zealand market. Synthetic cannabinoids, most commonly referred to as synthetic cannabis, are chemically produced psychoactive substances, which are the most recent trend in designer drugs. Until the 8th of May 2014, synthetic cannabis was purchased freely in retail stores throughout New Zealand. It was marketed as an alternative to natural cannabis and claimed to provide the user with a "marijuana-like high". However, its harm profile has been considered greater than other illicit substances and approximately four times more potent than natural cannabis (Muller et al., 2010; Sperling, Kohrmann, Huttner, Kornhuber, & Maler, 2010).

Synthetic cannabis originally was intended for research purposes, to study marijuana's effects on the brain (Crews, 2013; Shipman, 2013). Researchers were unable to isolate the ameliorative properties of synthetic cannabinoids from the negative psychoactive effects and, as a result, they were not considered appropriate for human consumption (Stephens, 2011).

The regulation and legislation of psychoactive substances can have a significant role in shaping social values and norms surrounding drug use (Winsock & Ramsey, 2010). Having psychoactive substances legally available on the New Zealand market for a lengthy period can influence the drug use behaviour of younger persons and it is alarming that the previous legal status of synthetic cannabis has allowed the drug to be freely accessible and easy to source (EMCDDA, 2009; Vandrey, Dunn, Fry, & Girling, 2012). The New Zealand government has historically been slow to respond to prohibiting synthetic drugs. For example, the previous legal availability of benzylpiperazine (BZP) party pills and nitrous oxide (Campbell, Evans, Lloyed & Peck, 1973; Wilkins & Sweetsur, 2013).

Instead of taking a precautionary approach and placing a temporary ban on all synthetic cannabis products until conclusive evidence regarding safety was obtained, the New Zealand government made a decision to regulate the legal sale of synthetic cannabis until research on health risks became available and they restricted the sale of synthetic cannabis to persons aged 18 and over (New Zealand Legislation, 2014). It is unknown what drug-related harm has resulted from synthetic cannabis being legally accessible in New Zealand to users for an extended period.

Research on synthetic cannabis has primarily been limited to toxicology studies attempting to identify the chemical constituents of synthetic cannabis products, or focused on case presentations of patients experiencing adverse effects of synthetic cannabis in hospital emergency departments. Few human studies examining synthetic cannabinoids have been completed, and there is a lack of research conducted within the context of New Zealand. This may be due to reliance on overseas research, or because of synthetic cannabis being a relatively recent introduction to the New Zealand drug market. Research is also limited in that many studies have relied on anecdotal data rather than surveying individuals directly to examine patterns of use and associated harms. Before the government considers further changes to the legal status of synthetic cannabis, and what actions they may take against manufacturers and distributors of synthetic cannabis, it would be helpful for there to be an awareness and understanding of the harms associated with synthetic cannabis use.

The current study is intended to add to the existing body of literature on synthetic cannabis and has five objectives. The first objective is to identify patterns of synthetic cannabis use in a sample of synthetic cannabis users before and after prohibition to examine how users have responded to the synthetic cannabis ban. Synthetic cannabis was a rapidly emerging drug of abuse in New Zealand until May 8th, 2014 and whether prohibition has had a significant effect on patterns of use is still unknown. The current literature outlining the reported psychological and physiological effects of synthetic cannabis is fairly small. Therefore, the study is also an effort to measure the subjective harms associated with synthetic cannabis use over these two domains. From numerous reports in the media, it appears that the harm profile of synthetic cannabinoids is more severe than other illicit drugs; however, more research is required to qualify this claim (the European Monitoring Centre for Drugs and Drug Addiction [EMCDDA], 2009). The current study will also explore the psychological well-being of synthetic cannabis users and additionally, investigate whether some users display symptoms of dependency. Finally, the role that synthetic cannabis has played in the initiation of other illicit drug use will also be examined and whether easy access to legal psychoactive substances has increased a user's propensity to experiment with other 'harder' illicit drugs. With respect to this objective, a causal link between synthetic cannabis use and the use of other drugs will not be established due to the complexity of this relationship; however, sequences of progression will be examined.

In light of these objectives, the particular research questions that will be answered along with the relevant hypotheses are:

**1) What is the prevalence of synthetic cannabis use pre-and post-prohibition in a sample of individuals who have previously used synthetic cannabis?**

- 1.1 It was expected that there would be a significant decrease in the use of synthetic cannabis post- prohibition due to the regulatory approach to prohibition having been effective with other psychoactive substances previously available on the New Zealand market such as benzyloperazine (BZP) party pills and nitrous oxide (Wilkins & Sweetser, 2013; Winstock & Wilkins, 2011).
- 1.2 It was expected that there would still be a demand for synthetic cannabis and that it would still be easily accessible to users. However, it was considered that any reduction in use would be partially due to prohibition acting to reduce drug availability and access, and deterring individuals from use due to their desire to conform with the law and avoid the risk of punishment (Bewley-Taylor, Hallman, & Allen, 2009; Kleiman, 1992; MacCoun, 2010; Smith, 2002).
- 1.3 It was expected that participants would have a greater reliance on drug dealers to obtain synthetic cannabis following prohibition. Overseas research has confirmed that synthetic cannabis users have continued to seek out synthetic cannabis drugs from the black market after they have been made illegal and less accessible from the marketplace (Macgregor & Payne, 2013; Vandrey, Dunn, Fry, & Girling, 2012).

**2) What are the psychological and physiological effects of synthetic cannabis use?**

- 2.1 It was expected that most synthetic cannabis users would experience adverse physical harms, with some effects of intoxication being severe. This expectation is informed by a wealth of overseas literature on synthetic cannabis-related harm (Bleeker, 2013; Castellanos & Thornton, 2012; de Havenon et al., 2011; Grigoryev, Savchuk, Melnik, Moskaleva, Dzburko, & Ershov, 2011; Harris & Brown, 2013; Hoyte et al., 2012; Macgregor &

Payne, 2013; Missouri Department of Health, 2010; Huffington Post, 2-13; Muller, Sperling, Kohrmann, Huttner, Kornhayber, & Maler, 2010; New Zealand Drug Foundation, 2013; Robinson et al., 2010; Schneir & Baumbacher, 2012; Schneir, Cullen & Ly, 2010; Vardakou et al., 2010; Wells & Ott, 2011; Winstock & Barratt, 2013). Animal studies have also confirmed the adverse physiological effects of synthetic cannabis use (Chan, Hinds, Impey, & Storm, 1998; Vaillend, Billard, Claudepierre, Rendon, Dutar, & Ungerer, 1998).

2.2 It was expected that synthetic cannabis users would also experience harmful psychological effects due to severe psychological harms being documented in research both overseas and within New Zealand (Castellanos & Thornton, 2012; Grigoryev, Savchuk, Melnik, Moskaleva, Dzhurko, & Ershov, 2011; Missouri Department of Health, 2010; Muller, Sperling, Kohrmann, Huttner, Kornhayber, & Maler, 2010; New Zealand Drug Foundation, 2013; Schneir, Cullen & Ly, 2010; Wells & Ott, 2011). The New Zealand media have also covered the synthetic cannabis issue extensively and focused on the perceived psychological harms of synthetic cannabis use, including the common incidence of synthetic cannabis induced psychosis (Collins, 2014; McNeilly, 2013; Otago Daily Times, 2014; Roxburgh, 2014).

2.3 It was expected that a small number of participants would have required emergency care following synthetic cannabis use. It has been reported that synthetic cannabis use has put a strain on healthcare systems overseas and within New Zealand with many users presenting to hospitals for emergency treatment (Goodwin, 2012; Hu, Primack, Barnett, & Cook, 2011; National Cannabis Prevention and Information Centre, 2011). The outcomes of intoxication can be more severe than other psychoactive substances due to the high chemical concentration of synthetic cannabis (Gibson, Peterson, & Walsh, 2013; Uchiyama et al., 2010; Varkakou, Pistos, & Spiliopoulou, 2010).

### **3) What is the extent of dependency among synthetic cannabis users?**

3.1 It was expected that there would be a high level of dependency among participants who had previously used synthetic cannabis due to synthetic compounds being full neuroreceptor agonists that occupy the cannabinoid receptor with a stronger binding affinity than natural cannabis (Grigoryev, Savchuk, Melnik, Moskaleva, Dzhurko, & Ershov, 2011; Vardakou et al., 2010). Research in this area is sparse but there are some studies which have established that the chronic use of synthetic cannabis can lead to addiction syndrome (Stephens, 2011; Vandrey, Dunn, Fry, & Girling, 2012; Vardakou, Pistos, Spiiopoulou, 2010; Gonzalez, 2007; Winstock & Barratt, 2013; Zimmerman et al., 2009), and that tolerance to synthetic cannabinoids can develop quickly and increase the risk of addiction (Bergen, 2010; Costa et al., 1996). Since tolerance to synthetic cannabis has been found to develop relatively quickly, there is a greater likelihood that use will lead to drug dependence (Zimmermann et al., 2009). Mental health services within New Zealand have also reported that users are becoming dependent and building up a tolerance to synthetic cannabis more rapidly than other illicit drugs resulting in an increase in the use of their services (Devlin, 2013).

### **4) What is the psychological well-being of synthetic cannabis users and other drug user groups within the sample?**

4.1 It was expected that current synthetic cannabis users in the sample would have an elevated level of psychological distress than current non-drug users due to the effects of use being amplified as a result of the high chemical concentration of synthetic cannabis products (Gibson, Peterson, & Walsh, 2013; Uchiyama et al., 2010). Some synthetic cannabis products are reportedly 100 times more potent than natural cannabis (Uchiyama et al., 2010; Varkakou, Pistos, & Spiliopoulou, 2010).

4.2 It was anticipated that the problematic areas of symptomology for synthetic cannabis users would be anxiety, depression, paranoia and psychosis, which are common psychological symptoms associated with substance use (Castellanos & Thornton, 2012; Wells & Ott, 2011).

4.3 It was also expected that there would be some participants in the sample who experienced psychotic symptomology relating to their synthetic cannabis use and that current synthetic cannabis users would have a greater incidence of psychotic symptoms than current non-drug users. Overseas research has documented the potential for synthetic cannabis to trigger psychosis among users (Brakoulis, 2012; Cyril D'Souza, Sewell, & Ranganathan, 2009; McGrath, Wellman, Scott et al., 2010; Muller, Sperling, Kohrmann, Huttner, Kornhuber, Maler, 2010). The New Zealand media has also covered the synthetic cannabis issue extensively with a focus on users experiencing drug-induced psychosis (Collins, 2014; Every-Palmer, 2010; Muller et al., 2010). Further to this, mental health services within New Zealand have reported an increase in the number of patients using their services because of synthetic cannabis induced psychosis and other mental health symptoms that are difficult to treat (Devlin, 2013).

**5) Is there an association between synthetic cannabis use and the subsequent use of other illicit substances?**

5.1 It was expected that there would be a small number of participants who have experimented with synthetic cannabis and progressed to harder drug use, but that most individuals in the sample are poly drug users or have experimented with other illicit drugs prior to using synthetic cannabis. This assumption is due to there being no conclusive evidence supporting the gateway effects of synthetic cannabis and while representatives of the synthetic cannabis industry argue that they provide recreational drug users with an option to gateway out of illicit drug use and dependence (Lindigkeit et al., 2009), opponents argue that there is a relationship between synthetic cannabis use and the subsequent initiation of other illicit drug use (Bowden, 2007). Research has instead provided more support that most synthetic cannabis users are poly-drug users (Winstock and Barratt, 2013).

It is hoped that the results of the study will be reinforcing to the decision that the New Zealand government has made about prohibiting psychoactive substances. In addition, it may be of use to other countries that are experiencing an increase in synthetic cannabis

use and are looking to develop regulatory laws prohibiting use. The study might be of interest to countries that have chosen to prohibit synthetic cannabis, but are examining the consequences of introducing regulations that are more liberal. Findings may also be helpful to healthcare providers to help them better understand synthetic cannabis and its effects. Despite synthetic cannabis now being illegal and less accessible to the public, as with all illicit substances, ongoing research is required to monitor harms associated with use.

## **Chapter 1: Literature Review**

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The following literature review is a summation of the research available that is relevant to the topic of synthetic cannabinoids. The purpose of the literature review is to look at the available research on the inception, toxicology, and legal status of synthetic cannabis in New Zealand and overseas; examine the effects of use, including its addictive potential and gateway effects of use; and consider the available literature on the effectiveness of drug prohibition.

### **The Inception of Synthetic Cannabinoids**

Synthetic cannabis was originally intended for research purposes and was not tested on humans. Synthetic compounds were developed in 1955 by researcher John Huffman, an organic chemist at Clemson University, to study marijuana's effects on the brain (Shipman, 2013). More specifically, Huffman was funded by the National Institute of Drug Abuse to study the development of cannabinoid compounds to assist with research in the area of multiple sclerosis, Acquired Immune Deficiency Syndrome (AIDS), and chemotherapy. Some of the chemicals used in synthetic cannabis were also developed for other purposes such as fertilisers, analgesics, painkillers, and cancer treatments (Haiken, 2013). Researchers were unable to isolate the ameliorative properties of synthetic cannabinoids from the negative psychoactive effects. Therefore, they were not considered appropriate for human consumption (Stephens, 2011). Huffman's research was published and illustrated the experimental method and ingredients used to create the cannabis-like high. This was witnessed by various other parties, replicated, and made popular among children and adolescent consumers. Huffman has since publically declared his concern regarding the human consumption of synthetic cannabis and warned that it may lead to serious and possibly irreversible neuropsychological damage (McNeilly, 2011).

There are three major categories of synthetic cannabis: classic cannabinoids, cyclohexylphenols, and aminoalkylindoles (Crews, 2013; Gay, 2010). Classic cannabinoids were developed in the 1980s and did not appear to be highly prevalent on the market as they are difficult to synthesise. Cyclohexylphenols were the second category of synthetic cannabinoids to be manufactured and were initially developed as



analgesic drugs. Authorities acted promptly to control these compounds but they were soon replaced by new designer cannabinoids of the aminoalkylindole variety. Aminoalkylindoles were the most prevalent synthetic cannabinoids used in products and are synthesised in a simple two-step process during production. There are a large number of chemicals in synthetic cannabis products that have not been formally identified. However, products typically contain 1-3 grams of dried plant matter, which is soaked in a chemical cannabinoid solution. The amount of drug in each packaged product varies from 0.2 % to 3% (Stafford, 2009). Synthetic cannabinoid products have been sold under hundreds of brand names with Spice being the most common product in Europe, Kronic and K2 in Australia and New Zealand, and K2 in the United States (Winstock & Barratt, 2013).

Some extracts from synthetic cannabis products have been found to have complex matrices and the addition of other non-psychoactive substances such as vitamin E, which is used to mask other active components (EMCDDA, 2009). Therefore, the compounds of synthetic cannabis products can be difficult to detect and will continue to be, which is problematic given that synthetic cannabis products are now illegal. The considerable intra- and inter- batch variability among synthetic cannabinoid products has also made the clinical effects of consumption unpredictable (EMCDDA, 2009).

### **Synthetic Cannabinoid Pharmacology and Toxicology**

Little is known about the toxicology and pharmacokinetics of synthetic cannabinoids, and few human studies have been conducted in this area. Cannabinoid compounds in synthetic cannabis products are believed to act on the same cell receptors in the brain as tetrahydrocannabinol (THC), which is the active compound in natural cannabis (Gibson, Peterson, & Walsh, 2013). The concerning difference is that most synthetic cannabis compounds are full agonists and occupy the cannabinoid receptor with a stronger binding affinity than natural cannabis (Grigoryev, Savchuk, Melnik, Moskaleva, Dzhurko, & Ershov, 2011). In contrast, THC in cannabis is a partial agonist and, therefore, has a less acute effect than synthetic cannabis.

It was in the 1980s that the two main cannabinoid receptors, CB1 and CB2, were discovered. These receptors are also implicated in THC intoxication, and this explains why synthetic cannabis produces similar effects to natural cannabis (Stephens, 2011).

CB1 receptors are located predominantly in the central nervous system on the central and peripheral nerve terminals. They are densely concentrated in the cortical and subcortical regions of the brain and primarily in the cephalus areas such as the hippocampus, basal ganglia, cerebellum, cortex, and amygdala (Atwood, Huffman, Straiker, & Mackie, 2010; Pertwee, 1999). CB1 receptors are also concentrated in the spinal cord and peripheral nervous system. They are responsible for the main psychoactive effects following synthetic cannabis intoxication and influence movement and posture, pain in the peripheral organs and tissues, elevate mood and emotion, and affect cardiovascular and gastrointestinal functions throughout the central nervous system (Ashton, Wright, McPartland, & Tyndall, 2008; McCarberg & Barkin, 2007). Examples of psychoactive effects in CB1 receptors include analgesia induction, decreased motor function, memory impairment, altered sense of time, and auditory and visual cognitive disruption (Pertwee, 1999; Wintermeyer, Moller, Thevis et al., 2010). CB2 receptors predominantly are located in the immune system, spleen, tonsils, and lymph nodes (EMCDDA, 2009; Huffman & Marriott, 2008; Stephens, 2011). This can have implications for neuroinflammation and pain, and the activation of the CB2 receptors can produce anti-inflammatory and immune modulatory effects both centrally and peripherally (Pertwee, 2006).

In terms of the neurotransmitters implicated in intoxication, synthetic cannabis has been demonstrated to regulate the release of inhibitory and excitatory neurotransmitters such as serotonin and dopamine. These neurotransmitters are influential in facilitating both the positive and negative effects of synthetic cannabis intoxication and psychoactive drug use in general (Robinson, Goonawardena, Pertwee, Hampson, Platt, & Riedel, 2010).

### **Factors Contributing to Synthetic Cannabis Use**

Like many designer drugs, synthetic cannabis is attractive to consumers for a variety of reasons and the main factors that appear to attract children and adolescents to synthetic cannabis have been affordability and accessibility (EMCDDA, 2009). Synthetic cannabis marketing also has previously targeted youth who have a desire to experiment with drugs, but fear the consequences associated with illegal drug use (Stephens, 2011). The packaging of the product has been alluring, and wrapping is mostly colourful with displays of figurative language. Consumers have been able to purchase products freely

through the Internet, which has ensured user anonymity, and it is noted that many synthetic cannabis products have been sold without age restrictions in a large number of overseas countries. A major misconception among users was that since the products were legal, they were safe. Further supporting this belief was that products often were falsely described on packet branding as “herbal” and “natural”. Recreational drug users appreciated avoiding the illegal drug market by using synthetic cannabis, and they were able to purchase their products from a "safe" place in the community. Other reasons for synthetic cannabis use were curiosity (78%), positive effects (58%), relaxation (48%), and to avoid drug detection (30%; Vandrey, Dunn, Fry, & Girling, 2012).

The legality of synthetic cannabis has been a major influence in decision-making around drug-use choices for many individuals who have previously used natural cannabis. In a study by Stephens (2011), 90% of participants preferred natural cannabis rather than synthetic cannabis. However, due to natural cannabis being a prohibited substance, users preferred legal synthetic products because they were motivated to conform to the law. Respondents advised that they did not prefer the negative side effects associated with synthetic cannabis use compared to the side effects of natural cannabis. It has also been noted in other research by Winstock and Barrett (2013) that the effects of synthetic cannabis were reported by users as less attractive and significantly shorter in effect duration compared to natural cannabis. In the same study, 58% of respondents chose to use synthetic products instead of natural cannabis due to the desired effect, 19% for ease of availability, 15% due to synthetic cannabis not being easily detected in drug screening, and 9% because of cost.

Despite synthetic cannabis now being prohibited in many countries, individuals continue to use synthetic cannabis instead of natural cannabis so they are able to pass drug screening tests within employment and correctional services (EMCDDA, 2009). It is still the case that synthetic cannabinoids are not identifiable through conventional urine and blood toxicology drug testing methods. Although it is possible to trace synthetic cannabis metabolites in human urine, there is not a specific test for synthetic cannabis and the existing drug screening for natural cannabis will not produce a positive test result for synthetic cannabis. For this reason, synthetic cannabis is a real issue within the prison, probation, and mental health services (Devlin, 2013; Every-Palmer, 2011; Macgregor & Payne, 2013).

### **Trends in Legal Highs in New Zealand: The BZP Phenomenon**

Attempts to develop legal alternatives to illicit drugs is not a new phenomenon. To examine and predict the harms associated with synthetic cannabis being freely available on the New Zealand market, and the subsequent effects of prohibition, it is helpful to look at other psychoactive substances that have previously been available on the designer drug market. Designer drugs containing fentanyl appeared on the international drug market in the early 1980s, followed by substituted phenethylamines in the late 1980s and tryptamines in the 1990s (Griffiths, Sedefov, Gallegos, & Lopez, 2010). Since early 2000, piperazines and cathinone derivatives were the compounds exploited for legal psychoactive substance use. This illustrates how the designer drug market has evolved over time, and that psychoactive substances have been an ongoing challenge within New Zealand.

Before the introduction of synthetic cannabis, the most recent psychoactive substance available on the New Zealand market was benzylpiperazine (BZP) party pills. The introduction of BZP party pills led to an increase in mass designer drug production and psychoactive substance use in New Zealand (Sheridan & Butler, 2010). BZP, a stimulant drug that produces similar effects to amphetamines, gained popularity in New Zealand and established its industry in the early to mid-2000s (Campbell, Evans, Lloyed & Peck, 1973; Wilkins & Sweetsur, 2013). BZP party pill manufacturers targeted the youth market; 18 to 24-year-olds were found to be the heaviest users of their products (Wilkins, Girling, Sweetsur, Huckle, & Haukau, 2006). Like synthetic cannabis, BZP featured heavily in the political and media arenas and created much public debate regarding its legal status and the harms associated with use (Rankin, 2006; Reiber, 2005).

Many BZP party pill users perceived BZP products to be “safe” since they were legally sanctioned (Sheridan & Butler, 2010). Other users expressed that they favoured not having to have contact with “dealers” or break the law to access and use psychoactive substances. Consumers also liked that the legal status of BZP party pills meant that their drugs were easily accessible and use was perceived as “socially acceptable”. Overall, the legal status of BZP party pills conveyed mixed messages to consumers because it influenced the perception that the products were safe and of good quality. This often led

to higher than recommended doses being consumed and increased drug-related harm (Butler & Sheridan, 2007).

Similar to the harm reduction argument employed by synthetic cannabis industry representatives, manufacturers and representatives of the BZP party pill industry publicly defended their product and claimed that BZP party pills reduced substance-related harm by means of reducing illicit substance use (Bowden, 2007). Supporters labelled the BZP party pill industry as the ultimate harm reduction tool for recreational drug users due to being able to provide a safer and legal alternative to drug use. They argued that prohibition would result in an increase in illicit drug use, especially methamphetamine, and create a black market for BZP products (Barnett, 2007).

Following research conducted on the harms associated with BZP party pill use, the only harm that users appeared to be protected from was the harm of criminal prosecution. Butler and Sheridan (2007) investigated the negative effects of BZP party pill use among youth in New Zealand and found that adverse effects were predominantly physical, including nausea, headaches, vomiting, dehydration, racing heart, tremors, loss of appetite, inability to urinate, impaired sexual performance, stomach pains, eye pain, and teeth grinding. A number of respondents also suffered negative psychological effects including feelings of tension, agitation, anxiety, and paranoia. Negative emotional and psychological effects such as depression, tension, and anxiety were still evident in users following the cessation of use.

Mixed evidence exists on the gateway effects of BZP party pills. Wilkins, Girling, Sweetsur, Huckle, and Huakau (2006) found that one in seven participants (14%) reported that they had started using BZP party pills and then progressed to illegal drug use. Four of 10 users (42%) reported that they used both illicit drugs and BZP party pills with no change in level of illegal drug use. Another group of respondents (44%) indicated that they had previously used illicit drugs but transitioned to mostly using BZP party pills. These findings indicated that while BZP party pill use served as a gateway to other illegal drug use, for an even larger proportion of users in the study, BZP party pills were used as an alternative to other illegal drugs. A similar finding was concluded in a large 2006 New Zealand household survey where 44% of BZP party pill users indicated that they had used illegal drugs but were now mostly using BZP pills as

a substitute (Cohen & Butler, 2011). Conversely, Wilkins et al. (2006) found that one in seven participants in their study had started using BZP party pills but now mostly use illicit drugs, which further supported the concern that BZP party pills had the potential to act as a gateway drug to other illicit drug use. It was apparent in the study that many BZP party pill users were poly-drug users. Other research has echoed these findings and confirmed that BZP party pill users were generally poly-drug users who consumed other illegal drugs recreationally and equally as often as those illicit drug users who did not use BZP party pills (Hammond, 2008). BZP party pills often were used in addition to other illicit drugs to enhance the effects of their drug of choice. Increasing the number of substances used by an individual escalates the risk of substance-related harm. Therefore, this did not support the theory of BZP manufacturers and distributors of BZP, that the drug was an effective harm reduction tool. The consensus of the available research is that BZP party pill consumers were a group of poly-drug users and high-risk drug users.

Since BZP party pill use was not found to reduce substance-related harm (Wilkins, Girling, Sweetsur, Huckle, & Haukai, 2006), it was considered that the prohibition of the drug in itself would reduce substance-related harm by reducing the number of psychoactive substances legally available to the public. Wilkins and Sweetsur (2013) examined the effects of prohibition on the prevalence of BZP and replacement of BZP with other drugs. The study was based on a New Zealand population survey conducted in 2006, when BZP party pills were legally available, and then repeated 12 months following prohibition in 2009. The study found that the prevalence of BZP party pill use fell from 15% in 2006 to 3% in 2009, which suggests that prohibition contributed to a decline in BZP use. The most common reasons for stopping BZP use were that it was illegal (43%), that users were just experimenting and did not desire further use (26%), that users did not know where to access the drug now that it was illegal (24%), and due to negative hangover effects (18%). BZP party pill use declined among frequent methamphetamine users from 32% in 2006 to 7% in 2010, and methamphetamine was reported by the majority of participants to be an unpopular alternative to BZP party pills following prohibition. Interestingly, the majority of participants advised that they would attempt to access BZP following prohibition. Hence, there was likely a demand for a black market selling the drug. Following the ban of BZP party pills, it was documented

that retailers started selling BZP-free party pills, which reportedly caused further substance-related harm (Chalmers & Nichols, 2008).

New Zealand was slow to respond to prohibiting BZP. The United States was one of the first countries to ban BZP in 2002, followed by Australia and Japan in 2006 (Cohen & Butler, 2011). Similar to the pattern of legislation regulating synthetic cannabis, BZP was reclassified as a 'restricted substance' in 2005 in New Zealand where it became illegal to sell BZP party pills to individuals younger than 18 years of age. The advertising of BZP products was also prohibited. It was not until 2008 that BZP was made illegal following a review of the available evidence; six years after the United States had identified the harmful effects of BZP and implemented legislation. BZP was re-classified in New Zealand as a Class C drug under the Misuse of Drugs Act (1975), making it illegal to sell, export, import, manufacture, supply, or consume psychoactive substances containing BZP.

### **The Legislation and Control of Synthetic Cannabinoids**

The New Zealand media have covered the synthetic cannabis issue extensively with the main political and public debate centring on the legality of synthetic cannabis. Media articles also have focused on the perceived harms of synthetic cannabis use and stories that have attracted the most attention were human-interest stories where individuals had suffered severe side effects following use. Some topical headlines of news articles in New Zealand included 'K2 may have contributed to death, coroner says'; 'Synthetic cannabis blamed for threats to kill'; and 'Seizures, vomiting: addict tells of long struggle with legal highs' (McNeilly, 2013; Otago Daily Times, 2014; Roxburgh, 2014). In particular, there was a focus on users presenting with drug-induced psychosis (Collins, 2014).

Synthetic cannabis was originally topical overseas, and the first laws banning synthetic cannabis eventuated in Western Europe in 2009 (Gay, 2010). Following this, many parts of the United States banned synthetic cannabis products in 2010. At a federal level, Barack Obama signed the Synthetic Drug Abuse Prevention Act in July 2012, which banned the compounds commonly found in synthetic cannabis (University of Vermont, 2010). Australia has both state-level laws and national laws on synthetic cannabis regulation, and as brands are identified as potentially harmful, they are added to the list



of banned products. In the United Kingdom, the government enacted a blanket ban, which covers all cannabinomimetic compounds. It is evident that there has not been a unified international response to the prohibition of synthetic cannabis but following the lead of America, many leading countries have enacted legislation that bans the sale and possession of synthetic cannabis. Current debate exists around this ban since it undermines some of the chemicals that are commonly used for medicinal purposes, and restricts the possibility of synthetic cannabis use for therapeutic purposes. Some countries, such as Finland, allow some synthetic cannabis products to be classified as medicine whereby users require a prescription to access the drug (University of Vermont, 2010).

New Zealand's response to banning synthetic cannabis was slow compared to other parts of the world, despite the rapid increase in use and problems identified at an early stage. The high potency of synthetic cannabis and unknown toxicology became an increasing concern to policymakers, especially due to an elevated awareness that younger demographics were experimenting with these psychoactive substances. An interim measure was imposed in October 2012 where 28 synthetic cannabinoids were subject to temporary class drug notices (New Zealand Drug Foundation, 2013). This measure resulted in the removal of over 50 synthetic cannabis products from market shelves. Features of a new regime passed in 2013, which still allowed many synthetic cannabis products to be legal, but a minimum purchasing age of 18 was enacted and it became illegal to advertise synthetic cannabis products (MedSafe, 2013).

The Psychoactive Substances Act (2013) came into force on July 18th, 2013, which regulated the manufacture, supply, and importation of psychoactive substances (New Zealand Legislation, 2014). The intention of the act was to reduce harm associated with psychoactive substance use and with this act came the establishment of the Psychoactive Substances Regulatory Authority, which was established within the Ministry of Health (Ministry of Health, 2015). Their primary role was to monitor compliance with the Act and ensure that products containing psychoactive substances met the safety requirements before being distributed in New Zealand. They were also responsible for licensing importers, manufacturers, researchers, retailers and wholesalers. Even at this stage, there were 148 retailers with interim retail licenses legally approved to sell psychoactive substances in New Zealand and products



continued to sell in adult stores, novelty stores, dairies, and other retail outlets (Ministry of Health, 2014). As more synthetic cannabis products were subject to prohibition, other designer drugs using synthetic cannabinoids were manufactured with new brands often being assessed as more harmful than the prohibited products (EMCDDA. 2009).

Legislators became aware of the dynamic relationship between prohibition and the development of new substitute synthetic cannabis products and the Psychoactive Substances Amendment Act came into effect on May 8th, 2014. This change was a response to the government's decision to introduce legislation ending interim product approvals and licensing to retailers and wholesalers. All licenses to sell synthetic cannabis were removed immediately, and the Psychoactive Substances Regulatory Authority issued an urgent recall on all products that had previously been granted product approval. All psychoactive substances have been removed from the market until further testing confirms that they present a low risk of harm to consumers (Ministry of Health, 2015). The only license that has not been revoked is the approval to import synthetic cannabis for research purposes. Manufacturers will now be required to apply for full product licenses and submit data that proves the safety of their product if they wish to sell their synthetic cannabis product on the New Zealand market.

Following the prohibition of synthetic cannabis in New Zealand, individuals with remaining synthetic cannabis products were instructed to return them to retailers or dispose of the substances safely. Police were given the power to seize any products where retailers were believed to be noncompliant with the recall requirements. It is now a criminal offence to possess an unapproved synthetic cannabis product and the penalty for being in possession of synthetic cannabis is a fine of up to \$500 (New Zealand Legislation, 2014). Enforcement of the new legislation around synthetic cannabis is now being monitored by the police and public health officers. The customs department is also responsible for monitoring the importation of products into New Zealand.

### **Future Sale of Synthetic Cannabis**

The government is continuing to develop regulations associated with synthetic cannabis, and further consideration will be given to the process of how synthetic cannabis products will be approved for sale. It has been anticipated that product approval applications could take up to 24 months to process (Murky future for legal highs, 2014),

and that these applications will require a comprehensive set of robust data on the safety and quality of a product, as well as a plan that outlines the products assessed level of harm. The New Zealand Ministry of Health (2015) have advised that the Psychoactive Substances Regulatory Authority will undertake assessments to approve or decline an application, which is based on a risk of harm score. Only those assessments that demonstrate a 'low risk of harm' will be granted approval under the Psychoactive Substances Amendment Act (2014) to be available in New Zealand. The risk assessment system used to score the harm of psychoactive substances is the Freiburg scoring framework, and this system has been adopted to allow the Psychoactive Substances Regulatory Authority to undertake risk assessments on all product applications. The framework is used for assessing other medicines and chemicals, and it takes a precautionary approach to decision-making. Products with a score of two or greater will be assessed as being more than a low risk of harm to users and will not be granted an interim license. If a product is approved for sale, the applicant will be subject to conditions within their license to undertake regular safety monitoring.

Despite there now being legislation in New Zealand that bans the sale and supply of synthetic cannabis, manufacturers are sophisticated with their approach to dispersing synthetic cannabis and use innocuous labels on their products such as "not for human consumption" or "incense" in order to prevent them from facing legal action (EMCDDA, 2009). The Internet has also become a source of unregulated drugs, which has major public health and legal implications (Macgregor & Payne, 2013). An ongoing issue is that due to there being hundreds of known synthetic cannabinoids in existence, this makes it more difficult to conduct toxicological identification and risk assessment of synthetic cannabis products (EMCDDA, 2009).

### **Prevalence and Patterns of Use of Synthetic Cannabis**

There are no demographic or prevalence statistics regarding synthetic cannabis use in New Zealand. New Zealand has an estimated 15% prevalence rate of natural cannabis users in the general population (Palmer, 2011). Therefore, due to the large number of natural cannabis users, it is assumed that New Zealand would be susceptible to having a larger population of synthetic cannabis users. Research conducted overseas has revealed that synthetic cannabis users appear to be a heterogeneous group (EMCDDA, 2009; Vardakou et al., 2010), and a study conducted by EMCDDA (2009) concluded that

synthetic cannabis products were abused more by teenagers and young people. This is concerning given that this demographic are particularly vulnerable to the harms associated with drug use and are also more likely to be influenced by other substance users. Synthetic cannabis as a drug of choice has also been found to be more popular among college students than any other substance that is typically abused by adolescents and young adults (Hu, Primack, Barnett, & Cook, 2011).

### **Adverse Health Risks Associated with Synthetic Cannabinoid Use**

Synthetic cannabis is similar to other illicit substances in that it is associated with the same risks of harm although it has been argued that the harm profile of synthetic cannabis is greater than that of natural cannabis. There appears to be some overlap between the adverse effects of natural cannabis and synthetic cannabis, although the prevalence and severity of harm appears to be higher in individuals who use synthetic cannabis (Gibson, Peterson, & Walsh, 2013; Uchiyama et al., 2010). The psychoactive effects of synthetic cannabis are likely amplified due to the high chemical concentration of synthetic cannabis products. Clinical trials using mice have found that the potency of synthetic cannabinoid CP 47, 497 is approximately 5 to 10 times greater than the strength of natural cannabis. Even more concerning is that cannabinoid HU-210 is approximately 100 times more potent than natural cannabis (Uchiyama et al., 2010; Varkakou, Pistos, & Spiliopoulou, 2010).

The effects and duration of synthetic cannabis intoxication vary among users. A comprehensive study of 29 patients who presented to an emergency department in Germany revealed that their toxicity symptoms after using synthetic cannabis lasted from 4 to 14 hours (Hermanns-Clausen, Kneisel, Szabo, & Auwarter, 2013). They noted that the effects of use could be unpredictable due to many synthetic products being mixed with different chemicals.

Research documenting the positive effects of synthetic cannabis intoxication is sparse but the desirable effects that have been reported following consumption are elevated mood, euphoria, disconnection from thoughts, relaxation, and sensory perception enhancements (Vandrey, Dunn, Fry & Girling, 2012). It appears that the negative physical and psychological effects associated with synthetic cannabis use that

accompany the short-term positive effects are far more prevalent in research and media articles regarding synthetic cannabis.

The physical harms associated with synthetic cannabinoid intoxication are tachycardia, vomiting, seizures, severe memory impairment, kidney problems, extremely elevated heart rate, increased blood pressure, tremors, and coma (Castellanos & Thornton, 2012; Grigoryev, Savchuk, Melnik, Moskaleva, Dzhurko, & Ershov, 2011; Missouri Department of Health, 2010; Muller, Sperling, Kohrmann, Huttner, Kornhayber, & Maler, 2010; New Zealand Drug Foundation, 2013; Robinson et al., 2010; Schneir, Cullen & Ly, 2010; Wells & Ott, 2011). Synthetic cannabinoids may also have carcinogenic properties and contain toxic metabolites that cause cancers (Vardakou et al., 2010). Synthetic cannabis was associated with more negative physical effects and hangover effects and due to this, it was found that 93% of users in a large online survey of 14,966 participants preferred natural cannabis (Winstock & Barratt, 2013).

Harris and Brown (2013) conducted a three-month case review examining individuals who had presented to an emergency department following synthetic cannabinoid use. This review found that two individuals were admitted for seizures, five patients presented with tachycardia, and two patients experienced hallucinations. The clinical presentation of the patients presenting to the emergency department was variable but in most cases patients experienced tachycardia and altered mental status. Other symptoms observed were central nervous system depression, psychosis, and anxiety. There are no confirmed deaths noted from direct synthetic cannabis exposure although the dangerous behaviour associated with use and hallucinations can put users at a greater risk of harm or death.

Of concern is that there has been a high rate (18%) of seizures among synthetic cannabis users in Australia (Bleeker, 2013), and it has been concluded that synthetic cannabis places users at a greater risk of experiencing a seizure than natural cannabis does (de Havenon et al., 2011; Hoyte et al., 2012; Schneir & Baumbacher, 2012). This risk potential may be due to natural cannabis being an anticonvulsant; synthetic cannabis does not contain these chemical properties.

In human subjects, synthetic cannabis intoxication has been found to produce a range of harmful psychological effects including psychosis, severe agitation, anxiety and panic, paranoia, delusions, violence, and hallucinations (Castellanos & Thornton, 2012; Grigoryev, Savchuk, Melnik, Moskaleva, Dzhurko, & Ershov, 2011; New Zealand Drug Foundation, 2013; Wells & Ott, 2011). In some cases, these adverse experiences have resulted in suicide attempts (Missouri Department of Health, 2010; Muller, Sperling, Kohrmann, Huttner, Kornhayber, & Maler, 2010; Schneir, Cullen & Ly, 2010). Due to synthetic cannabinoids being full rather than partial neuroreceptor agonists, there is an increased risk of psychiatric complications (Vardakou et al., 2010).

An adverse effect of synthetic cannabis use that has featured heavily in the media and research literature is the potential for synthetic cannabis to cause psychosis (Every-Palmer, 2010; Muller et al., 2010). Research has supported that synthetic cannabinoid intoxication is associated with acute psychosis and that synthetic cannabis use can either trigger chronic psychotic disorder among vulnerable individuals, or worsen psychosis in previously stable individuals (Muller, Sperling, Kohrmann, Huttner, Kornhuber, Maler, 2010). Individuals who start using synthetic cannabis at an early age may also have an increased risk of onset of psychotic disorder (Cyril D'Souza, Sewell, & Ranganathan, 2009; McGrath, Wellman, Scott et al., 2010). An Australian study based in a Sydney hospital has concluded that synthetic cannabis use is linked to psychosis with an elevated level of agitation compared to individuals who present with psychosis triggered by natural cannabis consumption (Brakoulis, 2012). Of significance is that synthetic cannabis products do not contain cannabidiol, which is a major CB1 and CB2 antagonist that has antipsychotic properties (Leweke et al., 2009; Huffman, Thompson, Wiley, & Martin, 2008). Natural cannabis does contain cannabidiol and, therefore, affords cannabis users with some inherent protection against psychotic symptoms and cognitive impairment.

In an explorative study, Every-Palmer (2011) examined the relationship between synthetic cannabis use and psychotic symptoms whereby the researcher interviewed 15 participants with mental illness at a New Zealand-based forensic and rehabilitation service. Anxiety and psychotic symptoms were common in patients following synthetic cannabis use, and 69% of patients experienced symptoms consistent with psychotic relapse after smoking synthetic cannabinoid JWH-018. Three respondents reported

developing a tolerance to synthetic cannabis; however, there were no reports of withdrawal symptoms. Eighty-seven percent of respondents admitted to using synthetic cannabis over the last year, and five patients reported a high level of use daily or almost daily. Five patients reported that they experienced psychotic relapse within 24 hours of smoking synthetic cannabis and that their episode lasted 2 days to several weeks. Of concern, is that most of the patients assumed that synthetic cannabis products were "herbal", "natural", and consequently "safe". This is particularly disconcerting given that substance abuse is a predictor of an increased risk of violence and criminality among the mentally disordered (Soyka, 2000).

Consideration must be given to the long-term effects and chronic exposure to the adverse toxicities of synthetic cannabis. However, little research is available in this area. What we have learned is that chronic synthetic cannabis exposure has been found to produce cardiovascular and nervous system complications (EMCDDA, 2009). The long-term effects of dependence and withdrawal also have been noted after prolonged use (Every-Palmer, 2011).

Since synthetic cannabis exerts similar effects on the CB1 and CB2 receptors as natural cannabis, the long-term effects of natural cannabis use may be able to provide us with some indication of the long-term effects of chronic synthetic cannabis use. Research has documented that natural cannabis users are twice as likely to be diagnosed with schizophrenia and schizophreniform disorder than nonusers are (Wells & Ott, 2011). Chronic natural cannabis users who start using before the age of 17 can suffer from brain damage that may result in lower personal attainment and quality of life (Cataldie, 2013). Long-term users have also been found to have lower brain volumes with structural differences in the hippocampus and amygdala, which are responsible for memory, emotion, and fear. However, it is likely that the adverse long-term effects of synthetic cannabis use are more severe due to its pronounced effects on the brain, and chronic synthetic cannabis use is more likely to lead to neuronal and cognitive impairment that may result in long-term persistent difficulties. Youths who abuse synthetic cannabis from an early age are likely more vulnerable to its harmful effects since their brain is developing, and this may have serious consequences for their academic, physical, emotional, and social development.

A rare animal study examined the effect of synthetic cannabis on the brain whereby rats were treated with a synthetic cannabis compound (Vaillend, Billard, Claudepierre, Rendon, Dutar, & Ungerer, 1998). The findings indicated an apparent reorganisation of dendrites within the hippocampus, and overall dendritic length was decreased. Dendrites were observed as twisted and disjointed segments, rather than continuous structures. Interestingly, rats in the control group displayed no brain cell disorganisation or cell death. The type of cell damage exhibited in the treatment group is commonly seen in individuals who have suffered from ischemia, traumatic head injury, or toxic damage, and this type of brain damage is associated with long-term potentiation deficits and learning disorders (Scarlett, 1991). Cell death in the hippocampus explains the memory impairment that has been observed in individuals following chronic synthetic cannabis use (Court, 1998). Other studies conducting similar experiments using rats have found an even greater degree of toxicity and cell damage in the brain (Chan, Hinds, Impey, & Storm, 1998).

Cases in the media have further illustrated the unpredictable and harmful effects of synthetic cannabis use. A sixteen-year-old American female, Emily Bauer, complained of a migraine after smoking synthetic cannabis and awoke in a psychotic state to then experience subsequent hallucinations and violent outbursts (Huffington Post, 2013). Ms Bauer's agitated and violent behaviour had continued for over 24 hours before medical staff placed her in an induced coma. A brain scan revealed that Ms Bauer had suffered several severe strokes and that synthetic cannabis use had caused the blood vessels in her brain to constrict, a condition known as vasculitis, which causes oxygen to be cut off to parts of the brain. When Ms Bauer's blood vessels began to re-open, this caused a large flow of blood to her brain and resulting pressure build-up. Emergency surgery was employed to relieve the pressure on her brain, which was a necessary procedure to save Ms Bauer's life. Further brain scans revealed that Ms Bauer had suffered severe brain damage, and further neuropsychological testing revealed that her brain function was reduced by approximately three quarters (Daily Mail, 2013). Ms Bauer began her recovery but has remained in a state where she has severe cognitive impairment, is immobile, blind, and unaware of her surroundings.



### **Impact of Synthetic Cannabis on New Zealand's Healthcare System**

The effects of synthetic cannabis use have put a strain on healthcare systems overseas and within New Zealand (Hu, Primack, Barnett, & Cook, 2011). New Zealand has had a significant number of individuals presenting to hospitals following synthetic cannabis use; particularly in Christchurch, Wellington, New Plymouth, Tokoroa, and Tauranga Emergency Departments (National Cannabis Prevention and Information Center, 2011). Dunedin Hospital Emergency Department specialists have described synthetic cannabis as the most toxic and harmful synthetic drug they have witnessed in patients presenting for emergency treatment (Goodwin, 2012). Individuals have either displayed varying psychological and physical symptoms when under the influence of synthetic cannabis or experienced difficulties whilst withdrawing from the drug. It has also been noted by medical staff that synthetic chemical compounds raise blood pressure and heart rate to dangerous levels and symptoms have been compared by doctors to that of methamphetamine. The co-ingestion of synthetic cannabis with other drugs may be a factor influencing harm in many of the hospital presentations. A frustration shared by many hospital staff is that synthetic cannabis users have placed a strain on healthcare resources and prevented medical attention to "worthy" emergency cases (Waikato Times, 2013).

Mental health services within New Zealand have also had an increased number of patients using their services because of synthetic cannabis use. The number of patients using the Southland mental health service has increased dramatically since synthetic cannabis was introduced and staff have documented that continued use is contributing to psychosis and other acute symptoms that are difficult to treat (Devlin, 2013). Mental health practitioners also have noted that users are getting dependent and building up a tolerance to synthetic cannabis more rapidly than other illicit drugs.

The American Association of Poison Control Center reports that more than 2500 calls relating to K2 intoxication were reported in 2010, compared to only 53 the year before in 2009 (American Association of Poison Control Centers, 2010). The New Zealand Poisons Centre (NPC) started receiving calls relating to synthetic cannabis intoxication in October 2010 (Schep, 2014). Calls received by the NPC were at their highest in April 2014 (n = 70) and have declined rapidly since this time. The ongoing decrease in calls



to the NPC from May (n = 45), June (n = 14), and July (n = 8), likely reflects the effectiveness of the government's ban on all legal psychoactive drugs, which took effect in May 2014. Alternatively, this may also reflect possible under-reporting of synthetic cannabis intoxication issues due to its current illegal status and users not wanting to disclose illicit drug use. Following synthetic cannabis prohibition, it was noted that many of the calls to the NPC regarded patients suffering from withdrawal effects. The NPC predict that there will be an ongoing decline in phone calls to their service in successive months.

### **Extent of Dependency Among Legal Psychoactive Drug Users**

Research on whether synthetic cannabis can create drug dependence is sparse but there are some studies that have established that the chronic use of synthetic cannabis can lead to addiction syndrome and withdrawal symptoms (Stephens, 2011; Vardakou, Pistos, Spiiopoulou, 2010; Gonzalez, 2007; Winstock & Barratt, 2013; Zimmerman et al., 2009). A report published in 2009 by the EMCDDA suggests that tolerance to synthetic cannabinoids can develop quickly and lead to a risk of addiction (Bergen, 2010). Drug dependence has been found to be rare among natural cannabis users (Hu, Primack, Barnett, & Cook, 2011). Therefore, a finding that synthetic cannabis is creating drug dependency raises concern.

Most classes of illicit drugs exert similar effects on the brain's reward pathway, which can lead to the development of addiction; synthetic cannabis appears to be no different in this respect (Gonzalez, 2007). The effects of synthetic cannabis intoxication are influenced by neurotransmitters; specifically dopamine, GABA, and glutamate. Dopamine release has a major influence on mood and motivation, and synthetic cannabinoids increase the activity of dopamine neurotransmitters in the ventral tegmental area and mesolimbic pathway. The dopamine circuits influence the reinforcing and rewarding effects of synthetic cannabis and play a major role in addiction with most drugs. Cannabinoid binding sites in the brain are located in the nucleus accumbens, which is the pleasure centre of the brain that also facilitates reward and is implicated in addiction (Carlson, 2013).

There is also strong evidence that cannabinoid receptors play a major role in developing tolerance (a need for increased amounts of a drug to achieve intoxication or a markedly

diminished effect with continued use of the same amount of substance; APA, 2000), and that tolerance is partially a consequence of pharmacodynamic events (Sviženská, Dubový, & Šulcová, 2008). Receptor internalisation may occur following long-term exposure to drugs, which may also result in increased tolerance to synthetic cannabis. Studies on rats have confirmed that synthetic cannabinoids produce behavioural tolerance after prolonged use (Costa et al., 1996). The active component found to be responsible for developing this tolerance is the hepatic drug metabolising enzyme system. This suggests that tolerance also is developed because of biotransformation activities though more research is required in this area. Since tolerance to synthetic cannabis has been found to develop relatively quickly, there is a greater likelihood that use will lead to drug dependence (Zimmermann et al., 2009).

Withdrawal, also characteristic of addiction, is a negative affective state following substance use and is an outcome of reward deficit following drug abstinence (Koob, 1996). Some of the chemical compounds used in synthetic cannabis are three to five times more potent than THC in natural cannabis (Bergen, 2010), and for this reason, it is not surprising that synthetic cannabis use can result in withdrawal symptoms and addiction. A United Kingdom study documented various withdrawal effects following heavy synthetic cannabis use where participants reported symptoms of anxiety, paranoia, panic attacks, problems with memory and concentration, confusion, disorientation, fear of dying, rapid heart rate, insomnia, difficulty breathing, constipation, nausea, problems with eating, and weight loss (EMCDDA, 2009).

Zimmerman et al. (2009) conducted a single case study which demonstrated the addictive potential of synthetic cannabis where a participant met five of the criteria for dependency under the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), as well as the criteria for dependency in the International Classification of Diseases (ICD-10). Vandrey, Dunn, Fry, and Girling (2012) have generated evidence using a larger sample size and found that a subset of their participants met the DSM-IV criteria for synthetic cannabis abuse and dependence. Specifically, 37% of respondents met the DSM-IV criteria for substance abuse, and 12% met the criteria for substance dependence. The most widely reported abuse criterion was using synthetic cannabis in a hazardous situation (27%), and the most commonly reported dependence criteria were being unable to cease or reduce use (38%), experiencing symptoms of tolerance (36%),

using for longer periods that intended (22%), and use causing interference with other activities (18%). In the same study, withdrawal symptoms were found to be more prevalent among frequent synthetic cannabis users and the most commonly reported withdrawal symptoms were anxiety/nervousness (15%), headaches (15%), coughing (15%), insomnia/sleep difficulties (14%), anger/irritability (13%), difficulty concentrating (9%), impatience (11%), restlessness (9%), nausea (7%), and depression (6%). The effects of addiction and withdrawal can have a significant effect on a child's or adolescent's motivation and attention, and may impact on their ability to learn effectively in an academic setting. Addiction can also have major consequences for social functioning if individuals are using synthetic cannabis at the expense of other important activities.

### **Synthetic Cannabis as a Gateway Drug**

Studies on gateway effects examine whether there is a causal relationship between drug use and the initiation or cessation of other illicit drug use (Golub & Johnson, 2002), and the existence of gateway effects regarding synthetic cannabis use has been debated from two different angles. In line with the harm reduction argument, proponents of the synthetic cannabis industry argue that they provide recreational drug users with an option to gateway out of illicit drug use and dependence (Lindigkeit et al., 2009). The other side of this argument is that there is a relationship between synthetic cannabis use and the subsequent initiation of other illicit drug use (Bowden, 2007). While there is evidence supporting the latter gateway effect, there is little evidence to suggest that a reverse gateway effect exists among synthetic cannabis users.

Harm reduction was one of the marketing strategies employed by members of the synthetic cannabis industry and they argued that their products provided safer alternatives to illicit drugs for individuals who were already using illicit substances, but also for persons wanting to experiment with psychoactive substances (Lindigkeit et al., 2009). It was emphasised that individuals would be able to take responsibility and manage their drug use and that they would not face a criminal conviction in doing so. Supporters argued that they were giving illicit drug users the "golden opportunity" to come off or reduce their illicit drug use; an argument that is similar to the concept of the methadone programme in New Zealand, which supports opiate users to gateway out of heroin use.

What synthetic cannabis advocates have failed to acknowledge is the potential for new drug users to use synthetic cannabis and subsequently gateway to other harmful substance use, a potential that might be more likely than the alternative gateway effect. Opponents of the synthetic cannabis industry suggest that there is a temporal sequence of drug initiation where synthetic cannabis use leads to other 'harder' drug use (Hall & Lynskey, 2005). When synthetic cannabis was legal, there was significant concern that easy access to legal psychoactive substances would increase a young synthetic cannabis user's propensity to experiment further with more harmful substances such as methamphetamine. Research has not yet established a temporal association and it is hoped that the current study will generate knowledge in this area.

Research has provided support for another perspective, that most synthetic cannabis users are poly-drug users. Winstock and Barratt (2013) supported this theory and found that many synthetic cannabis users were poly-drug users and that only a minority of participants had fully substituted natural cannabis for synthetic cannabis. Many synthetic cannabis users had also used natural cannabis before choosing synthetic brands (Hu, Primack, Barnett & Cook, 2011). This indicates that natural cannabis itself remains a significant public health issue and that synthetic cannabis might have little overall effect on illicit drug use, which further refutes the harm minimisation argument proposed by the synthetic industry.

Hall and Lynskey (2005) have provided evidence that a gateway effect exists between natural cannabis and illicit drug use, which is useful when examining the gateway effects of synthetic cannabis since both drugs appear to exert similar physiological and psychological effects on the body. Their research consisted of a large-scale longitudinal study, which attempted to control for individual predisposing factors. Even when social, attitudinal, genetic, and environmental factors were controlled for, a strong and significant relationship was found between cannabis use and illicit drug use. Twin studies, which have also controlled for environmental, social, and genetic factors, have also provided evidence for the gateway theory and demonstrated an association between natural cannabis use and illicit drug use (Lynskey et al., 2003). What these studies are not able to control for is access to illicit drugs and contact with drug dealers following the commencement of natural cannabis use; these factors may partially account for

observed gateway effects. We cannot solely rely on the gateway effect of natural cannabis as a reference to understand the dynamics of a synthetic cannabis gateway effects since synthetic cannabis use may have fostered an increased risk of further illicit drug use due to its previous legal status and accessibility.

Some researchers have argued that gateway effects are simply an artefact of substance access and availability, as well as predisposing factors of illicit drug users, and that these two factors are closely linked (Hall & Lynskey, 2005; Morral, McCaffrey, & Paddock, 2002). It is conceded that individuals who are predisposed to illicit drug use will access the most freely available drug first, which is often natural cannabis or legal psychoactive substances, and then through associating with other drug users and dealers become exposed to other “harder” drugs. Being immersed in a drug culture may lead to an escalation in other more harmful drug use. However, not all natural cannabis users progress to harder drug use; therefore, a causal gateway hypothesis is not robust (Hall & Lynskey, 2005).

### **Does Prohibition Work?**

A necessary part of the literature review is to examine whether the prohibition of psychoactive substances has been an effective action taken by governing bodies. There are few empirical studies on the effects of prohibition on psychoactive substances. Therefore, the objective of the current study is to examine whether the tighter regulation of synthetic cannabis has changed patterns of use and to compare the prevalence of synthetic cannabis and other substance use before and after prohibition.

Having a psychoactive substance legally available on the market can imply normality and safety. Therefore, it is concerning that synthetic cannabis products initially were granted approval and licensing within New Zealand. Products became easy and convenient to purchase by consumers and appeared as a legitimate drug to use. Smith (2002) argues that the legality or decriminalisation of a psychoactive drug sends a message to the public condoning use and in some instances may even encourage use.

Prohibition has been shown to reduce drug-related harm by reducing availability and access to harmful substances, increasing the price of illegal substances, and deterring people from use due to the law (Kleiman, 1992). Synthetic cannabis has been prohibited

by the New Zealand government with the intention that they will gain control over the substance and increase the powers of police and customs officers to intervene (Smith, 2002), and such a ban makes it more expensive and inconvenient for users to purchase synthetic cannabis. It also sends a message by promoting social norms against use (MacCoun, 2010). It is likely that synthetic cannabis prohibition will prevent a new generation of younger people having access to legal recreational drugs and becoming accustomed to using substances during social and recreational activity. Limiting the availability of nitrous oxide in New Zealand through the Medicines Act is an example where a regulatory approach to prohibition has been effective (Winstock & Wilkins, 2011).

Despite prohibition being implemented in Australia, it appears that products containing prohibited synthetic cannabinoids are still being sold and accessed over the Internet (Macgregor & Payne, 2013). They are being marketed as legal products with ingredients that are not covered on the list of banned compounds, and many products contain ingredients that are not stated on the packaging (Dargan et al., 2011). This makes it difficult for police and other authorities to identify and seize illegal products.

There are some objections to prohibition in that it arguably fails to reduce illicit drug use and can produce negative outcomes such as bringing the law into disrepute and subjecting users to the risk of arrest and legal punishment (Haden, 2008; Moore, 1990; Smith, 2002; United Nations, 2008). It is also argued that prohibition hands the drug supply over to criminal groups and creates a black market for substances. Prohibition can lead to an increase in or maintenance of synthetic cannabis use patterns for some individuals due to creating a “forbidden fruit” effect where using the drug is associated with rebellion (MacCoun, 1993; Wilkins & Sweetser, 2013). There is also a risk that prohibition could encourage those who continue to source synthetic cannabis to initiate contact with drug dealers or associates who expose them to more harmful substances alongside synthetic cannabis. Finally, evidence from international studies indicates that banning synthetic cannabis products may lead to an increase in the development and availability of other psychoactive products that contain more harmful compounds (Macgregor & Payne, 2013). Supporters of the above arguments contend that the legal consequences of illicit substance use are far worse than the harms associated with the use of synthetic cannabis as a legal substance (Levine, 2003).

Vandrey, Dunn, Fry, and Girling (2012) indicated that synthetic cannabis users have continued to use and seek out synthetic cannabis drugs after they have been made illegal and banned from the marketplace. Despite 29% of their survey participants reporting residing in an area where synthetic cannabis had been banned, 87% of respondents reported obtaining their synthetic cannabis from retail stores, 38% from the Internet, 29% from friends or relatives, and 2% from a drug dealer. Many respondents reported that they continued to use synthetic cannabis following prohibition, which suggests that there is enough demand for a black market to be established.

It is often assumed that strong enforcement will deter potential users and drug dealers from being involved in the illegal drug market (Bewley-Taylor, Hallam, & Allen, 2009). This idea is underpinned by the concept of deterrence where it is hoped that the fear of punishment for drug use will act as a deterrent through raising the risk of arrest, criminal conviction, and imprisonment. It is hoped that such a deterrent leads to decreased levels of drug use in the general population. However, in the New Zealand prison population, drug offenders consist of a growing number of individuals who have manufactured, imported, and sold Class A and B drugs, rather than those who are subject to convictions for possession or use (Bewley-Taylor, Hallam, & Allen, 2009).

Perhaps a distinction needs to be made between the effect of prohibition on different populations and that although research has indicated that illicit drug users do not regard legal penalties as a major deterrent to use, prohibition may be more effective among individuals who have not used illegal drugs before but are contemplating use, or individuals who seldom use psychoactive substances (Weatherburn et al., 2003). This population of drug users tend to live more conventional lifestyles, which are not consistent with breaching the law (Bewley-Taylor et al., 2009; MacCoun, 2010). In contrast, experienced drug users tend to stop using drugs, not because of legal reasons, but due to concerns about health, family, or due to maturation (Weatherburn et al., 2003; Wilkins & Sweetser, 2013). Changes in use can also be attributed to cultural trends, changes in availability and price, developments in prescribing practices, stricter legal control, and targeted law enforcement campaigns (Barbor et al., 2010).



## **Chapter 2: Method**

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### **Introduction**

This chapter outlines the rationale for the development and design of the study, and describes the participants and measures used. It provides information on the procedure used for data collection and notes the statistical analysis methods that have been applied to the data. Ethical considerations associated with the research are also discussed.

### **Study Design and Rationale**

The investigation is an exploratory study using survey research to gather information on a relatively new drug, which has previously generated little research in New Zealand. Exploratory research was considered an appropriate preliminary step in the approach to understanding synthetic cannabis since there is already a minimal level of understanding in this area. A non-probability sample was obtained since the researcher sought to recruit, screen, and select participants who had previously used a specific drug; synthetic cannabis. Quantitative research methods were adopted for the study; a process of measurement was sought using instruments and other methods for measurement to answer each of the five research questions. Quantitative methods were also used so that participant responses could be kept anonymous and to encourage respondents to be honest about the extent of their drug use and drug-related experiences. The current study is a survey research design, and there is no control to determine that any effects observed were caused by the drugs examined, and not other factors. Therefore, the study was based on a single sample and was an observational study. It was a retrospective study in that there was an element of recall made with some of the questioning and assessments employed. A more in-depth analysis of the disadvantages and advantages of the study design is explored further within the limitations section of the discussion chapter.

Research on illicit drug use historically has been challenging and the recruitment of participants has been a difficult part of the research process, especially when the target population is not easily accessible through contact with treatment or other institutions (Fendrich & Vaughn, 1994; Johnson & O'Malley, 1997; Tourangeau & Yang, 2007). For this reason, anonymous survey research was the chosen approach for data collection but also due to participants often being less willing to discuss sensitive or incriminating



personal information as research candidates. The current research targets drug users, often a vulnerable and hidden population, requiring adequate participant recruitment methods and participant assurance of confidentiality.

## **Participants**

The population of interest was individuals who had previously used synthetic cannabis. The intended number of participants recruited for the study was 100, and the total surveyed was 94. The decision to strive for depth at the expense of breadth was deliberate due to time constraints, the type of study, which is exploratory in nature, and due to the anticipated limited accessibility to research participants.

Standard demographic data were collected from participants including age, ethnicity, gender, employment status, source of income, and qualification. The decision was made to collect demographic data so a description of the sample could be obtained, and demographic comparisons made between drug user populations in other research conducted within New Zealand. These data are summarised in the results section of the study.

### *Eligibility Criteria*

To be eligible to participate in the study, participants needed to be at least 16 years of age in order to provide informed consent. They were required to be proficient in speaking and reading English, able to operate a computer, and must have used synthetic cannabis two or more times before it was made illegal in New Zealand on May 8th, 2014. The limit on previous use was implemented to prevent obtaining a large number of participants who may have experimented with synthetic cannabis on one occasion, which might be a common behaviour among younger persons.

The researcher was available to assist with numeracy and literacy during the computerised survey, if required, although if it became apparent that a participant's literacy issues were too significant that they could not complete the questionnaire, it was anticipated that they would be exited from the study. This was considered important since participants needed to comprehend the survey questions to be able to provide accurate responses. For a similar reason, individuals who were suspected of being intoxicated by any substance(s) at the time of survey completion were also excluded from the study. There were no situations during data collection where

researcher/participant contact was terminated, and participants were exited from the study.

The primary researcher is a probation officer. Therefore, individuals who had previously been on the researcher's caseload were excluded from the study to prevent any conflict of interest. There was only one occasion where a participant was excluded for this reason. This applicant was still provided with information about how to access support for alcohol and drug concerns.

A final exclusion criterion was that participants must not have suffered from any known psychiatric disorder prior to the initiation of their synthetic cannabis use. This was a necessary condition to reduce the effects of potential confounds and to maximise the strength and accuracy of the association between synthetic drug use and substance-related psychiatric conditions.

A large number of participants ( $n = 12$ ) who responded to the recruitment advertisement did not appear for scheduled contact with the researcher to complete the survey. All participants who were present ( $n = 94$ ) were assessed as eligible and proceeded to complete the survey.

### *Power Analysis*

To perform the study responsibly, and to avoid the use of excessive or inadequate numbers of participants to detect a significant effect in the study, G\*Power (Faul, Erdfelder, Buchner, & Lang, 2009) was used to calculate the required sample size (see Appendix 6). The power analysis was conducted using a correlational model and an alpha level of 0.05 along with the desired power of 0.80 (standard). The analysis was conducted for a low, medium, and high effect size where the medium effect size is generally accepted, especially in social science research. As such, the desired sample size was 84 to allow for a worthwhile effect to be examined, which was obtained in the current study.

## **Instrumentation**

### *Survey Questionnaire*

There is no existing instrument that assesses synthetic cannabis-related harm and individual response to drug policy, nor is there a questionnaire available that covers

similar concepts. A structured computerised questionnaire (Appendix 5) was specifically designed for the study to gather data concerning the drug use patterns of participants and to answer the research questions. The self-complete online questionnaire was intended to gather demographic data about the participants and self-reported drug use pre- and post-prohibition (8th of May 2014).

The survey was hosted on the secure Qualtrics survey system (<http://qualtrics.com>), using an existing licence operated by Massey University's Programmer/Analyst. This web-based survey software enables users to carry out online data collection and is utilised to capture survey results from participants who are specifically recruited and given access to the survey. Qualtrics was used to assist with both survey creation and data collection in the current study. The choice to use Qualtrics survey software over other survey tools was made due to Qualtrics having been successfully utilised for research within Massey University for a number of years due to its safe and reliable means for survey distribution and data collection.

In terms of the survey format, forced choice format was used where closed-ended questions with a selection of fixed responses to each question were employed within the survey to limit the answers of participants to response options provided on the questionnaire. Survey questions were carefully worded to remove any implications or cues, and dichotomous, multiple choice, and scaled questions are examples of the closed-ended questions employed in the survey. Using categorical answer sets within the survey was considered a more time efficient approach for both data collection and analysis purposes since responses are easier to code and interpret. It is also an appropriate method for the type of research being conducted, quantitative research, and to answer the research questions. A considered disadvantage to this approach is that participants are required to choose responses in the questionnaire that may not exactly reflect their answer and the researcher is unable to further examine the meaning of particular responses. To assist with this limitation, there were some opportunities for participants to answer open-ended questions in the survey where there were no predefined options or categories and participants were able to provide their own answers. These options were listed as 'other' and required participants to further specify their responses. Participants were also given the opportunity at the end of the survey to provide any further information they thought was relevant to the study.

The survey responses of participants were anonymous and the advantage of this approach to assessing drug use is that participants are more likely to be honest about the extent of their drug use, rather than tell a stranger in a face-to-face interview about any illegal activity they are engaged in. Face-to-face studies are more likely to result in under-reporting (Bowling, 2005), specifically around the disclosure of illicit drug use. The decision to use a computerised survey for participants to self-complete over other methods, such as human interviews or paper questionnaires, was made due to participants being more likely to provide more accurate answers to sensitive questions using this method. Response rates are also likely to be higher since participants are more likely to agree to partake in the process, as opposed to sitting down with an interviewer. Online survey research allows for a participant's identity to be kept anonymous and still permits the researcher to obtain large amounts of data using categorical response sets. Survey research is also ideal in that it provides participants with a standardised method where each participant receives the same survey, which is administered in the same format each time. There is less, little, or no observer subjectivity and the researcher's personal biases are eliminated.

The researcher chose to have physical contact with participants, as opposed to placing the survey on an Internet-based forum, so more control was gained by having the opportunity to screen participants and ensure that they met the eligibility criteria to participate in the study. The intention was also not to limit the research population to only those with Internet access since Internet users are unlikely representative of the drug user population and do not represent the population as a whole. The current study is also only applicable to the New Zealand context, and if the survey is accessible on a webpage, there is little control over who responds, where they are from, and how many times they choose to complete the survey, which has the potential to introduce biased results.

The survey questionnaire was piloted by five individuals known to the researcher prior to participant administration to anticipate problems with the survey and its application. The reaction of pilot participants was favorable, and no refinements were made. However, minor changes were made to the questionnaire following ethical consultation. Questions regarding self-harm and suicide following synthetic cannabis use were removed from the study because the Ethics Board believed that there was a risk to participants to disclose this information.

### *Validity of the Survey Questionnaire*

There is no existing instrument that provides a standard against which the questionnaire designed for the study can be compared. As such, validation procedures were focused on content and construct validation (i.e., the extent to which a study measures the construct it claims to be measuring). To improve the validity of the study, standardised psychometric tools were incorporated into the survey questionnaire. They each have their own merits, which served to objectively answer the research questions that the study intended to answer.

Two psychometric instruments were incorporated within the survey; the Severity of Dependency Scale (SDS) and Brief Symptom Inventory (BSI). These standardised instruments were utilised so drug dependence and psychological well-being could be measured more objectively.

### *Severity of Dependency Scale*

To answer research question three, and ascertain whether synthetic cannabis use had created dependency among users, a short drug-screening instrument was incorporated in the questionnaire. Drug dependency is considered an important area to examine since dependency among drug users is central to the evaluation of harm. However, dependency is often difficult to define and measure and, in the absence of a specific instrument to measure dependency among synthetic cannabis users, the approach taken was to employ the Severity of Dependency Scale (SDS; Gossop, Griffiths, Powis, & Strang, 1992). This scale has previously been validated for amphetamine dependency but was adapted to the current study to be applied to synthetic cannabis use. The SDS has been successfully used in previous drug research, including a recent study by Wilkins et al. (2006) to evaluate the harms of another synthetic drug that was legally marketed in New Zealand in the early- to mid-2000s, benzylpiperazine (BZP).

The SDS is a brief measure of the psychological aspects of dependence experienced by users of various illicit drugs, and it assesses an individual's preoccupation and anxieties around his or her drug use, and feelings of non-control over use. The wording of the original SDS items was adapted to cover synthetic cannabis as the focus substance and to do this the word *drug* was substituted with *synthetic cannabis*. The five items of the SDS presented in the survey were:

1. Do you think your synthetic cannabis use was out of control?
2. Did the prospect of missing a dose of synthetic cannabis make you anxious or worried?
3. Did you worry about your synthetic cannabis use?
4. Did you wish you could stop using synthetic cannabis?
5. How difficult did you find it to stop or go without synthetic cannabis?

Each of the five items was scored on a four-point Likert-type scale where for items 1-4, 0 = never/almost never, 1 = sometimes, 2 = often, and 3 = always/nearly always. For item 5, 0 = not difficult, 1 = quite difficult, 2 = very difficult, and 3 = impossible. The total SDS score is obtained by adding the scores for all items and participants who get a combined score of greater than four on this measure are classified as having been dependent. Higher scores from the scale indicate higher levels of dependence.

It must be noted that in the current study, the use of the SDS and its results refer to the lifetime prevalence of synthetic cannabis dependency, and whether a participant is currently or has been previously dependent on synthetic cannabis. There is no reference to synthetic cannabis dependency occurring at any specific time (i.e., before or after synthetic cannabis prohibition), but rather if a participant has ever experienced any of the symptoms listed in the five items of the scale. This was done to determine the dependency potential of synthetic cannabis, in general, especially since participants were consumers of synthetic cannabis at different time points.

A benefit of using the SDS is that it is a brief screening instrument that is, therefore, an economical option for a survey where there are multiple other objectives to address. Another advantage of the tool is that the use of vocabulary in the SDS is straightforward and understood by a wide audience.

The use of alternative drug dependency screening tools was considered for the current study, but they were either too lengthy to incorporate into the survey (e.g., Addiction Severity Index), required an interview format and not self-report (e.g., Alcohol, Smoking and Substance Involvement Screening Test), or specific training was required to administer the survey. The SDS also was also advantageous in that it specifically measures the

severity of drug dependence whereas other measures solely identify problem drug use (e.g., Drug Abuse Screening Test), and not drug dependency.

#### *Validity of the Severity of Dependence Scale*

Overall, the SDS has good psychometrics and demonstrates high test-retest correlations, good internal consistency, and optimal sensitivity and specificity (Gossop et al., 1995; Hides, Dawe et al., 2007; Lawrinson et al., 2003; Topp & Mattick, 1997). For example, the SDS displayed good internal consistency (Cronbach's alpha ranging from .80 to .90) and good test-retest reliability (.89) in a sample of heroin users (Gossop et al., 1995; Gossop, Best, Marsden, & Strang, 1997). The SDS also has been demonstrated to have good internal consistency and test-retest reliability across a wide range of drug users, including adolescent populations (Martin et al., 2006).

The SDS has been validated across a range of drug user groups, including cannabis, cocaine, heroin, amphetamines and benzodiazepine users; in particular, research has demonstrated the SDS to be a reliable measure of dependence among amphetamine, heroin, and cocaine users (de las Cuevas, Sanz, de la Fuente, Padilla, & Berenguer, 2000; Gossop et al., 1995; Martin, Copeland, Gates, & Gilmour, 2006). The SDS also is widely validated in an Australian context, which is similar to New Zealand's bicultural setting, and it has been successfully used among aboriginal groups, the indigenous culture of Australia (Schlesinger et al., 2007).

There is evidence to support that the construct validity of the SDS is also of a good standard. Research has confirmed significant correlations with behavioural signs of dependence including frequency, dose, and duration of use (Darke, Ross, & Hall, 1996).

#### *Brief Symptom Inventory*

To answer research question four and assess the current psychological well-being of synthetic cannabis users and other drug user groups within the study, the Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983) was incorporated into the survey. The BSI is a brief form of the Symptom Checklist-90-Revised (SCL-90-R), which evaluates a broad range of psychological problems and symptoms of psychopathology. The BSI also provides an overview of an individual's current psychological symptom status and severity of their symptoms, but is a briefer measure



and assesses both patients and non-patients for psychological problems. It is a self-report 53-item measure where 9 domains of psychopathology are assessed; Table 2.1 outlines the nine primary symptom dimensions and three global indices of distress that are measured.

Table 2.1

*Dimensions of the Brief Symptom Inventory*

Primary Symptom Dimensions	Description
Somatization (SOM)	Reflects psychological distress resulting from the perception of bodily dysfunction (e.g., cardiovascular, gastrointestinal, respiratory, aches, and pains).
Obsessive-Compulsive (O_C)	Thoughts and actions that are experienced as unremitting and irresistible by an individual but are of an unwanted nature (e.g., checking and double checking actions, difficulty making decisions, trouble concentrating).
Interpersonal Sensitivity (I_S)	Feelings of personal inadequacy and inferiority (e.g., self-deprecation, feelings of uneasiness, marked discomfort during interpersonal interactions).
Depression (DEP)	Reflects signs and symptoms of clinical depressive syndromes (e.g., dysphoric affect and mood, withdrawal of interest and motivation in life activities, loss of vital energy).
Anxiety (ANX)	Symptoms usually associated clinically with high manifest anxiety (e.g., restlessness, nervousness, tension, panic).
Hostility (HOS)	Organized around three categories of hostile behaviour: thoughts, feelings, and actions (e.g., feelings of annoyance and irritability, urges to break things, frequent arguments, uncontrollable outbursts of temper).
Phobic Anxiety (PHOB)	Symptoms of phobic anxiety states or agoraphobia (e.g., phobic fears of travel, open spaces, crowds, public places)
Paranoid Ideation (PAR)	Paranoid behaviour as a disordered mode of thinking (e.g., projective thought, hostility, suspiciousness, centrality, fear of loss of autonomy, delusions).
Psychoticism (PSY)	Ranges from mild psychoticism (e.g., withdrawn, isolated, schizoid lifestyle), to more extreme psychotic status (e.g., schizophrenia, dramatic psychosis).
The General Severity Index (GSI)	The best indicator of current distress levels and combines measures on the number of symptoms and intensity of perceived distress.
The Positive Symptom Distress Index (PST)	A pure intensity measure. Also measures response style and whether an individual is amplifying or attenuating distress in their self-report.
The Positive Symptom Total (PSDI)	A count of the symptoms that an individual reports.



Participants will rate the extent to which they have been bothered by various symptoms with a response scale of 0-4, with 0 = not at all, 1 = a little bit, 2 = moderately, 3 = quite a bit and 4 = extremely. They are asked to note whether they have experienced symptoms within the last 7 days and the rationale for this timeframe is that this period is usually when individuals are able to more accurately reflect and communicate the most relevant information about their psychological symptoms (Derogatis & Melisaratos, 1983). Assessing symptoms experienced prior to this period might introduce distortions, due to memory processing, and it is a requirement of the measure for this timeframe to be used. Therefore, it is a measure of *current* psychological symptom status.

The BSI also captures three global indices of psychological distress; the Global Severity Index (GSI), Positive Symptom Distress Index (PSDI), and Positive Symptom Total (PST). The GSI is designed to quantify an individual's overall psychological distress level, the PSDI measures the intensity of symptoms experienced, and the PST indicates the number of self-reported symptoms. The PST and PSDI are used together with the GSI to gain a more meaningful understanding of the clinical picture.

For interpretation, all raw scores from the nine symptom dimensions and three global indices are converted to standardised T-scores for each participant. The norm group used was the non-psychiatric population and norms were also gender keyed (i.e., separate norms are available for males and females). This was due to the belief that females report significantly more psychological symptoms and greater levels of distress than males do (Derogatis, 1993), and it is intended to increase precision.

Interpretation of the BSI is performed at three distinct levels. Initially, interpretation is carried out using the global scores of distress to gain an understanding of the degree of overall distress. In terms of identifying when respondents' scores are within a problem area range, guidance was taken from Kuhn, Bell, Seligson, Laufer, and Lindner (1988), who developed the operational score for clinical significance when using the BSI. If a participant obtains a T-score greater than 63 in the GSI, then psychological well-being is considered to be compromised.

Evaluation will then occur at the level of each psychological domain to see whether there are any specific areas of psychopathology. This provides information on the profile of the individual's psychological status in psychopathological terms and notes

the nature and intensity of distress. If a score of greater than 63 is obtained in any 2 of the nine primary dimensions, psychological well-being also is considered to be compromised, and areas of concern are identified.

A more specific focus can then be directed towards the level of discrete symptoms, which communicate detailed symptomatic manifestations by looking at individual items of the measure. There was no emphasis on these items in the current study, as large scale analysis was conducted and time did not allow for the 53 individual items of each of the 94 participants to be analysed, nor was it required to answer any of the formulated research questions.

The benefits of using the BSI over other instruments that measure psychological well-being is that it has been normed on non-psychiatric populations so can be used with the general public, which is relevant to the current study. It has the ability to provide exclusive information regarding an individual's psychological well-being, which is often not available to external observers. The BSI is highly sensitive to a broad spectrum of psychopathologies and distress, and while it can be used to detect change in psychological symptoms, it is also effective for using as a single, point-in-time assessment of an individual's psychological status. It is also economical in that each participant interviews himself or herself via self-report, so it is easily incorporated into the survey questionnaire. In addition, administration, scoring, and interpretation could be accomplished by non-professionals (i.e., the researcher), and a small time commitment was required to learn and administer the test to participants. Time was limited in the current study. Therefore, this measure was appropriate for the non-clinical setting and research situation.

Respondent cooperation in completing the BSI was very good; all participants attempted to complete the assessment. However, when a respondent scores all items with the same value (e.g., all 0s), this is considered invalid test administration and cannot be interpreted. Similarly, if more than 40% of items are omitted by a respondent, the test is also considered invalid. Twenty-four of the 94 participants completed invalid assessments, so these were unable to be considered for interpretation. The remaining 70 valid responses were considered an adequate sample size for further analysis.

### *Validity of the Brief Symptom Inventory*

Overall, findings from studies support the use of the BSI as a clinically appropriate instrument that can be utilised in both research and clinical settings. The validity, utility, and reliability of the BSI instrument have been tested in over 400 research studies and proved to be very robust (Derogatis, 1993).

Evidently, the BSI has good internal reliability demonstrating an average rating of above .70 (Croog et al., 1986; Derogatis, 1993; Arion & Patsdaughter, 1989). The range for test-retest reliability is also favourable and ranges between .68 and .91. for the primary symptom dimensions, and from .8 to .9 for the global indices (Baider, Amikam, & De Nour, 1984; Thompson, Gallagher & Breckenridge, 1987; Johnson & Thorn, 1989). Internal consistency reliability is also of a good standard and coefficients of primary symptom dimensions range from .71 to .85.

Moderate convergent and concurrent validities are reported in research, with some studies reporting excellent concurrent and convergent validities, and others reporting more modest findings (Derogatis, 1993). Given that the construct validity of the BSI is moderately strong, this provides support that the BSI measures what it intends to measure. The correlation between the BSI and SCL-90-R, which is the scale that the BSI is intending to replicate, ranges from .92 to .99 for the primary symptom dimensions.

A Cronbach's alpha test was performed for the BSI and its nine scales. This test is performed to estimate the reliability of a psychometric test. Any value of Cronbach's alpha which is between .8 and .9 is considered good reliability, and above .9 is excellent. The alpha for the 53 items was .99 which therefore indicates a very good internal consistency or reliability of the overall test. The alpha of each individual subscale was also calculated and as shown in Table 2.2; the alphas were above .9 for most of the scales.

Table 2.2

*Results from the Cronbach alpha analysis for each of the BSI subscales*

Psychological Dimension	N of Items	Cronbach's Alpha
Somatization	7	.92
Obsessive-Compulsive	6	.94
Interpersonal Sensitivity	4	.92
Depression	6	.92
Anxiety	6	.9
Hostility	5	.94
Phobic Anxiety	5	.93
Paranoid Ideation	5	.91
Psychoticism	5	.88

The BSI has been successfully applied to a diverse range of groups, including those with lower level functioning who may otherwise struggle with psychological test administration. For example, research investigating the utility of the BSI with individuals who have borderline intellectual functioning or mild intellectual disability, adequate internal consistency and validity across the subscales was noted (Wieland et al., 2012). This makes it appropriate to administer to high-risk populations, who might have greater needs with regards to being able to complete the assessment effectively; the instrument presents a basic vocabulary level. It has also been proven to be highly sensitive to individuals with substance use issues, which is also relevant to the current study (Derogatis, 1993).

### **Recruitment**

Response rates are fundamental to the success of survey research and in the current study, two recruitment methods were utilized to ensure a high response rate; purposive sampling, and snowballing sampling. These strategies for recruitment proved to be effective because, within 6 weeks, 94 surveys were completed by participants recruited from the community.

Initially, participants were recruited via a flier (Appendix 1), which was distributed throughout various community support agencies in Napier and Flaxmere, Hawke's Bay. If eligible, participants were instructed to indicate their interest by contacting the

researcher through calling or texting a dedicated mobile phone set up for the study, or through emailing the researcher. This method of recruitment, known as purposive sampling, is a technique that allows for the selection of participants who are knowledgeable about the topic of interest, synthetic cannabis, and who are willing to share this knowledge and experience.

Following the recruitment of participants using purposive sampling, a snowballing sampling technique also was utilized during contact with participants to increase the number of candidates involved in the study. This is also a non-probability sampling technique where existing research participants recruit future participants from among their acquaintances. Participants who answered the recruitment advertisement were asked to pass on a recruitment advertisement to friends and family who might be interested in the study and who were eligible candidates. It is unclear how many more participants this technique generated. However, there was evidence during participant contact that some respondents had learned of the research opportunity through their peers.

It is noted that the snowballing sampling technique is susceptible to various forms of bias (Atkinson & Flint, 2004). Firstly, while individuals tend to associate with others who might have the relevant study eligibility characteristics, they may have similar characteristics in general, which may produce skewed results. Whether this is the outcome in the current study cannot be determined. However, it was a compromise that needed to be made to recruit an adequate sample size. Secondly, the snowballing technique is not random. Random sampling is the ideal strategy to be using in empirical studies but it is not realistic to assume that a drug user population can be recruited randomly from the general population.

Despite the limitations noted above, the snowballing technique was considered a useful method in the current study, due to there being few other sampling strategies to reach and locate the specific target population that was sought. Because the research involves participants talking about their illicit drug use, the sensitivity of coming forward to participate in such a study is more acute and the drug user population is less likely to identify themselves to take part in research than other social groups (Tourangeau &

Yang, 2007). By involving participants to recruit other individuals to take part in the research, this potentially breaks down some of these anticipated barriers.

## **Procedure**

Following recruitment, survey administration was carried out in a public setting at the Napier Public Library, and they were conducted in the study area of the library; a quiet area sectioned off from the rest of the venue. The researcher's place of work, Community Probation Services, had been declined by the Ethics Committee as a suitable venue for data collection. Therefore, conducting researcher/participant contact in the public domain was considered the next safest alternative, as opposed to other secluded and unsupervised locations. If participants were not willing to attend the Napier Public Library, the Camberley Community Centre and Flaxmere Community Centre (interview rooms) were offered as alternative venues.

Potential participants were screened for eligibility, using the screening questionnaire (Appendix 2), at their initial contact with the researcher and again when they presented in person for survey completion. The screening questionnaire was designed by the researcher to identify and eliminate unsuitable candidates early on in the research process. The objective of the screening questionnaire was to determine whether candidates had the required characteristics, according to both the inclusion and exclusion criteria, that would make them eligible to participate in the study. Individuals who did not meet these criteria were declined the option to participate in the study. The screening process built the foundation for reliable and valid data collection and allowed the researcher to obtain a sample of participants who provided helpful information to answer the study's research objectives.

At the initial contact between participant and researcher, an appropriate appointment time was negotiated for both parties to attend one of the agreed locations to complete the survey. A detailed computerised information sheet (Appendix 4) was provided to each participant to read and they were asked to verbally confirm their understanding that participation in the research was voluntary and that their responses to the questionnaire would be kept anonymous and confidential. Informed consent was gained verbally and without the participant needing to disclose his or her identity.

Prior to survey commencement, the importance of participants providing honest and accurate responses to each question in the survey was emphasised. They were encouraged to ask questions during survey completion and the researcher remained accessible to participants for this reason. In line with ethical requirements, and to protect research participants from harm, participants were informed that they could choose to withdraw from the study at any stage of the research process.

To ensure that there was no misunderstanding around what constitutes synthetic cannabis, an exhaustive list of synthetic cannabis product names (Appendix 3) was available to participants identifying all synthetic cannabis brands that were available for sale in New Zealand prior to prohibition. Each participant was given instructions about how to complete the computerised survey and the researcher then initiated the online questionnaire. Compensation, in the form of a 10-dollar supermarket voucher, was issued to each participant prior to survey commencement.

It took six weeks to recruit the desired number of participants for the study, and the online questionnaire took approximately 8-18 minutes for each of the 94 participants to complete.

### **Data Analysis Procedure**

Due to the exploratory nature of the study, descriptive statistics were primarily used to portray the data and to evaluate the drug use and demographic characteristics of respondents. For the descriptive analysis, the mean and standard deviation were used to report continuous variables, and frequencies and absolute counts for categorical variables.

The sample in the current study was compared with the drug user population of the 2007 Illicit Drug Monitoring System (IDMS; Wilkins, Girling, & Sweetsur, 2008) to examine generalisability and determine whether the demographic makeup of the current study was comparable to research already conducted within the context of New Zealand. Using SPSS, a two sample test of proportions and Chi-square tests were applied to compare the demographics of the current sample to the demographic characteristics of the 2007 IDMS study.

To answer question one, to ascertain whether synthetic cannabis users had increased or decreased their synthetic cannabis use following prohibition, survey data were collected at two time intervals; retrospectively, consumption prior to synthetic cannabis prohibition on May 8, 2014 and current use, which was at the time of survey completion (March 27, 2015 to May 8, 2015). A straightforward comparison between the two periods was undertaken to determine whether there had been a change in the frequency of use pre- and post-prohibition. In addition to this, a paired *t*-test was performed to determine whether any difference observed was significant.

For research question two of the study, regarding the subjective harmful effects of synthetic cannabis use, a measure of physiological and psychological symptoms was administered where respondents were asked if they had experienced any of the listed symptoms from consuming synthetic cannabis over their lifetime. The symptoms have been drawn from the literature reviewed in the current study on the adverse health risks associated with synthetic cannabis use (Castellanos & Thornton, 2012; Grigoryev, Savchuk, Melnik, Moskaleva, Dzhurko, & Ershov, 2011; Missouri Department of Health, 2010; Muller, Sperling, Kohrmann, Huttner, Kornhayber, & Maler, 2010; New Zealand Drug Foundation, 2013; Robinson et al., 2010; Schneir, Cullen, & Ly, 2010; Wells & Ott, 2011).

To answer research question three, the Severity of Dependency Scale was administered to examine the number of participants who have experienced symptoms of synthetic cannabis dependency. A graph was used to plot the individual scores of each participant, along with a graph indicator to illustrate the cut-off score for dependency. This indicator highlighted the proportion of participants who have met the criteria for synthetic cannabis dependence.

For research question four, regarding the psychological well-being of different drug user groups within the sample, the Brief Symptom Inventory was used to assess the psychological symptom status of participants. As already noted in the Instruments section of this chapter, raw scores from the BSI subscales will be converted to diagnostic scores using a standardised *t*-table and the adult non-patient norms will be used for analysis. The average sample T-scores for each psychological dimension will



be displayed in table format so comparisons can be made to determine whether the symptom profile is of a magnitude to be considered in the clinical range.

The group means of the BSI subscales will also be compared among the different drug user groups in the sample; current synthetic cannabis only users, current poly-drug users, and current non-drug users. These results will be summarised in a graph so that any variances can be observed, and a one-way ANOVA will be conducted to look for significant differences in the scales among the three different drug user groups.

The measure of psychoticism was of particular interest in the current study due to there being significant concern reported in the media and other literature regarding synthetic cannabis users experiencing drug-induced psychosis following consumption (Every-Palmer, 2010; Muller et al., 2010). For this reason, results from the BSI psychotic screen were specifically investigated to see whether there was a link between synthetic cannabis use and psychosis.

For question five, which was an examination of whether there was an association between synthetic cannabis use and the progression of other illicit drug use, participants were asked to respond to a drug use assessment containing questions regarding which illicit substances they had previously used, and which illicit drugs they currently use. They were also asked to note the frequency of their drug use under each drug category pre- and post-prohibition. These questions were intended to inform an understanding of the role that synthetic cannabis had in illicit drug use and how they were interrelated. A comprehensive list of illegal substances in New Zealand was adopted for this question from research by Wilkins, Griffiths, and Sweetser (2010) as a reference to the illegal substances available and most commonly used in New Zealand. A paired *t*-test was performed to compare the frequency of illicit drug use pre- and post-prohibition to see whether there were any significant differences in the frequency of illicit drug use pre- and post-prohibition.

Further questioning on the subsequent use of methamphetamine following synthetic cannabis use was also made to see whether the use of synthetic cannabis increases the risk of starting to consume another, possibly more harmful, illicit drug. Participants were also asked to note whether any methamphetamine use preceded synthetic cannabis

use. This gave some indication of whether a gateway or reverse gateway effect existed. The objective is not to establish causation, as there are many potential mechanisms that can underlie drug use progression, which cannot be accounted for, even with stringent and sophisticated statistical analysis, which is outside the scope of the current study.

In terms of the software programmes used for data analysis, as already noted, the power study was completed using G\*Power and Qualtrics survey software supported the analytical method chosen for the current study. SPSS (version 22) was the software programme used for statistical analyses. In addition to this, a qualified statistician was consulted during the analysis of the results.

Regarding the parameters for determining statistical significance, a significance level of  $p < .05$  was used for all inferences. However, results significant at a  $p < .10$  level were reported. While this might not have been significant relative to the standard alpha level of .05, such findings were still considered of value but were interpreted with caution.

### **Ethical Considerations**

The research was carried out with the ethical approval from the Northern Region Human Ethics Committee and adhered to the Massey University Human Ethics Committee Code of Ethics. The central ethical issues pertinent to the current study included participant disclosure of illegal conduct and confidentiality, participant consent, risk(s) to the researcher, and offer of compensation to participants.

A major ethical issue identified was that participants were asked to disclose potentially illegal and incriminating activity. Therefore, confidentiality and anonymity for each participant were important factors throughout the study, and were preserved throughout the research process. It was only during the recruitment phase that participants were required to disclose their contact information, consisting of their first name only, for the purpose of organising an appointment time. Contact information was destroyed immediately after the completion of each individual's survey. Participants did not record their personal information onto the survey questionnaire; as a result, their responses to the questionnaire remained anonymous.

As an additional measure to maintain confidentiality, participants provided oral consent to participate in the study. Further to this, signed consent was also replaced with *implied*

*consent* whereby participants read the written information sheet, which outlined the rights of participants and details of the study. Participants then made a choice whether they proceeded to complete the questionnaire, and in doing so, indicated their consent to participate in the research. The Ethics Committee requested that the researcher give further consideration to obtaining written consent. However, it was argued that if it was a requirement for participants to give consent in writing, it might be more likely that they would provide false personal information, socially desirable responses to survey questions or withdrawal from the study during data collection. The researchers request and rationale for oral and implied consent as the means for obtaining informed consent were accepted.

A further ethical consideration was that the researcher would have contact with a potentially vulnerable or high-risk population of substance users and the risks to participants of taking part in the study was contemplated. It was regarded that the project served as an opportunity for research candidates to consider or engage in getting support for their substance use issues since participants were given information on how to access support prior to commencing the survey questionnaire. The flier advises participants who have severe or distressing drug-related symptoms to contact their local GP or family doctor. Other helpful contact numbers listed refer respondents to the Hawke's Bay Community Mental Health and Addiction Services, and the National Alcohol and Drug Helpline.

Due to the study recruiting participants who may have been current drug users or criminal offenders, there was also the potential that the researcher may encounter participants who were difficult to work with or who displayed challenging or confronting behaviours. It was planned that in any situation where the researcher felt unsafe, contact would be terminated immediately. There were no situations throughout the study where researcher/participant contact was ceased.

The decision made for contact between researcher and participants to only occur in the public domain was made to ensure the safety of both the researcher, who was a lone female, and participants. The researcher acted alone on all occasions to improve confidentiality. Therefore, this measure was taken to ensure that contact with drug user groups and other high-risk populations was conducted in a setting that was private but also allowed for measures to be taken if safety was compromised. This is especially

important given that investigating criminal behaviour and drug use may invoke strong feelings and adverse reactions in respondents.

A final ethical concern expressed by the Ethics Board regarded money being offered as an inducement to participants. The main ethical concern with offering compensation is that informed consent for some participants might not be voluntary and that monetary benefits can lead to the presence of coercion or undue influence. Offering compensation can provide an attractive incentive to participate in research, especially for individuals from marginalised societies which place a higher value on even small monetary gain. Inducements may have skewed the findings of the survey, or the validity of informed consent may have been compromised (Groves & Peytcheva, 2008). This threat was considered. However, the intention of offering compensation was not employed in the current study to help with recruitment or increase compliance, but to compensate participants for their time investment in the study. It is acknowledged that offering compensation may have reduced non-response bias but assisted the researcher to achieve a sample that is more representative of the population being studied than could otherwise be achieved.

Measures were taken to reduce the chance that participants were induced to participate in the research for monetary gain. Compensation was not used to improve retention since participants were given compensation *prior* to commencing the survey. This reduced the pressure to complete the survey and participants were made fully aware that they could withdraw from the study at any time or refuse to answer particular questions without losing their payment. Participants also received sufficient information to consider both the benefits and risks of participating in the study, so that informed consent was not influenced solely by the offer of compensation.

It must also be considered at what point monetary gain from participation is undue influence. In the current study, it is considered that a \$10 supermarket voucher is less likely to distort candidate's judgements of the risks of participation, nor is it likely to interfere with informed consent. Firstly, money is not offered as a benefit but a voucher that can only be spent on obtaining supermarket goods. Secondly, the financial amount offered is only small and not considered to be a major financial incentive, but enough to be beneficial to compensate participants for 10-15 minutes of their time.

In terms of cultural considerations regarding the study and research process, the researcher has cultural competence and has completed study and workplace trainings on bicultural perspectives in psychology and cultural engagement. Therefore, the researcher has an appreciation of how to work respectfully with Maori and other ethnic groups, as well as marginalised groups in society. Further to this, consultation and on-going dialogue occurred with a Maori advisor throughout the research process to monitor and manage any identified cultural issues. Demographic data on ethnicity was collected and reported on though care was taken when presenting the findings of the research to ensure that no particular ethnic group was stigmatised. Ethnicity data was collected for the sole demographic purpose of describing the sample and to determine how the sample compares to the wider population. Generalisations are also made about the population as a whole. Legal and illegal drug use is an issue that occurs across all ethnic and class distinctions and it is assumed that there will be variability within the sample and between cultures in the results of the study.

## Chapter 3: Results

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### Introduction

The current chapter reports on the results of the study and begins by giving a description of the sample and how the sample compares to the drug user population in other studies conducted within New Zealand. It then proceeds to address each of the five research questions regarding the prevalence of synthetic cannabis use, effects of use, extent of dependency and psychological well-being of users, and association between synthetic cannabis and other illicit drug use. Further findings are reported in terms of the demographics by type of user. The final section of this chapter briefly reports on the clinical significance of the study in relation to the results.

### Description of the Sample

Table 3.1 illustrates the demographic makeup of the sample ( $N = 94$ ). The main characteristics identified were that 71 participants were male and 22 female, with one participant choosing not to state his/her gender. Ages ranged from 18 to 54 years ( $M = 29.4$ ,  $SD = 9.1$  years). Forty-nine percent of participants identified as New Zealand European, 49% as New Zealand Maori, and 2% as other. The sample was diverse in terms of employment and qualifications whereby 57% of participants were unemployed, 31% employed and 10% were students. In terms of the highest qualification that respondents had achieved, 43% had no school qualification, 27% achieved NCEA level 1 and above or equivalent, 22% had a trade or other professional certificate or diploma, and 1% had a university degree or diploma. The majority of participants (42%) received a government benefit as their source of income, 32% obtained income from employment, 10% from a student loan or allowance, and a further 10% received no source of income.

Table 3.1

*Demographic Characteristics of the Sample*

Demographic Characteristics	<i>N</i>	Percent (%)
N=	94	100
Gender		
Male	71	76
Female	22	23
Not specified	1	1
Age		
21 and under	19	20
22-34	48	51
35-44	19	20
45-54	8	9
Ethnicity		
NZ Maori	46	49
NZ European	46	49
Other	2	2
Highest Qualification Achieved		
No school qualification	43	46
NCEA level 1 and above or equivalent	27	29
Trade certificate, professional certificate or diploma	22	23
University degree or diploma	1	1
Not stated	1	1
Employment Status		
Unemployed	54	57
Employed	29	31
Student	10	11
Other	1	1
Source of Income		
Government benefit	42	45
Income from employment	32	34
Student loan or allowance	10	11
No source of income	10	11

The sample in the current study was compared with the drug user population of another study to determine whether the demographic makeup of the current study was comparable to research already conducted in the context of New Zealand. The demographics of the current study was compared with a sample of drug users interviewed in the 2007 Illicit Drug Monitoring System (IDMS; Wilkins, Girling, & Sweetsur, 2008). The IDMS is conducted regularly in New Zealand to examine drug use patterns and drug-related harm where approximately 300 drug users are interviewed from different parts of the country. The purpose of the IDMS study is to gather data to

inform responses to drug problems in New Zealand and how resources are allocated to treat drug users. The reason this study was selected for comparison is due to there being few other available studies on the drug-using populations in New Zealand. It is difficult to obtain participants to self-identify in illicit drug use research and this issue is discussed further in the discussion chapter as it is relative to the objectives and limitations of the current study.

In the 2007 IDMS study, the age of the drug users ranged from 16-58 years old. The median age of the whole sample was 28 years ( $M = 30$  years). In the current study, the age of drug users ranged from 18-54 years and the median age of the sample was 26 years ( $M = 29.4$ ,  $SD = 9.1$ ). The standard deviation of the 2007 IDMS study is unknown so it is difficult to accurately calculate whether there is a significant difference between the samples in terms of age. Given that the age range of the 2007 IDMS study was 16-58, and assuming that all data in the sample is within  $\pm 3$  SD from the mean, we can assume a standard deviation of 10 (Wilkins, Girling, & Sweetsur, 2008). A t-test was calculated comparing the two samples and found no significant differences between the current sample and 2007 IDMS study;  $t(413) = .05$ ,  $p = .6$ . Therefore, both samples are likely equivalent in terms of age. Due to respondents showing similarities in age between the two studies, this demonstrates that the demographic of the participants in the current study matches the age profile of one of the largest group of drug users in New Zealand.

Sixty-nine percent of drug users were male in the 2007 IDMS survey, which is also consistent with the demographic profile of drug users interviewed for previous IDMS national household drug surveys. In the current study, 76% of participants were male. When comparing this percentage with the one obtained from the 2007 IDMS study, using a two-sample test of proportions, it was observed that this difference is not statistically significant ( $z = 1.03$ ,  $p = .3035$ ). Therefore, both samples are also comparable in terms of gender.

The same cannot be said about ethnicity where in the 2007 IDMS study, the sample was heavily weighted towards New Zealand European respondents (80%), and only 15% were Maori. This differs from the current study and these differences in ethnic



distribution are statistically significant, meaning that the two samples are not comparable in terms of ethnicity;  $\chi^2(2, N = 94) = 46.72, p = .00$ .

There were also significant differences in employment status wherein the 2007 IDMS study, 46% of drug users were 'unemployed, sick, or invalid', 27% were employed and 20% were students  $\chi^2(3, N = 94) = 10.62, p = .01$ . Statistically significant differences in education were also observed between the two samples. In the 2007 IDMS study, 27% of drug users had no qualifications, 31% had a high school qualification and 20% a tertiary qualification as their highest educational qualification;  $\chi^2(3, N = 94) = 25.3, p = .00$ . Few similarities are drawn between the demographics of the current study and the IDMS study. Therefore, it can be said that the results of the current study are less likely to be generalizable to the wider population.

#### **What is the prevalence of synthetic cannabis use prior to and post-prohibition in a sample of individuals who have previously used synthetic cannabis?**

The first research question is intended to examine whether there is a difference in the prevalence of synthetic cannabis use prior to and after synthetic cannabis prohibition among participants.

Figure 3.1 further outlines the results of this comparison whereby there is a decrease in use across all frequency categories. Of note, is that daily use decreased by more than 50% following prohibition, and 52% of participants stopped using synthetic cannabis altogether. The graph suggests that the demand for synthetic cannabis use is still existent and that previous synthetic cannabis users continue to seek out synthetic cannabis, despite it now being illegal.

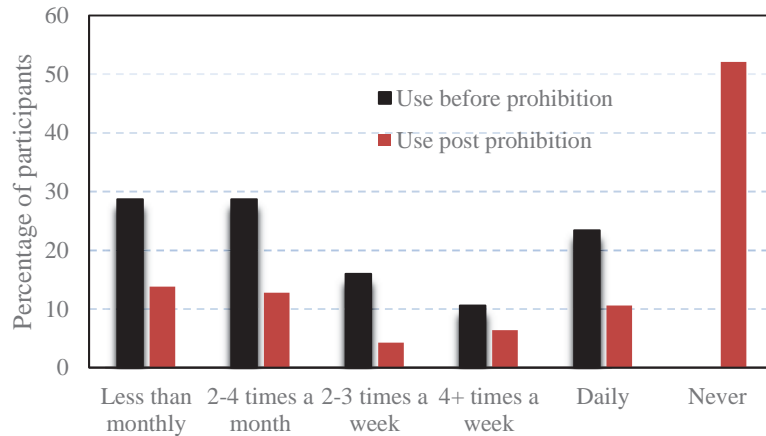


Figure 3.1. Frequency of use before synthetic cannabis was made illegal and use following prohibition.

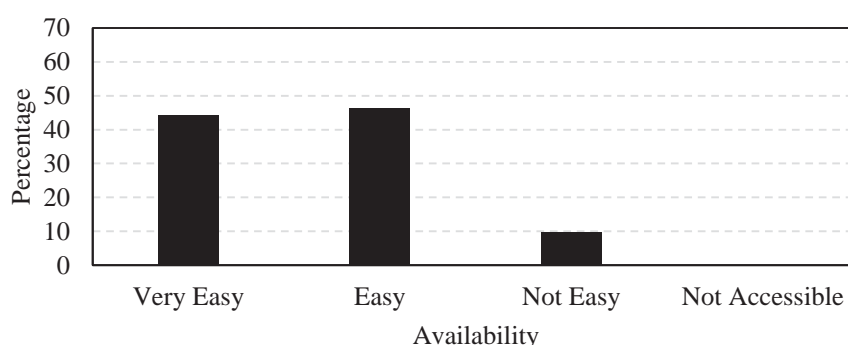
The mean score in the frequency of use pre-prohibition ( $M = 2.79$ ,  $SD = 1.54$ ), was considerably greater than the mean score in the frequency of use post-prohibition ( $M = 1.31$ ,  $SD = 1.74$ ), and using a paired  $t$ -test (Table 3.2), this difference was found to be significant;  $t(93) = 7.51$ ,  $p = .00$ . Therefore, we can conclude that there was a significant decrease in participant's frequency of use of synthetic cannabis after it was made illegal in New Zealand.

Table 3.2

*Paired Samples  $t$ -test for comparison between frequency of use pre- and post- synthetic cannabis prohibition.*

		Paired Differences					<i>t</i>	<i>df</i>	Sig. (2-tailed)
		<i>M</i>	<i>SD</i>	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	How often did you consume synthetic cannabis prior to it being made illegal on 8th May 2014?	1.48	1.89	.2	1.09	1.87	7.57	93	.00
	How often do you consume synthetic cannabis now?								

Twenty participants (21%) reported that using synthetic cannabis was their first experience with drug use, and thirty-eight participants (40%) indicated that they would continue to source synthetic cannabis illegally. The graph in Figure 3.2 summarizes responses to how easy participants believed it was to access synthetic cannabis at the present time (i.e., time of survey completion). The majority of participants believed that synthetic cannabis was either ‘very easy’ (44%) or ‘easy’ (46%) to source, despite it now being illegal. Of note, is that none of the participants reported that synthetic cannabis was ‘not accessible.’

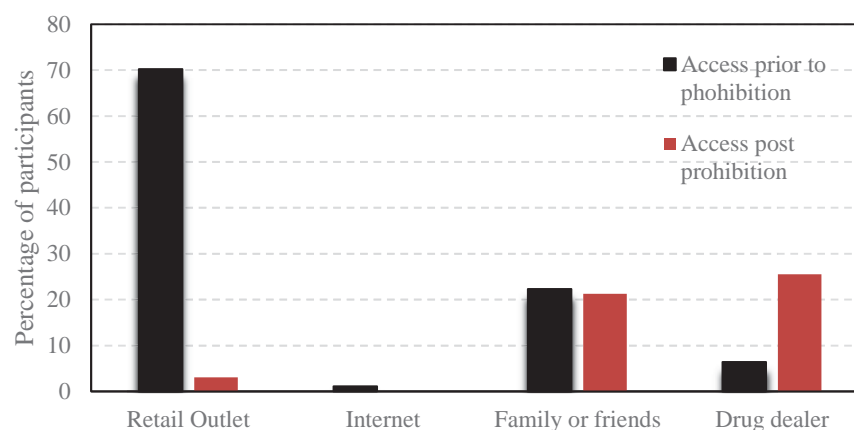


*Figure 3.2. Current availability of synthetic cannabis, 2015*

Participants were asked what their most common method was for obtaining synthetic cannabis when it was legal, and what their most common method was for sourcing synthetic cannabis following prohibition. These results are displayed in Figure 3.3. Synthetic cannabis products were most frequently obtained from retail outlets prior to prohibition (70%), and despite synthetic cannabis being made illegal in May 2014, a small number of participants reported that they continued to source synthetic cannabis from retail outlets (3%). This indicates that synthetic cannabis is still being sold in retail outlets, despite the introduction of the law prohibiting the sale, possession, and use of synthetic cannabinoids in New Zealand.

Of the participants who reported that they used synthetic cannabis post-prohibition, the largest population reported obtaining it through a drug dealer (25%), or from family or friends (21%). Family and friends played a consistent role in participants being able to obtain synthetic cannabis before and after synthetic cannabis prohibition, whereas drug dealers played a more significant role in providing users with synthetic cannabis following its illegalisation. Synthetic cannabis was not frequently purchased over the

Internet by users, which is a trend more commonly reported in overseas research (EMCDDA, 2009; Stephens, 2011; Vardakou, Pistos & Spiliopoulou, 2010; Winstock & Barratt 2013).



*Figure 3.3.* Methods for obtaining synthetic cannabis prior to and following synthetic cannabis prohibition.

### **What are the psychological and physiological effects of synthetic cannabis use?**

To answer research question two regarding effects of synthetic cannabis use, participants were asked whether they had experienced physiological and psychological symptoms following synthetic cannabis use and identified these symptoms from a list of 23 physical problems and 12 psychological symptoms. Negative physiological and psychological effects were experienced by 100% of the sample.

The subjective, physiological effects of synthetic cannabis use reported by participants are outlined in Table 3.3. The largest proportion of participants (66%) indicated that they experienced stomach pains/nausea/vomiting following the use of synthetic cannabis products. Over half of the participants reported less serious symptoms such as poor concentration (57%), sweating (55%), headaches (54%), and insomnia (54%). Almost one-third of participants (29%) experienced chest pain and shortness of breath. A small but concerning number of participants (9%) self-reported coma following synthetic cannabis use, and a further 7% of participants reported having experienced seizures following use.

Table 3.3

*Self-reported physiological effects of synthetic cannabis use*

Physiological Problem Experienced	<i>N</i>	Percent (%)
Stomach pains/nausea/vomiting	62	66
Poor concentration	54	57
Sweating	52	55
Headaches	51	54
Insomnia	51	54
Loss of energy	43	46
Dizziness	43	46
Poor appetite	38	40
Tiredness/drowsiness	38	40
Tremors/shakes	35	37
Blurred vision	30	32
Shortness of breath	27	29
Chest pain	27	29
Breathlessness	23	25
Loss of consciousness	22	23
Poor memory	21	22
Fainting	21	22
Teeth problems	16	17
Muscle aches	12	13
Harmful effect on lungs	12	13
Skin problems	11	12
Coma	8	9
Seizures	7	7

The subjective psychological effects of synthetic cannabis use are illustrated in Table 3.4 where the most common psychological symptom experienced by users was paranoia (68%). Other common psychological symptoms reported were anxiety/panic (59%), mood swings (51%), depression (50%), agitation (49%), and confusion (49%). A large portion of participants reported more concerning symptoms such as hallucinations (40%), and 19% reported psychosis.

Table 3.4

*Self-reported psychological effects of synthetic cannabis use*

Psychological Problem Experienced	<i>N</i>	Percent (%)
Paranoia	64	68
Anxiety/panic	55	59
Mood swings	48	51
Depression	47	50
Agitation	46	49
Confusion	46	49
Irritability	42	45
Hallucinations	38	40
Strange thoughts	32	34
Psychosis	18	19
Feelings of aggression	17	18
Loss of sexual desire	4	4

A further 14% of the sample reported ‘other’ outcomes following synthetic cannabis use, which consisted of both negative and positive responses. Positive outcomes noted were ‘good feelings’, pleasure, and increased confidence. Negative feelings reported were not being able to think or talk properly, heart palpitations, use of violence, bad withdrawal symptoms, and ‘feeling out of it’. Nearly a quarter of participants in the study (25%) reported that they had required emergency care following synthetic cannabis use.

**What is the extent of dependency among synthetic cannabis users?**

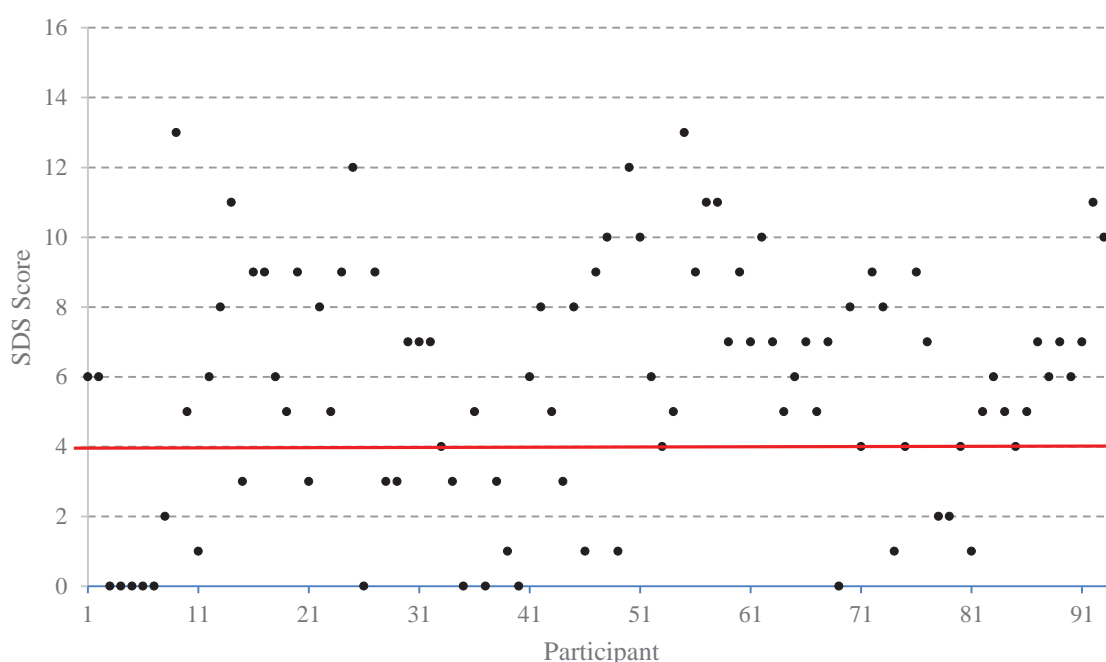
Research question three examined the extent of dependency among synthetic cannabis users, and the results of the Severity of Dependence Scale (SDS) are outlined in Table 3.5. Results indicated that 68 participants (72%) in the sample were classified as having been dependent on synthetic cannabis by scoring four or more over the five questions of the scale. The average SDS score was 5.83. Only 11% of participants had a combined score of zero on the SDS scale.

Table 3.5

*Results of the Severity of Dependence Scale*

	<i>N</i>	Minimum	Maximum	<i>M</i>	<i>SD</i>
SDS score	93	.00	15.00	5.83	3.57

Figure 3.4 notes the individual scores of each participant in the sample. The graph highlights the proportion of participants who met criteria for dependence and that the majority of participants displayed symptoms of dependence by scoring above 4 on the SDS. It also suggests that a large number of participants developed a very high level of dependency regarding their synthetic cannabis use.



*Figure 3.4.* Short Dependency Scale scores of synthetic cannabis users and severity indicator (score of 4 or higher).

The results for each of the five questions which make up the SDS are presented below. For the purposes of scoring the SDS, a ‘never/almost never’ or ‘not difficult’ response received a score of zero. The other response options were scored as 1, 2, or 3 respectively.

Participants were asked whether they thought their synthetic cannabis use was out of control. The extent that use was out of control was the most commonly endorsed dependence criteria with 41% of the sample reporting that they ‘often’ or ‘always’ believed that their use was out of control (Figure 3.5). One quarter of the sample (25%) answered that they ‘never’ felt that their synthetic cannabis use was out of control.

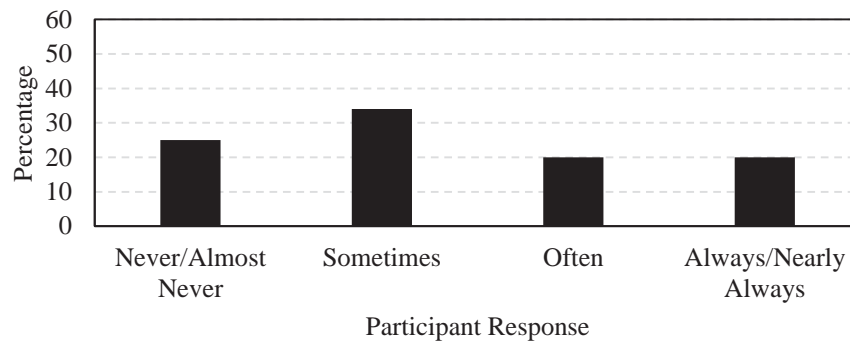


Figure 3.5. Extent that synthetic cannabis use was out of control

Participants were asked if the prospect of missing a dose of synthetic cannabis made them feel anxious or worried. The majority of participants (45%) reported that they ‘sometimes’ felt that the possibility of missing a dose of synthetic cannabis made them feel anxious (Figure 3.6). Fewer participants (22%) were either ‘often’ or ‘always’ anxious about this prospect.

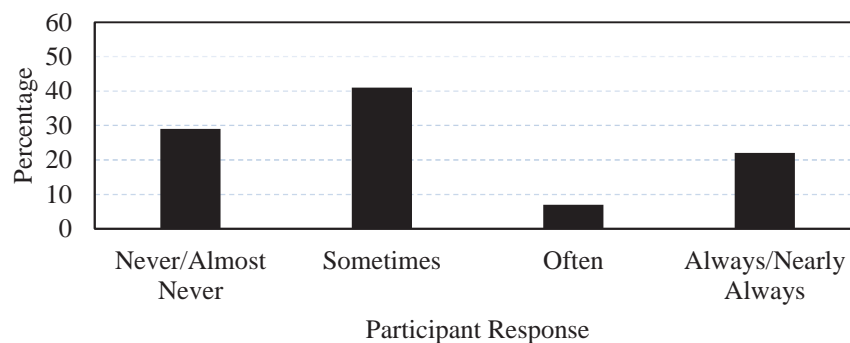


Figure 3.6. Prospect of missing a dose made you feel anxious or worried

Participants were asked if they worried about their synthetic cannabis use and 22% of respondents replied ‘never’ (Figure 3.7). Forty-three percent of participants ‘often’ or ‘always’ worried about their synthetic cannabis use.



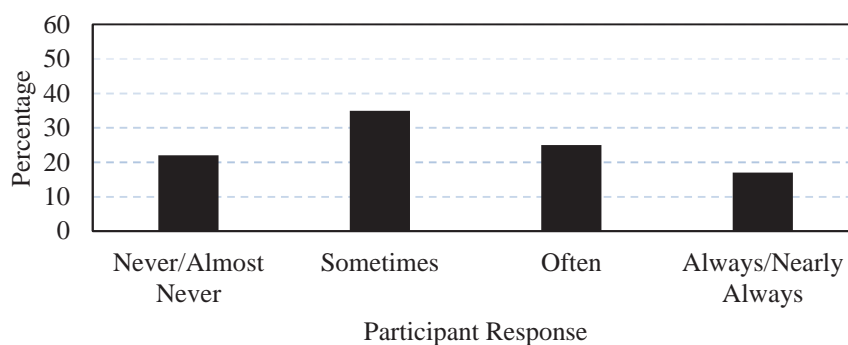


Figure 3.7. Worry about your synthetic cannabis use

Participants were asked whether they wished they could stop using synthetic cannabis. Desire to stop using synthetic cannabis was commonly reported and the majority of participants (41%) reported that they ‘sometimes’ wished that they could stop using the drug (Figure 3.8). Twenty-nine percent of participants reported that they ‘never’ felt inclined to stop using synthetic cannabis.

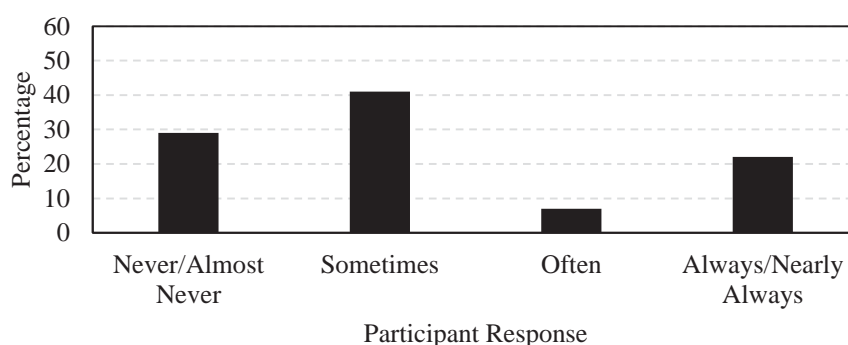


Figure 3.8. Wish you could stop using synthetic cannabis

Finally, participants were asked how difficult they would find it to stop or go without using synthetic cannabis. The majority of participants (39%) reported that it would not be difficult to discontinue using synthetic cannabis (Figure 3.9). Fifty-eight percent of participants found it ‘quite difficult’ or ‘very difficult’ to stop using synthetic cannabis. A small minority of participants (2%) found it impossible to cease or go without using synthetic cannabis.

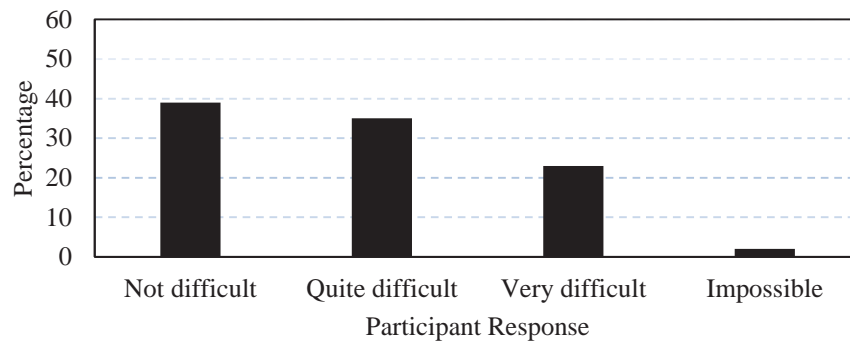


Figure 3.9. How difficult did you find it to stop using synthetic cannabis

### **What is the psychological well-being of synthetic cannabis users and other drug user groups within the sample?**

Research question four investigated the psychological well-being of synthetic cannabis users and other drug user groups within the sample. The Brief Symptom Inventory (BSI) was administered to assess participants' psychological symptomology and provide an overview of the severity of their symptoms. The results of the BSI scales are outlined in Table 3.6. As already noted in the methodology section, only 70 participants completed valid responses to be analysed using the BSI.

In terms of the BSI operational score for clinical significance, if a subject obtains a T-score greater than 63 in the Global Severity Index (GSI), or a score greater than 63 in any two of the five primary dimensions, then psychological well-being is considered to be compromised. Overall, the participants average symptom profile appears to be of a magnitude to be considered in the clinical range since the average GSI score of the sample is above 63 (64.83). The intensity of the distress scale is at a normative mean level.

Participants appear to have some evidence of psychological distress across all psychological domains since all average scores are elevated, and there are no domains where scores are below 50. However, because most scores, other than somatisation and obsessive-compulsive, are considered to be at normative mean levels (<63), they are essentially classified as clinically unremarkable.

The problematic psychological dimensions across the sample appear to be somatisation and obsessive-compulsive. Scores in areas of anxiety, hostility, and paranoia are approaching the clinical range but are not of sufficient magnitude to be clinically noteworthy.

Table 3.6

*Brief Symptom Inventory results displaying average T-scores for each psychological dimension*

Psychological Dimension	<i>N</i>	Minimum	Maximum	<i>M</i>	<i>SD</i>
Somatization (SOM)	70	41	80	63.59	11.61
Obsessive-compulsive (O_C)	70	38	80	63.69	11.54
Interpersonal sensitivity (I_S)	70	41	80	59.57	13.99
Depression (DEP)	70	42	80	60.91	12.31
Anxiety (ANX)	70	38	80	62.46	11.33
Hostility (HOS)	70	39	80	62.33	11.81
Phobic anxiety (PHOB)	70	45	80	60.46	12.81
Paranoid ideation (PAR)	70	42	80	62.01	11.37
Psychoticism (PSY)	70	46	80	60.41	12.90
General severity index (GSI)	70	38	80	64.83	11.69
Positive symptom distress index (PST)	70	36	80	63.39	11.97
Positive symptom total (PSDI)	70	41	80	59.67	11.93

Other notable aspects of the results are made when the BSI results are compared between the different drug user groups within the sample; current poly drug users, current drug non-users and current synthetic cannabis users. Participants were asked to describe their *current* drug use pattern, and a comparison between the BSI scores of each user group is summarised in Figure 3.5. The majority of respondents in the sample identified as poly drug users (56%), with 26% being non-drug users and 19% synthetic cannabis only users. Poly drug users and synthetic cannabis users appeared to have an elevated level of psychological distress across all psychological domains, compared to drug non-users.

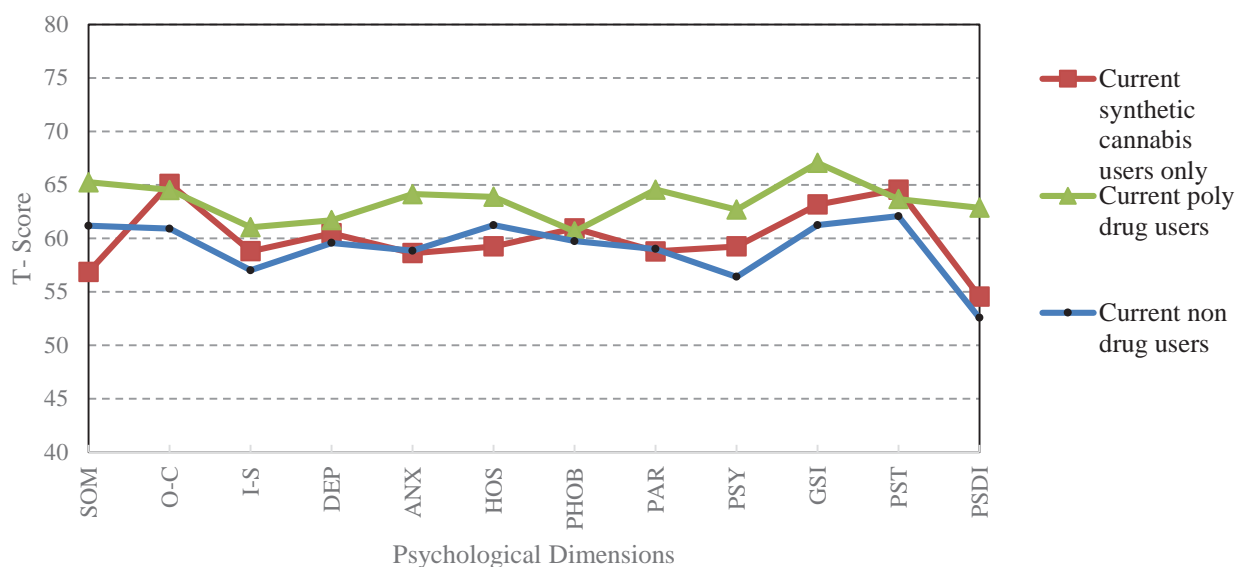


Figure 3.10. Brief Symptom Inventory clinical profile of respondents

A one-way analysis of variance (ANOVA) was conducted to determine whether there were any significant differences in psychological well-being between the three drug user groups. These results are outlined in Table 3.7. The only significant difference observed, at a 10% level, was for the Positive Symptom Distress Index (PSDI);  $F(2,66) = 2.92, p = 0.61$ , and this difference is between poly drug users ( $M = 62.33, SD = 11.13$ ) and synthetic cannabis only users ( $M = 54.26, SD = 11.1$ ). Although differences are noted in Table 3.10, where the mean of each psychological symptom is elevated across all psychological domains, it can be concluded that there were no significant differences observed in psychological well-being between individuals who used synthetic cannabis alone, those who were poly-drug users, and non-drug users.

Table 3.7

*ANOVA for differences in BSI scores between the drug user groups*

Psychological Dimension		Sum of Squares	df	Mean Square	F	Sig.
SOM	Between Groups	446.06	2	223.03	1.7	.19
	Within Groups	8646.14	66	131		
	Total	9092.2	68			
O_C	Between groups	317.14	2	158.57	1.19	.31
	Within groups	8819.67	66	133.63		
	Total	9136.81	68			
I_S	Between groups	239.36	2	119.68	.61	.55
	Within groups	13060.58	66	197.89		
	Total	13299.94	68			
DEP	Between groups	87.95	2	43.97	.28	.75
	Within groups	10221.36	66	154.87		
	Total	10309.3	68			
ANX	Between groups	28.45	2	14.23	.11	.9
	Within groups	8689.75	66	131.6		
	Total	8718.2	68			
HOS	Between groups	356.17	2	178.08	1.27	.29
	Within groups	9244.47	66	140.07		
	Total	9600.64	68			
PHOB	Between groups	96.21	2	48.11	.28	.75
	Within groups	11169.44	66	169.23		
	Total	11265.65	68			
PAR	Between groups	433.33	2	216.66	1.72	.19
	Within groups	8322.59	66	126.1		
	Total	8755.91	68			
PSY	Between groups	420.315	2	210.16	1.28	.28
	Within groups	10808.24	66	163.76		
	Total	11228.55	68			
GSI	Between groups	333.5	2	166.75	1.23	.3
	Within groups	8920.44	66	135.16		
	Total	9253.94	68			
PST	Between groups	70.52	2	35.26	.24	.79
	Within groups	9763.68	66	147.94		
	Total	9834.2	68			
PSDI	Between groups	792.17	2	396.09	2.92	.06
	Within groups	8966.78	66	135.86		
	Total	9758.96	68			

Table 3.8 outlines a comparison between the drug user groups and the percentage of participants who obtained a T-score greater or equal to 63 for each subscale, which is the cut-off score to be of a magnitude to be considered in the clinical range for psychopathology.

As expected, a high number of participants (64%) in the poly-drug user group had elevated GSI scores over or equal to 63, which indicates a high level and intensity of distress among this user group. There was a greater percentage of users in the synthetic cannabis group (46%) than the non-drug user group (39%) who had elevated GSI scores.

When comparing the psychological dimensions across each of the drug user groups, some clinically noteworthy observations can also be made. Firstly, a larger number of synthetic cannabis only users (54%) obtained higher T-scores on the anxiety scale, than any other drug user group. Further to this, when comparing the T-scores of the non-drug users and synthetic cannabis groups, the specific areas of psychopathology which appear to be problematic among the synthetic cannabis only users are somatisation, obsessive compulsive, interpersonal sensitivity, depression, anxiety and psychoticism, with some of these categories (somatisation, anxiety, psychoticism) having twice as many participants obtaining higher T-scores ( $\geq 63$ ) than the non-drug user group.

Table 3.8

*Comparison of Brief Symptom Inventory T-scores between drug user groups*

Brief Symptom Inventory Subscale	Current poly drug users $N= 39$ T-score $\geq 63$ Percent (%)	Current non-drug users $N= 18$ T-score $\geq 63$ Percent (%)	Current synthetic cannabis only users $N= 13$ T-score $\geq 63$ Percent (%)
Somatisation	56	18	46
Obsessive Compulsive	62	44	62
Interpersonal Sensitivity	44	28	38
Depression	54	22	38
Anxiety	44	22	54
Hostility	49	39	31
Phobic Anxiety	54	50	46
Paranoid Ideation	62	44	38
Psychoticism	56	17	38
Global Severity Index	64	39	46
Positive Symptom Total	56	44	54
Positive Symptom Distress Index	49	28	23

### **Is there an association between synthetic cannabis use and the subsequent use of other illicit substances?**

Research question five investigated whether there is an association between synthetic cannabis use and the subsequent use of other illicit substances. Participants were asked what drugs they had consumed prior to synthetic cannabis prohibition, and what drugs they use now (at the time of survey completion). Nearly all participants (90%) had used other illicit drugs prior to synthetic cannabis prohibition. Only 3% had started using synthetic cannabis prior to its illegalisation and progressed to other illicit drug use following prohibition.

The drug types used pre- and post-synthetic cannabis prohibition are illustrated in Table 3.9. These data exclude statistics for synthetic cannabis use and only capture other illicit drug use. Kava was removed from the analysis because it is currently a legal substance, and when used traditionally, it is a regulated food under the Food Standards Code (Food Standards Australia New Zealand Act, 1991).

Participants exhibited a diverse profile of drug use, as is typical for the drug user population. However, there was a noticeable decrease in the number of drug types used following synthetic cannabis prohibition. There was a strong preference for natural cannabis although there was still a major decline in the number of participants who used natural cannabis following synthetic cannabis prohibition. Approximately one-third of participants reported that they did not use any illicit substances after synthetic cannabis was made illegal.

Table 3.9

*Other drugs used by participant users before and after synthetic cannabis prohibition*

Drug Type	Percent (%) use pre-prohibition	Percent (%) use post-prohibition
Natural cannabis	83%	47%
Amphetamines (meth, P, pure)	34%	16%
Ecstasy (E, MDMA)	31%	9%
Ice (crystal meth)	30%	6%
LSD	27%	3%
Cocaine	18%	0%
Hallucinogenic mushrooms	17%	0%
Nitrous oxide	12%	0%
Other opiates	10%	1%
Rush (amyl nitrate, butyl nitrate)	6%	0%
GHB (gamma-hydroxybutyrate)	0%	0%
Other hallucinogens (PCP, datura)	0%	0%
None	0%	31%

It is important to note that the results in Table 3.9 only account for general use of a drug and do not account for the frequency of use. Respondents could also provide more than one response to each of the drug categories; hence the percentage columns in the table do not total 100%.

There was also a noticeable decrease in the frequency of substance use across all drug categories. A comparison was made between the frequency of drug use prior to synthetic cannabis prohibition ( $M = 3.79$ ,  $SD = 1.34$ ) and frequency of participant's current level of drug use ( $M = 3.05$ ,  $SD = 1.58$ ) by conducting a paired  $t$ -test. The results outlined in Table 3.10 indicate that there was a significant decrease in the use of other illicit drugs after synthetic cannabis was made illegal,  $t(74) = 3.73$ ,  $p = .000$ .



Table 3.10

*Paired Samples Test for frequency of other illicit drug use pre- and post- synthetic cannabis prohibition*

		Paired Differences				<i>t</i>	<i>df</i>	Sig. (2-tailed)	
		<i>M</i>	<i>SD</i>	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower				Upper
Pair 1	How often did you use the substance(s) outlined above? How often do you use these substance(s) now?	.73	1.7	.2	.34	1.13	3.73	74	.00

To further examine the association between synthetic cannabis use and other illicit substance use, participants were asked to select the category that best described their drug use. Results are displayed in Table 3.11. Of note, is that 21% of the sample reported that they started using synthetic cannabis but now only use other illicit drugs. Forty-seven percent of participants indicated that they used synthetic cannabis as an alternative to other illegal drugs when it was legally available on the market, but now that it is illegal, only 14% of participants substitute previous illicit drug use with synthetic cannabis.

Table 3.11

*Select the category that best describes your current drug use*

Category	<i>N</i>	Percent (%)
No drug use	26	28
Use both synthetic cannabis and other illegal drugs	23	25
Started using synthetic cannabis but now mostly use other illicit drugs	20	21
Have used illegal drugs but now use synthetic cannabis alone	14	15
Synthetic cannabis use only	9	10

Participants were asked how their use of illicit drugs had changed since synthetic cannabis was made illegal. Just over one quarter of participants (27%) reported that their overall level of drug use had increased since using synthetic cannabis while 42% indicated that their level of drug use had decreased. Approximately one third (32%) of participants reported that their level of drug use had not changed since using synthetic cannabis.

Following synthetic cannabis prohibition, nearly one third of participants (32%) tried methamphetamine and had not used this substance in the past. Fourteen percent of participants reported using methamphetamine as an alternative to synthetic cannabis now that synthetic cannabis is illegal.

### Demographics by Type of User

A major concern with legal synthetic cannabis was that they were widely used and accessed by younger people and other vulnerable populations who might be more vulnerable to the harmful effects of the drug. The following presents the demographic characteristics between the different drug user groups to further explore the validity of this concern.

One-way ANOVA (Table 3.12) was conducted to see whether there is a different mean age between poly drug users ( $M = 29.58$ ,  $SD = 9.85$ ), synthetic cannabis only users ( $M = 29.74$ ,  $SD = 9.1$ ), and current non-drug users ( $M = 27.77$ ,  $SD = 6.71$ ). There were no significant differences in age across the three types of user groups;  $F(2,89) = .42$ ,  $p = .66$ .

Table 3.12

*ANOVA for demographic characteristics between drug user groups for age*

		Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.
How old are you?	Between Groups	65.4	2	32.7	.42	.66
	Within Groups	7019.52	89	78.87		
	Total	7084.91	91			

In terms of ethnicity, looking at the cross tabulation in Table 3.13, we observe that across the three drug user groups there is a higher percentage of poly drug users among the Maori population (58%), compared to Europeans (33%). It is also noted that the percentage of non-drug users is also slightly higher among European participants (38%) compared to Maori (20%). The synthetic cannabis only user population was slightly higher among European's (29%) than Maori (22%).

Table 3.13

*What ethnic group do you most identify with? Cross tabulation by type of user*

What ethnic group you most identify with?		type of user			Total
		poly drug user	synthetic cannabis user only	non- drug user	
NZ Maori	Count	26	10	9	45
	% within What ethnic group do you most identify with?	58%	22%	20%	100%
NZ European	Count	15	13	17	45
	% within What ethnic group do you most identify with?	33%	29%	38%	100%
Other	Count	2	0	0	2
	% within What ethnic group do you most identify with?	100%	0%	0%	100%
Total	Count	43	23	26	92
	% within What ethnic group do you most identify with?	47%	25%	28%	100%

The Fisher's exact test results, illustrated in Table 3.14, indicates that these differences in ethnicity were observed to be statistically significant only at the 10% level;  $\chi^2(4, N = 92) = 7.22, p = .07$ .

Table 3.14

*Chi-Square Test for differences in ethnicity between drug user groups*

	Value	<i>df</i>	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson chi-square	8.12	4	.09	.07		
Likelihood ratio	8.98	4	.06	.05		
Fisher's exact test	7.22			.07		
Linear-by-linear association	.08	1	.78	.81	.42	.04
<i>N</i> of valid cases	92					

There were no significant differences in education across the three types of drug user groups. However, differences were observed between the three drug user groups in regard to employment status (see Table 3.15). Employed respondents consisted of a higher percentage of poly drugs users (65%) compared to the unemployed (42%), and students (20%). Students made up a higher percentage of participants from the synthetic cannabis use only drug user group (60%).

Table 3.15

*What is the highest qualification you have achieved? Cross-tabulation by type of user*

			type of user			Total
			poly drug user	synthetic cannabis user only	non-drug user	
What is the highest qualification you have achieved?	No school qualification	Count	19	10	12	41
		% within What is the highest qualification you have achieved?	46%	24%	29%	100%
	NCEA level 1 and above or equivalent	Count	13	7	7	27
		% within What is the highest qualification you have achieved?	48%	26%	26%	100%
	Trade certificate, professional certificate or diploma	Count	10	6	6	22
		% within What is the highest qualification you have achieved?	46%	27%	27%	100%
	University degree or diploma	Count	0	0	1	1
		% within What is the highest qualification you have achieved?	0%	0%	100%	100%
	Total	Count	42	23	26	91
		% within What is the highest qualification you have achieved?	46%	25%	29%	100%

The chi-square test in Table 3.16 indicates that the differences observed between the three drug user groups and their employment status are significant;  $\chi^2 (4, N = 92) = 10.38, p = .03$ .

Table 3.16

*Chi-Square Test for differences in employment status between drug user groups*

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson chi-square	11.83	4	.02	.02		
Likelihood ratio	10.96	4	.03	.04		
Fisher's exact test	10.38			.03		
Linear-by-linear association	.5	1	.48	.53	.27	.06
N of valid cases	92					

There were also significant differences observed across source of income;  $\chi^2 (6, N = 92) = 16.43, p = .01$ . As shown in Table 3.17, participants with income from employment were more likely to be poly drug users (69%) followed by individuals receiving a government benefit (43%). Participants receiving a student allowance had a higher percentage of synthetic cannabis only use, and participants with no source of income had a higher percentage of no drug use (60%).

Table 3.17

*What source of income do you receive? Cross tabulation by type of user*

What source of income do you receive?			type of user			Total
			poly drug user	synthetic cannabis user only	non-drug user	
What source of income do you receive?	Income from employment	Count	22	4	6	32
		% within What source of income do you receive?	69%	13%	19%	100%
	Government benefit	Count	17	11	12	40
		% within What source of income do you receive?	43%	28%	30%	100%
	Student loan or allowance	Count	2	6	2	10
		% within What source of income do you receive?	20%	60%	20%	100%
	No source of income	Count	2	2	6	10
		% within What source of income do you receive?	20%	20%	60%	100%
	Total	Count	43	23	26	92
		% within What source of income do you receive?	46%	25%	28%	100%

Table 3.18

*Chi-Square Test for differences in source of income between drug user groups*

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson chi-square	18.5	6	.01	.00		
Likelihood ratio	17.28	6	.01	.01		
Fisher's exact test	16.43			.01		
Linear-by-linear association	8.56	1	.00	.00	.00	.00
N of valid cases	92					

### Clinical Significance

Historically, the importance of statistical significance over clinical importance has been emphasised in the interpretation and reporting of research results. Statistical significance in the current study relates only to the likelihood that results obtained were not due to chance, and a significance level of  $p < .05$  was used for all inferences although results significant at a  $p < .10$  level were also reported. The researcher has used significance testing as one means to judge the clinical importance of comparisons made within the study.

Because the current study is not an intervention that is being tested, the importance of assessing the differences between evaluated groups is not undertaken to evaluate the effectiveness of an intervention. Instead, judgements are made about a particular drug that was used by participants, and the focus is, therefore, more on clinical relevance and whether the study is relevant to practice interests.

The study is relevant to practice interests, particularly of healthcare practitioners so they are better able to understand synthetic cannabinoids and be aware of treatment options for the toxic effects of consumption and in order to counsel their patients accordingly. The perspective of the participants in the study is also considered valuable in the determination of clinical importance. Little research has been conducted on synthetic cannabis within the context of New Zealand. Whether the current study produces similar findings to overseas research will also add credibility to the significance of the results.



## Chapter 4: Discussion

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### Introduction

This chapter presents the overall findings of the study with reference to the five research questions presented in Chapter 1:

- 1) What is the prevalence of synthetic cannabis use pre- and post-prohibition in a sample of individuals who have previously used synthetic cannabis?
- 2) What are the psychological and physiological effects of synthetic cannabis use?
- 3) What is the extent of dependency among synthetic cannabis users?
- 4) What is the psychological well-being of synthetic cannabis users and other drug user groups within the sample?
- 5) Is there an association between synthetic cannabis use and the subsequent use of other illicit substances?

The results are interpreted in the context of the research literature outlined in Chapter 1, and the extent to which each research question has been addressed will also be discussed. Limitations of the study and recommendations for future research are also considered, along with a final conclusion.

### Summary of Findings

#### *Description of the Sample*

There are no demographic or prevalence statistics available regarding synthetic cannabis users in New Zealand. Demographic statistics of the sample in the current study are described in the Results section of the study, and they indicate that synthetic cannabis users appear to be a heterogeneous group, as has been found in overseas research (EMCDDA, 2009; Vardakou et al., 2010). A central concern regarding synthetic cannabis was that products were widely used by adolescents who are particularly vulnerable to the harms of drug use and to persuasion and influence by media advertising (EMCDDA, 2009). Ages in the current sample ranged from 18 to 54 years, so this was not the case with the mean age of users being 29 years of age. However, it is noted that recruitment advertisements for the study were placed at social service

agencies where younger people are less likely to frequent; hence, this might explain why a younger demographic was not evident in the sample. There was an equal makeup of New Zealand European and Maori in the sample, which was unexpected given that Maori are over-represented in the drug user population (Ministry of Health, 2010). The sample was diverse in terms of employment and qualifications, but as anticipated, the sample had a high level of unqualified individuals, which can be expected for the drug user population and for individuals who frequent community support agencies.

The demographic characteristics of the different drug user groups and their *current* drug use pattern (polydrug users, synthetic cannabis only users, and current non drug users) was also examined. No significant differences in age across the three types of user groups were observed. There was a higher percentage of polydrug users among the Maori population compared to Europeans, and the percentage of non-drug users was greater among European participants. This statistic was not surprising since Maori are over-represented in drug, alcohol, and smoking statistics in comparison to Pākehā (Ministry of Health, 2010). However, these differences were only found to be statistically significant at the 10% level so should be interpreted with caution. Unexpectedly, significant differences were observed between the different user groups in terms of their employment status and source of income, and participants with income from employment were more likely to be polydrug users. It could be assumed that individuals would be less likely to use drugs if they are employed and more likely “functioning” members of society. However, it could also be supposed that some employed individuals have more disposable income to spend on psychoactive substances than those who are unemployed. Students were found to have a higher level of synthetic cannabis only drug use patterns. This is not surprising given that they have been found to be the group most vulnerable to synthetic cannabis use and that synthetic cannabis products have been evidently more popular among overseas college and university students (EMCDDA, 2009; Hu, Primack, Barnett, & Cook, 2011).

The demographic characteristics of respondents in the study were contrasted with another drug user group in a New Zealand-based study, the 2007 Illicit Drug Monitoring System (IDMS; Wilkins, Girling, & Sweetsur, 2008), to determine whether the demographic makeup of the current study was comparable to research already conducted in the context of New Zealand. As already noted in the Results section of the

current study, both samples were only equivalent in terms of age and gender. This suggests that the demographic of the participants in the current study matches the age and ethnic profile of one of the largest groups of drug users in New Zealand. The same could not be said about ethnicity, employment status, or education where statistically significant differences were detected. Overall, the sample in the current study is quite different from the 2007 IDMS study. Therefore, assuming that the 2007 sample is representative of the drug user population in New Zealand, this may indicate that the results of the current study are less likely to be generalizable to the wider population. The current sample appears to be less educated and more unemployed than the 2007 IDMS sample and appear to be a more marginalised people. This is not surprising given that participants were recruited from community support agencies; the study has likely attracted a segment of the population that is more disadvantaged due to the way in which the study was advertised. Further to this, although similar techniques were used in the IDMS study for recruitment (purposive sampling), the survey method used was a one-hour, in-depth, face-to-face interview, which may also have attracted a different demographic of participants compared to the current study where survey responses were kept completely anonymous.

***What is the prevalence of synthetic cannabis use pre- and post-prohibition in a sample of individuals who have previously used synthetic cannabis?***

- 1.1 It was expected that there would be a significant decrease in the use of synthetic cannabis post- prohibition.*
- 1.2 It was expected that there would still be a demand for synthetic cannabis following prohibition and that it would still be easily accessible to users.*
- 1.3 It was expected that participants would have a greater reliance on drug dealers to obtain synthetic cannabis following prohibition.*

One of the objectives of the current study was to examine whether the tighter regulation of synthetic cannabis has changed patterns of use and, in particular, whether there has been a reduction in use since prohibition. Synthetic cannabis was a rapidly emerging drug of abuse in New Zealand, and to date, whether prohibition has had a significant effect on patterns of use has been undetermined. To answer question one, and ascertain whether synthetic cannabis users had increased or decreased their synthetic cannabis use following prohibition, survey data were collected at two time intervals; retrospectively, consumption prior to synthetic cannabis prohibition on May 8, 2014, and current use,

which was at the time of survey completion, between March 27 and May 8, 2015. A straightforward comparison between frequencies of use in the two periods was undertaken to determine whether there had been a change in use pre- and post-prohibition.

Overall, the results of the current study indicated that there was a significant decrease in the use of synthetic cannabis post-prohibition. There was a decrease among all frequency groups (daily- less than monthly), but of importance was that there was over a 50% decrease in daily use and just over half of participants in the study reportedly stopped using synthetic cannabis altogether. This evidence suggests that synthetic cannabis prohibition has been an effective action taken by governing bodies in New Zealand to reduce the level of consumption. Specifically, the success of limiting the availability of synthetic cannabis through the application of the Psychoactive Substances Amendment Act (2014) demonstrates that regulatory approaches to prohibiting psychoactive drugs can be effective.

The current study did not investigate specific reasons why participants reduced or ceased synthetic cannabis use following prohibition, and there are various hypotheses about why prohibition might have been effective in reducing illicit drug use. The criminalization of synthetic cannabis might reduce use through the deterrent effect of punishment, restricted drug availability and the consequential increase in drug prices, and by promoting social norms against use.

#### *Deterrent Effect of Punishment*

Firstly, the legal system is a mechanism that can influence drug use whereby laws subject illicit drug users to the risk of arrest and legal punishment. This idea is underpinned by the concept of deterrence where it is hoped that the fear of punishment for drug use will act as a deterrent to users through raising the risk of arrest, criminal conviction, and imprisonment (Beccaria, 1963; Bentham, 1948). Therefore, the Psychoactive Substances Amendment Act (2014) and the enforcement of this law through policing achieve general deterrence and can discourage potential synthetic cannabis users from engaging in use. Deterrence can be even stronger when other social costs, such as relationships and other opportunities following arrest and prosecution, are higher (Gibbs, 1975).

It is also likely that strong enforcement will deter potential users from being involved in the illegal drug market (Bewley-Taylor, Hallam, & Allen, 2009). Prior to prohibition, recreational drug users might have appreciated avoiding the illegal drug market by using synthetic cannabis and being able to freely purchase their drug from a safe place in the community. Overseas research has supported this notion and found that before prohibition, many individuals indicated that they preferred the effects of natural cannabis, but chose to use synthetic cannabis because they were able to legally purchase it in the community and were motivated to conform with the law (Stephens, 2011). They favoured not needing to have contact with dealers or break the law to access psychoactive substances for personal use. Now that synthetic cannabis is illegal, the risk of punishment through the adult criminal justice system is a reality, and users will need to risk engaging with the black market to access synthetic cannabis if they wish to continue use.

The impact of prohibition and concept of deterrence may have different effects on different populations. While chronic illicit drug users may not regard legal penalties as a major deterrent to use (Weatherburn et al., 2003), prohibition may have been more effectual among individuals in the sample who had not previously used illegal drugs, or those who seldom used psychoactive substances. This is advantageous because it eliminates the risk to groups in society, such as new drug users, who may be vulnerable to progressing to harder drug use (i.e., gateway effects) following the initiation of experimental drug use.

#### *Effect of Law on Drug Availability*

Environmental factors, such as availability and price, can also be primary influences on drug use and drug-related harm (Reuter & Kleiman, 1986). In essence, drug laws and their enforcement are generally expected to reduce the availability of drugs and make them more expensive to purchase, thereby reducing opportunities for consumption. Prior to prohibition, overseas research noted that synthetic cannabis was mainly attractive to consumers due to its affordability and accessibility (EMCDDA, 2009). Since synthetic cannabis has been made illegal, it has been removed from the licit market, and such a ban has likely made it more expensive and inconvenient to source and purchase. However, results of the study indicated that a large majority of

participants found synthetic cannabis either ‘very easy’ or ‘easy’ to access. No participants reported that synthetic cannabis was ‘not accessible’ and these statements were made approximately one year following synthetic cannabis prohibition. This might suggest that an availability effect was not solely associated with a decline in synthetic cannabis use among users in the sample and that synthetic cannabis prohibition in itself will unlikely eliminate use. Overall, it is considered that the illegalisation of synthetic cannabis and eliminated market availability will likely serve to prevent a new generation of younger people having access to legal psychoactive drugs and becoming accustomed to using substances during social and recreational activity.

#### *Effect of Law on Promoting Social Norms against Drug Use*

A final reason considered regarding why prohibition may have served to reduce synthetic cannabis use is that making synthetic cannabis illegal to possess and consume promotes social norms against use. Prior to its illegalization, having synthetic cannabis legally available on the market could have implied normality and safety, and made it appear as a legitimate drug to use. In some cases, it may have even encouraged use (Smith, 2002). The moral force of the law can be instrumental for those individuals who might be influenced less by sanctioning risks and more by their own beliefs about the morality and appropriateness of illicit drug use (Etzioni, 1988).

Social norms can either promote or discourage drug use but this can depend on their source. Cialdini et al. (1991) has made a distinction between two different types of social norms—injunctive norms and descriptive norms. Injunctive norms are an individual’s beliefs about how other people think they should behave, and different reference groups (e.g., peers, siblings, media, and gang culture) communicate different injunctive norms. The influence of injunctive norms varies with the individual’s association and motivation to comply with the source (Hirschi, 1969). Descriptive norms are an individual’s beliefs of how his/her reference groups behave and provide contextual cues about appropriate and acceptable behaviour according to the reference group, as well as a powerful means for learning (Cialdini et al., 1991). For example, if some synthetic cannabis users learn that other associates continue to use synthetic cannabis and break the law, then they too are more likely to break the law. The immediate social context of an individual and the beliefs and morals established within

that environment will also influence an individual's behaviour and motivation to comply with prohibition.

To what extent could the decline in synthetic cannabis use detected in the sample be attributed to another trend in drug use in New Zealand? Findings indicate that there was not only a decrease in the use of synthetic cannabis following prohibition, but a significant decrease in the frequency of substance use across all illicit drug types in the sample. This raises questions about whether the trend observed was due to synthetic cannabis prohibition alone, or whether it was part of a broader decline in illicit drug use in the general population. To further examine this potential, a comparison was made between the impact that prohibition had on the most recent popular psychoactive drug that was available on the New Zealand market, benzylpiperazine (BZP) party pills. Wilkins and Sweetsur (2013) examined the effects of prohibition on the prevalence of BZP use and found that BZP party pill use fell from 15% in 2006 to 3% in 2009, which suggests that prohibition contributed to a decline in BZP use. Given that there were similar levels of reduced drug use in the current sample, this provides further evidence that prohibition has been instrumental in reducing the use of synthetic cannabis.

#### *Further Findings*

Drug prohibition can impact the way a drug is manufactured, distributed, and sold (Kilmer et al., 2010; Reuter, 1983). Forty percent of participants reported continued use of synthetic cannabis following the prohibition of these products and their constituents. They indicated that they would continue to source synthetic cannabis illegally, which suggests that there is still a demand for synthetic cannabis, and likely an established black market for the drug. Results did support that participants had a greater reliance on drug dealers to obtain synthetic cannabis following prohibition. Family and friends played a consistent role in participants being able to access synthetic cannabis pre- and post-prohibition. As expected, retail outlets were the main source for obtaining synthetic cannabis prior to prohibition, but interestingly, following illegalisation, a small number of retail outlets were reportedly still illegally selling the drug to users. Overseas research has also confirmed an ongoing demand for synthetic cannabis products and users continuing to seek out synthetic cannabis drugs after they have been made illegal and banned from the marketplace (Vandrey, Dunn, Fry, & Girling, 2012).



A large number of participants had only used synthetic cannabis on a few occasions prior to synthetic cannabis prohibition (i.e., 29% of participants less than monthly). This, coupled with the significant decrease in synthetic cannabis use after it was made illegal, suggests that the use of synthetic cannabis may have been a phase of experimentation for many participants. Such experimentation may have partially been attributed to the drug being legal and easily accessible and the concern with the opportunity to experiment with legal psychoactive substances is that it may lead some experimental users to become vulnerable to further and continued substance use. This potential will be addressed further in the current chapter in reference to research question five regarding the use of synthetic cannabis and potential drug progression effects.

The opposition to prohibition must also be acknowledged in reference to the findings regarding research question one. It was reported in the literature that prohibition can fail to reduce illicit drug use and can produce other negative outcomes such as subjecting users to risk of arrest and legal punishment (Haden, 2008; Moore, 1990; Smith, 2002; United Nations, 2008). It was also believed that prohibition would lead to an increase in synthetic cannabis use patterns due to creating a “forbidden fruit”-like effect where using the drug is associated with rebellion (MacCoun, 2010; Wilkins & Sweetser, 2013). The results of the current study clearly refute these arguments, but data about whether those participants who continue to use synthetic cannabis have been punished through the criminal justice system is unknown. A further concern was that the risk of prohibition would encourage those who continue to source synthetic cannabis to initiate contact with drug dealers or associates who expose them to more harmful substances alongside synthetic cannabis (Macgregor & Payne, 2013). While some users did rely more on drug dealers following prohibition, the majority of participants stopped using synthetic cannabis, and the overall use of illicit substances also decreased.

A harm reduction approach needs to be considered with respect to the remaining concerns about the negative effects of synthetic cannabis prohibition. The results of the current study indicate that the use of synthetic cannabis has caused major psychological and physiological consequences to users. It is considered that the legal consequences of illicit synthetic cannabis use and risk of punishment to individuals is far less harmful



than having the drug legally available on the New Zealand market where a wider number of individuals can be exposed to its toxic effects.

***What are the psychological and physiological effects of synthetic cannabis use?***

- 2.1 It was expected that synthetic cannabis users would commonly experience adverse physical harms, with some effects of intoxication being severe.*
- 2.2 It was expected that synthetic cannabis users would also experience harmful psychological effects.*
- 2.3 It was expected that a small number of participants would have required emergency care following synthetic cannabis use.*

Research question two examined the psychological and physiological effects of synthetic cannabis use by participants. To address research question two, a measure of 23 physiological and 12 psychological symptoms were administered where respondents were asked if they had experienced any of the listed symptoms from consuming synthetic cannabis over their lifetime.

A wide range of adverse physical effects were self-reported by participants with the majority of participants reporting stomach pains, nausea, and/or vomiting following use. A small number of participants (9%) reported other outcomes of concern following synthetic cannabis use such as coma, chest pain, breathlessness, loss of consciousness, and harmful effect on lungs. The available literature outlining both the reported psychological and physiological effects of synthetic cannabis are fairly small, so few comparisons have been able to be completed; the value of the current study is that it expands on this deficit. Despite this, the spectrum of physiological effects experienced by participants is consistent with the available research literature where the physical harms associated with synthetic cannabis intoxication have been most commonly noted as vomiting, seizures, elevated heart rate, and coma (Castellanos & Thornton, 2012; Grigoryev, Savchuk, Melnik, Moskaleva, Dzburko, & Ershov, 2011; Missouri Department of Health, 2010; Muller, Sperling, Kohrmann, Huttner, Kornhayber, & Maler, 2010; New Zealand Drug Foundation, 2013; Robinson et al., 2010; Schneir, Cullen, & Ly, 2010; Wells & Ott, 2011).

Some of the physiological symptoms reported by participants were of concern and, in some cases, life-threatening. In particular, 7% of the sample self-reported having experienced a seizure. A high rate (18%) of seizures following synthetic cannabis use has been noted in overseas research (Bleeker, 2013), and it has been concluded that synthetic cannabis places users at a greater risk of experiencing a seizure than natural cannabis does (de Havenon et al., 2011; Hoyte et al., 2012; Schneir & Baumbacher, 2012). This is likely due to natural cannabis containing chemical properties that serve as an anti-convulsant; synthetic cannabis does not have this chemical component. The incidence of seizures is of particular concern since the brain is deprived of oxygen and glucose, which carries a risk of permanent brain damage. A caution has been issued in previous research warning that synthetic cannabis use may lead to serious and possibly irreversible neuropsychological damage (McNeilly, 2011). Of concern is that now synthetic cannabis is illegal, and it is likely being manufactured in an uncontrolled environment, products may be more likely to be contaminated with other unidentified substances and larger doses sold to users.

The most commonly reported psychological symptom following synthetic cannabis consumption reported by participants was paranoia, which is a common symptom of drug use in general, and approximately half of participants experienced anxiety, mood swings, depression, agitation and confusion. This is expected given that the CB1 and CB2 receptors are predominantly located on central and peripheral nerve terminals and are responsible for inducing anxiety and panic emotive responses (Stephens, 2011). The more concerning alterations in psychological state noted by participants were hallucinations and psychosis, and this will be discussed further when addressing research question four regarding the psychological well-being of synthetic cannabis users. These results are consistent with findings in other research literature where synthetic cannabis intoxication has been frequently found to produce a range of harmful psychological effects including psychosis, severe agitation, anxiety and panic, paranoia, delusions, and hallucinations (Castellanos & Thornton, 2012; Grigoryev, Savchuk, Melnik, Moskaleva, Dzhurko, & Ershov, 2011; New Zealand Drug Foundation, 2013; Wells & Ott, 2011).

Of major concern was that one quarter of participants (25%) reported that they had required emergency care following synthetic cannabis use, and many of the symptoms

reported by participants were consistent with toxicity reported by hospital emergency departments (Goodwin, 2012; Harris & Brown, 2013). It must be acknowledged that the co-ingestion of synthetic cannabis with other substances may be a factor influencing many of the hospital presentations. It has been reported in the media that emergency department specialists have described synthetic cannabis as the most toxic and harmful synthetic drug they have witnessed in patients presenting for emergency treatment (Goodwin, 2012), so it is not surprising that many participants had experienced hospital admission following synthetic cannabis use.

Some of the physiological and psychological symptoms reported by research participants may be markers for addiction. The current research literature documents the withdrawal effects following synthetic cannabis use as anxiety, paranoia, panic attacks, problems with memory and concentration, confusion, disorientation, fear of dying, rapid heart rate, insomnia, difficulty breathing, constipation, nausea, problems with eating, and weight loss (EMCDDA, 2009). These symptoms were commonly reported by participants in the current study and are indicative of addiction. Synthetic cannabis dependency will be discussed further in the following section of the current chapter and is addressed by research question three.

From the results of the physiological and psychological screen, it can be concluded that synthetic cannabis is similar to other illicit substances in that it is associated with similar risks of harm. However, in terms of the severity of harm, it can be argued that the harm profile of synthetic cannabis is greater than the harm profile of other illicit drugs. In comparison to natural cannabis, there appears to be some overlap in the adverse effects experienced by users, although the prevalence and severity of harm appear to be higher in individuals who use synthetic cannabis. Research on the effects of natural cannabis use appears to report more *positive* physiological and psychological acute side effects following consumption such as euphoria, relaxation, intensification of sensory experiences, and perceptual alterations (Hall, Solowij, & Lemon, 1994); very few positive effects were reported by users in the current study. Research has associated heavier natural cannabis use with poorer lung function and greater airway abnormalities (Bloom et al., 1987; Tashkin et al., 1990). Approximately one-third of participants in the current study also experienced physiological effects associated with lung issues, including shortness of breath, chest pain, and breathlessness. Research indicates that the

most common adverse effects of natural cannabis use are anxiety and panic reactions (Hall & Pacula, 2003), which is similar to the psychological effects reported in the current study; anxiety and panic was the second most common reported symptom experienced by 59% of participants. Larger doses of natural cannabis are required to produce psychotic symptoms, including confusion, amnesia, hallucinations, and delusions (Chopra & Smith, 1974; Hall & Degenhardt, 2009; Hall & Pacula, 2003; Hall & Solowij, 1998), but overall, psychotic reactions from natural cannabis use are considered rare and remit rapidly after abstinence from use (Hall, Solowij, & Lemon, 1994). Incidence of psychosis in the current study was more common among synthetic cannabis users whereby a large number of participants reported experiencing psychosis and other psychotic symptoms such as strange thoughts (34%) and hallucinations (40%). The risk of harm associated with synthetic cannabis use is likely amplified due to the high chemical concentration of synthetic cannabis (Gibson, Peterson, & Walsh, 2013; Uchiyama et al., 2010), and can be attributed to most synthetic cannabis compounds being full agonists; they occupy the cannabinoid receptor with a stronger binding affinity than natural cannabis (Grigoryev, Savchuk, Melnik, Moskaleva, Dzhurko, & Ershov, 2011). THC in natural cannabis is a partial agonist and, therefore, has a less acute effect than synthetic cannabis.

It is thought-provoking to consider the adverse effects experienced by synthetic cannabis users within the context of the harm reduction argument employed by synthetic cannabis manufacturers and representatives who publically defended their products and claimed that synthetic cannabinoids served as a harm reduction tool that provides recreational drug users with a *safer* alternative to psychoactive drug use. Any participant experience of the use of synthetic cannabis with no obvious ill effects may appear to support this argument, and contradict the strong negative publicity directed against synthetic cannabis use in general. This was not the case since every participant in the sample noted at least one adverse psychological or physiological symptom experienced following synthetic cannabis use. In fact, results suggest that synthetic cannabis users have experienced very serious side effects, both physically and psychologically, including outcomes more severe than other illicit drug use. It was also evident in the results that the overall level of illicit drug use, including methamphetamine, decreased following synthetic cannabis prohibition and that the incidence of synthetic cannabis dependency, which carries its own harms and effects on

physical, psychological, and social health, was also at a high level in the sample. Overall, in reference to the legality and perceived safety of synthetic cannabis, when it was legally available on the New Zealand market, the results regarding the psychological and physiological effects of use support that ‘legal’ does not mean ‘safe’ in the case of synthetic cannabis.

The findings of the current study only provide an indication of the presence of physiological and psychological problems related to synthetic cannabis use. It should be noted that it is difficult to attribute many of the reported effects of use of synthetic cannabis alone since a combination of synthetic cannabis consumption along with the concurrent use of other substances may have produced the effects reported. Other factors (e.g., health conditions, lack of sleep, or dehydration) may also contribute to negative experiences following drug use. Due to participants not having been monitored during or following drug intoxication, and due to the way the survey questionnaire was constructed to assess effects of use, it is also not known whether the negative physiological and psychological effects experienced by participants were present at the time of intoxication, or whether they extended well into the following days/weeks following consumption. The long-term effects of synthetic cannabis use are also unknown due to the short duration in which synthetic cannabis products have been in existence. However, it is expected that the clinical effects of potent cannabinoid receptor agonists will lead to serious outcomes with excessive use. A more in-depth investigation into the severity of both the physiological and psychological effects following synthetic cannabis use is required.

### ***What is the extent of dependency among synthetic cannabis users?***

#### ***3.1 It was expected that there would be a high level of dependency among participants who had previously used synthetic cannabis.***

To answer research question three, the Severity of Dependency Scale (SDS) was administered to examine the number of participants who had experienced symptoms of synthetic cannabis dependency. Results indicated that the majority of participants (72%) met the criteria for synthetic cannabis dependence. Not only did a large number of

participants experience issues with synthetic cannabis dependence, but a concerning number of participants developed a *high* level of dependency.

In examining the answers for the individual questions of the SDS, the results revealed a high level of individual concern about participants' synthetic cannabis use. The extent that use was out of control was the most commonly endorsed dependence criterion, which is a significant indicator of addiction, along with anxiety experienced over missing a dose of synthetic cannabis, which was reported at a moderate to strong level by over half of participants. Numerous participants also worried about their synthetic cannabis use and desire to stop using was reported by almost half of participants. The results suggest evidence of a physical craving related to synthetic cannabis use since over half of the participants reported that they would find it difficult to stop or go without synthetic cannabis.

The results regarding dependency among users are consistent with findings from other research studies and media reports indicating that the use of synthetic cannabis can lead to addiction syndrome (Gonzalez, 2007; Stephens, 2011; Vardakou, Pistos, Spiopoulou, 2010; Winstock & Barratt, 2013; Zimmerman et al., 2009). The time taken for dependency to establish was not explored in the current study, but research has noted that tolerance to synthetic cannabinoids can develop quickly and lead to a greater risk of addiction (Bergen, 2010). This finding is of concern given that drug dependence has been found to be rare in other illicit substance use, such as natural cannabis (Hu, Primack, Barnett, & Cook, 2011).

There are neuropsychological explanations for why drug dependency might be stronger among synthetic cannabis users. Synthetic cannabis exerts similar effects on the brain's reward pathway to other addictive drugs, which makes it more powerful in the development of drug dependency (Gonzalez, 2007). These effects have been discussed in greater depth in the literature review, but ultimately the effects of synthetic cannabis intoxication are influenced by neurotransmitters; specifically, dopamine, GABA, and glutamate, which have a major influence on mood and motivation and influence the reinforcing and rewarding effects of synthetic cannabis use. Given that some of the chemical compounds used in synthetic cannabis are three to five times more potent than

THC in natural cannabis (Bergen, 2010), it is not surprising that synthetic cannabis use can result in high levels of dependency among users.

It is interesting that despite the high rates of dependency detected in the sample that so many participants decreased or stopped using synthetic cannabis following prohibition. If a strong psychological or physical dependence were fostered following the use of synthetic cannabis, it is assumed that it would be more difficult and less likely that users would be able to cease use following a change in the law. It is possible that prohibition in itself was effective in reducing levels of use, and/or it was easier for participants to stop using given the adverse physical and psychological effects experienced by users in the sample, as noted in the previous section and addressed through research question two. It would have been helpful to further determine whether the potential for synthetic cannabis dependency was higher for new users, or whether levels of dependency were high only for chronic or regular synthetic cannabis users.

Overall, the results indicated that synthetic cannabis has a high dependency potential, which is of concern when considering the potential outcomes of drug dependency and areas of life harmed, which are not captured in the current study. The effects of addiction and withdrawal can have a major impact on an individual's motivation and attention, and affect his or her ability to operate sufficiently in an academic or employment setting. Addiction can also have major consequences for social functioning if individuals are using synthetic cannabis at the expense of other important activities. More deaths, illnesses, and disabilities stem from substance dependence alone than from any other preventable health condition (Gateway Foundation, n.d.), and individuals who live with substance dependence have a higher risk of other negative outcomes including unintentional physical and accidental injuries, internal injuries to body and organs, increased risk of domestic violence, pregnancy, sexually transmitted diseases, risk of exposure to other infectious diseases, increased vulnerability to mental illness and stress, relationship breakdown, legal and financial issues, and homelessness (Gateway Foundation, n.d.; Reachout, 2013). The consequences of such outcomes can have a major negative impact on daily functioning and overall well-being and could even result in premature death. These concerns are all relevant to synthetic cannabis since a high potential for drug dependency among users has been established.



Due to the high rates of synthetic cannabis dependency detected in the current study, a strict drug policy, such as one incorporating the Psychoactive Substances Act (2013) and Psychoactive Substances Amendment Act (2014), is considered beneficial. The extent of dependency among synthetic cannabis users should be continued to be studied and monitored since the levels of dependency may increase as users experience heavier or prolonged use over time. It has only been just over one year since synthetic cannabis was prohibited so research on the effects of long-term exposure would be valuable.

***What is the psychological well-being of synthetic cannabis users and other drug user groups within the sample?***

*4.1 It was expected that current synthetic cannabis users in the sample would have an elevated level of psychological distress than current non-drug users.*

*4.2 It was anticipated that problematic areas of symptomology for synthetic cannabis users would be anxiety, depression, paranoia and psychosis.*

*4.3 It was also expected that there would be some participants in the sample who experienced psychotic symptomology relating to their synthetic cannabis use and that current synthetic cannabis users would have a greater incidence of psychotic symptoms than current non-drug users.*

Research question four investigated the psychological well-being of synthetic cannabis users and other drug user groups within the sample. The Brief Symptom Inventory (BSI) was administered to assess participants' psychological symptomology and provide an overview of the severity of their symptoms.

Overall, the sample had an elevated level of global psychological distress, which might be expected of a group of individuals who had previously used psychoactive substances, many who self-identified as regular and poly- drug users. It is likely that participants in the sample who have substance use issues have higher rates of psychological distress since epidemiological studies have demonstrated that there is a high rate of comorbidity between substance use disorders and other psychological disorders (Kushner et al., 1990).

Across the whole sample, participants demonstrated elevated levels of psychological distress over all psychological domains but results were clinically remarkable for



somatisation and obsessive-compulsive domains. It was not expected that these areas of psychopathology would be as problematic as other psychological symptoms associated with drug use, such as anxiety, depression, paranoia, and psychosis, which were problematic psychological effects of synthetic cannabis use reported by participants for research question two and are common psychological symptoms experienced by substance users in general (Castellanos & Thornton, 2012; Wells & Ott, 2011). It is noted that the BSI scores for anxiety, hostility, and paranoia did approach the clinical range, but were not of sufficient magnitude to be clinically noteworthy. Of consideration is that the BSI assesses psychological symptomology within 7 days prior to test administration so while many participants self-identified as having experienced adverse psychological symptoms from their drug use for research question two, these were experiences of the past and many participants now self-identified as current non-drug users.

The overall group means of the BSI actually provided little benefit to the study since negative results detected across the sample were likely an indication of poor psychological well-being of drug users, in general, as opposed to synthetic cannabis use alone. Therefore, further comparisons were made between the BSI results of the different drug user groups within the sample; current polydrug users, current non-drug users, and current synthetic cannabis users.

Polydrug users followed by synthetic cannabis users appeared to have an elevated level of psychological distress across all BSI domains, compared to the non-drug users. However, there were few significant differences detected between these groups across all nine psychological domains. Again, it can be argued that drug users, in general, have poorer psychological well-being, as opposed to any specific user group, but it was expected that polydrug users would have demonstrated the highest levels of psychological distress since research has supported that individuals who abuse multiple substances experience a higher level of drug-related harm and increased levels of psychopathology and symptomology (Sumnall, Wagstaff, & Cole, 2004).

This then raises questions as to whether the BSI assessment was an accurate and reliable measure to use for assessing the psychological well-being of participants in the current study. The Cronbach's alpha test that was performed to assess the reliability of the BSI and confirmed that the scale had very good overall internal consistency and reliability,

and it is therefore assessed as an appropriate tool to address research question four. There is no outstanding research literature to refer to or make comparisons in regard to BSI outcomes for synthetic cannabis user populations. Hence, the replication of the current study is required to ascertain whether the results are coincidental, and to provide more insight into the research objectives under investigation for research question four.

A further and final comparison was made between current non-drug users and current synthetic cannabis users to obtain a clearer idea of the psychological effects of synthetic cannabis use alone. A central finding was that a greater percentage of users in the synthetic cannabis group than the non-drug user group had elevated GSI scores (i.e., greater overall levels of psychological distress). Another noteworthy observation that was made was that a large number of synthetic cannabis only users (54%) obtained higher T-scores on the anxiety scale than any other drug user group. This was expected given that anxiety was the second most common self-reported psychological effect of synthetic cannabis use reported by 59% of participants in the sample for research question two. Anxiety has also been a frequently reported symptom in individuals presenting to hospital emergency departments (Harris & Brown, 2013), and in overseas and New Zealand-based literature regarding the effects of synthetic cannabis use (Castellanos & Thornton, 2012; Grigoryev, Savchuk, Melnik, Moskaleva, Dzhurko, & Ershov, 2011; New Zealand Drug Foundation, 2013; Wells & Ott, 2011). Other specific areas of psychopathology that appear to be problematic among the synthetic cannabis only users are somatisation, anxiety, and psychoticism, which had twice as many participants obtaining T-scores equal or higher than 63 compared to the non-drug user group. It is impossible to distinguish a causal direction using the present retrospective study design, but it can be hypothesised that the findings represent premorbid traits among the synthetic cannabis only user group relating to their drug use. This outcome might be reflective of a dose-response relationship.

It is considered that there are two possible explanations for those individuals who displayed clinical noteworthy outcomes and two different substance user typologies: (a) participants who displayed elevated levels of psychological distress that preceded their substance use or (b) participants with a substance-related psychological distress. Whether the psychological distress reported in the BSI is associated with an increased risk of experimenting with psychoactive substances and developing substance abuse problems, or whether the direct use of a substance causes psychological distress, is

unknown and has not been confirmed in other research studies (Lynskey & Ferguson, 1995). The precise causal relationship is difficult to determine and was not examined in the current study.

#### *Incidence of Psychotic Symptomology*

The measure of psychoticism in the BSI is of particular interest in the current study due to there being significant concern reported in the media and other literature regarding synthetic cannabis users experiencing drug-induced psychosis following consumption (Collins, 2014; Every-Palmer, 2010; Muller et al., 2010). For this reason, results from the BSI psychotic screen were specifically examined to determine whether there was a link between synthetic cannabis use and psychosis.

The psychotic screen in the BSI for the sample as a whole did not produce clinically remarkable results and the mean score was only approaching the clinical range but was not of significance. However, when comparing the results of the psychotic screen between the different drug user groups, as expected, results indicated that polydrug users displayed higher levels of psychotic symptomology with over half of participants in this particular drug user group reporting psychotic symptomology within seven days prior to test administration. Of note is that over one-third of the synthetic cannabis user group also demonstrated elevated scores for psychosis, which is of significance, with over twice as many users in the synthetic cannabis only drug user group than the current non-drug user group.

Psychosis was also a common effect following synthetic cannabis use reported by participants in the psychological screen for research question two, where 19% of the sample reported having experienced psychosis. Other symptoms associated with psychosis, such as paranoia, confusion, hallucinations, and strange thoughts were also reported by 34-68% of the sample, which might provide further evidence of synthetic cannabis use and its risk potential for drug-induced psychosis.

There are two possible hypotheses regarding the incidence of psychotic symptomology detected within the sample. It might be that heavy synthetic cannabis use may cause a synthetic cannabis-like (drug-induced) psychosis, a psychosis that would not occur in the absence of synthetic cannabis intoxication. These symptoms would be expected to remit some time after abstinence from use. Alternatively, it might be that synthetic

cannabis use might advance an individual's pre-existing disposition to psychosis and exacerbate psychotic symptomology, particularly in vulnerable persons. Research has supported this theory and reported that synthetic cannabinoid intoxication is associated with acute psychosis where use can either trigger chronic psychotic disorder among vulnerable individuals or worsen psychosis in previously stable individuals (Muller et al., 2010). A final possibility is that synthetic cannabis might be used by individuals who experience psychotic disorder to medicate the unpleasant symptoms of psychosis.

It would be difficult to determine evidence of either association which excludes other plausible explanations of the relationship, such as other drug use or an individual vulnerability to psychosis, and this is outside the scope of the current study. An exclusion criterion was enforced to eliminate individuals from the study with known pre-existing psychiatric difficulties. However, this was a "rule" that was not controlled for or further tested. There is no existing controlled research on whether synthetic cannabis directly causes psychosis, and epidemiological methods must be used to rule out other causal hypotheses. Whether a synthetic cannabis psychosis exists remains a matter for debate but taking into account both the psychological symptom screen from research question two and the BSI results, there is still good reason for concern that synthetic cannabis use may influence the presentation of psychosis. Psychosis can be a serious and disabling condition (Gelder, Mayou, & Geddes, 2005), and the dangerous behaviour associated with hallucinations and other psychotic behaviours can place an individual at risk of further harm. Therefore, given the number of participants in the current study who have experienced psychotic symptomology, it remains a matter of concern, especially since synthetic cannabis has been found to produce psychosis with an elevated level of agitation compared to individuals who present with psychosis triggered by natural cannabis use (Brakoulas, 2012).

***Is there an association between synthetic cannabis use and the subsequent use of other illicit substances?***

*5.1 It was expected that there would be a small number of participants who have experimented with synthetic cannabis and progressed to harder drug use, but that most individuals in the sample are poly drug users or have experimented with other illicit drugs prior to using synthetic cannabis.*

For research question five, which gives consideration to whether there was an association between synthetic cannabis use and the progression of other illicit drug use, participants were asked to respond to a drug use assessment containing questions regarding which illicit substances they had used prior to synthetic cannabis prohibition, and which illicit drugs they used at the time of survey completion. Respondents were asked to note the frequency of their drug use under each drug category pre- and post-prohibition. Specifically, the objective was to examine the role that synthetic cannabis has played in the initiation of other illicit drug use, and whether easy access to legal psychoactive substances has increased a user's propensity to experiment with other "harder" drugs. With respect to this objective, a causal link between synthetic cannabis use and the use of illicit drugs was not established due to the complexity of this relationship; however, sequences of progression were examined.

The existence of gateway effects regarding synthetic cannabis use has been debated from two different angles; synthetic cannabis as a harm reduction tool, and synthetic cannabis as a gateway drug. In line with the harm reduction argument, proponents of the synthetic cannabis industry contended that they provide recreational drug users with an option to gateway out of illicit drug use and dependence (Lindigkeit et al., 2009), and this position was used as a marketing strategy by the industry. There is little evidence from the current study, and other research literature, to suggest that a reverse gateway effect exists among synthetic cannabis users. The only evidence from the findings that supports this argument is that nearly half of participants in the sample reported that they used synthetic cannabis as a substitute for other illegal drugs when it was legal. The benefits of doing so meant that they avoided the illegal drug market, and the risk of prosecution to use psychoactive substances was removed. It also entailed less risk of coming into contact with drug dealers and opportunity to be exposed to harder drugs. However, overall, the results of the current study do not suggest that synthetic cannabis provides a safer alternative to other illicit drug use or for persons wanting to experiment with psychoactive substances. Firstly, results from the physiological and psychological screen from research question two supported that the effects of use were similar, if not more harmful, than other illicit drugs. Levels of drug dependency were also very high among participants in the sample who had used synthetic cannabis. A final point that refutes the harm reduction argument, is that users can now be criminally prosecuted for

synthetic cannabis use or possession; the argument that synthetic cannabis products reduce the risk that users will be criminally prosecuted is no longer valid.

The other side of the argument is the gateway theory, that there is a relationship between synthetic cannabis use and the subsequent initiation of other illicit drug use (Bowden, 2007). The gateway hypothesis in the context of synthetic cannabis use proposes that the use of synthetic cannabis directly increases the risk of consuming harder drugs (Hall & Lynskey, 2005). Results of the current study indicate mixed evidence for the gateway effects of synthetic cannabis. For 21% of participants, this was their first experience with drug use and only a minority of participants (3%) had started using synthetic cannabis prior to its illegalisation and then progressed to other illicit drug use following prohibition. This pattern describes a gateway sequence. However, it is unable to be determined whether this pattern of use was influenced by synthetic cannabis use alone, or whether users progressed to harder drug use due to other unknown factors. Results of the study that provide evidence against the gateway argument are that there was a notable decrease in the frequency of substance use across all drug categories and there was a significant decrease in the overall frequency of illicit substance use following synthetic cannabis prohibition. On the whole, a causal relationship between synthetic cannabis and other illicit drug use cannot be confirmed since not all synthetic cannabis users in the sample progressed to other illicit drug use. However, since the results indicate that there were users who progressed to using other more harmful substances, the argument that synthetic cannabis has the potential to be a gateway drug cannot be discounted.

Representatives of the synthetic cannabis industry also argued that banning synthetic cannabis would lead to an increase in the use of methamphetamine (Lindigkeit et al., 2009). Further questioning on the subsequent use of methamphetamine following synthetic cannabis use was incorporated into the survey questionnaire to see whether the use of synthetic cannabis increases the risk of starting to consume another, possibly more harmful, illicit drug. Following synthetic cannabis prohibition, nearly one-third of the sample (32%) had tried methamphetamine, but not used this substance in the past. Further to this, 14% of participants continued using methamphetamine as an alternative to synthetic cannabis once synthetic cannabis became illegal. This evidence in itself adds to the potential that synthetic cannabis carries the risk of being a gateway drug.

However, there was an overall decrease in the level of methamphetamine use among participants in the sample pre- and post-prohibition, so this also needs to be taken into consideration when analysing the gateway effects of synthetic cannabis use.

Aside from the gateway and harm reduction hypotheses, an alternative scenario is that synthetic cannabis is more commonly used in combination with illicit drugs and has little impact on overall illicit drug use. For the majority of participants in the sample, synthetic cannabis did not appear to act as a gateway drug or harm reduction tool but rather synthetic cannabis was used in combination with other illicit substances.

Participants exhibited a diverse profile of drug use, as is typical for the drug user population, and one-quarter of the sample identified as *current* polydrug users. Other research on synthetic cannabis use patterns has also provided support for this perspective and concluded that most synthetic cannabis users are polydrug users (Winstock & Barratt, 2013). This is concerning given that increasing the number of substances used by an individual likely escalates the risk of substance-related harm.

It was anticipated that there might be an increase in the use of other illicit drug types, such as natural cannabis, following synthetic cannabis prohibition, but the results indicated that there was little change to participants' drug preferences. There was still a strong preference for natural cannabis (47%), but of note was that synthetic cannabis was being consumed at similar levels to natural cannabis (48%) and was still the main drug of choice following prohibition. Forty percent of participants also reported that they would continue to source synthetic cannabis illegally, so this further supports a preference for the drug over other illicit substances.

Overall, there was no evidence found in this study or in any other research literature that is decisive enough to support either the gateway or harm reduction hypotheses. It is helpful to then contrast the outcomes of synthetic cannabis use and its potential for further drug use, compared with research on a previous synthetic drug that was legally available on the New Zealand market—benzylpiperazine (BZP) party pills. Mixed evidence also exists on the gateway effects of BZP party pills and the findings suggest that while BZP party pill use served as a gateway to other illegal drug use, for an even larger proportion of users in a study, legal BZP party pills were used as an alternative to other illegal drugs (Wilkins, Girling, Sweetsur, Huckle, & Huakau, 2006; Wilkinis &



Sweetsur, 2013). Methamphetamine was reported by the majority of participants to be an unpopular alternative to BZP party pills following prohibition. Similar to the current study, findings also confirmed that BZP party pill users were generally polydrug users who consumed other illegal drugs recreationally and equally as often as those illicit drug users who did not use BZP party pills (Hammond, 2008).

Research has supported that gateway effects are an artefact of both substance access and availability, as well as there being predisposing factors of individuals to illicit drug use, and that these factors are closely linked (Hall & Lynskey, 2005; Morral, NcCaffrey, & Paddock, 2002). Individuals who are predisposed to illicit drug use might access the most freely available drug first, which was synthetic cannabis prior to prohibition, and then it is through associating with other drug users and/or dealers that they become exposed to other “harder” drugs. Now that synthetic cannabis is illegal, users are required to source their drug from the black market and through this pathway they may have more access and opportunity to source other illicit drugs and consequently gateway into other drug use. The act of obtaining synthetic cannabis through this illegal market can bring users into contact with antisocial others whom they might not have otherwise met. Conversely, if access is reduced through illegalisation, and individuals choose not to engage in the purchasing of drugs through the black market, levels of illicit drug use can decrease, and there is no gateway effect.

Other unobserved factors may influence the relationship between synthetic cannabis and the use of other illicit drugs and the contributions that social context, individual characteristics, and drug effects add to the relationship between synthetic cannabis use and the subsequent use of other illicit drugs needs to be considered. For example, it might not be that synthetic cannabis use alone is a strong predictor of further illicit drug use, but that the early initiation and regular use of synthetic cannabis is more strongly predictive of illicit drug progression. Alternatively, the experience of a traumatic childhood may be causally important for both the initiation of synthetic cannabis use and the later use of other illicit substances and there are other multiple other factors that can be taken into consideration (e.g., socioeconomic status, sexual and other forms of abuse, criminality, and other individual characteristics such as gender, intelligence, school drop-out, conduct and attitude problems, peer and gang affiliations; Hall & Lynskey, 2005). If these factors are unobserved, which they were in the current study, it



would be misleading to conclude that synthetic cannabis is a gateway drug or harm reduction tool since the effects of omitted third variables are not counted for. However, to account for this in research is very difficult since variables affecting use are often unavailable or difficult to measure.

The current study's survey design is also least suited to answer questions relating to causal gateway effects. Simply documenting that current illicit drug users started with synthetic cannabis use, or that heavy drug users substituted illicit drugs with legal synthetic cannabis, is not sufficient to establish a causal link. Testing for gateway effects with retrospective survey data also poses its challenges. Empirically testing the gateway theory is inherently difficult, along with separating heterogeneity and causal effects, and this was anticipated in the current study, which sought to examine any associations observed, and not make any concrete conclusions. More research is required on the gateway effects of synthetic cannabis use and replications of the current study will make chance a less unlikely explanation for any effect observed regarding whether there was an association between synthetic cannabis use and the progression of other illicit drug use.

In terms of whether the current research question has been answered, a consistent relationship has not been found between synthetic cannabis and other illicit drug use. It remains inconclusive whether synthetic cannabis acts as a 'gateway' to other illicit drug use or, conversely, whether it played a role in harm reduction with users substituting harder drug use with legal alternatives. There appears to be some support for both positions, but more decisive evidence is required to determine whether there is a significant risk that synthetic cannabis is a gateway drug. Despite this, it is believed that policy and law should continue to aim to delay the use of psychoactive drug use by prohibiting use, reducing access, and consequently reducing the *likelihood* that young people or other vulnerable populations will gateway into using other illicit drugs.

### ***Further Findings***

Participants were asked to note any further comments relevant to the study and responses in this section mostly expressed negative attitudes towards synthetic cannabis. Participants commented on the legality of synthetic cannabis and that if it was not legal then individuals would not seek out the drug. Many also reported their opinion that it

*should* stay illegal. Perceptions of the addictive potential of the drug included participants beliefs of ‘everything in moderation’ and that if you choose to abuse synthetic cannabis then it can be harmful. One individual reported his/her experience of being arrested for possession of synthetic cannabis, along with other synthetic cannabis-fuelled offending, and that if he/she had not been sent to prison and had a period of abstinence from the drug, that he/she would still be addicted to synthetic cannabis. This gives one example from a single case, which emphasises the addictive potential of synthetic cannabis. Other examples reported were ‘I’m now addicted to P because of synthetic cannabis’. Conversely, one participant reported that he/she was previously addicted to P, but now used synthetic cannabis as his/her drug of choice as it was a cheaper habit to maintain than methamphetamine addiction. Some participants reported in this section that they believed synthetic cannabis should be a class A drug, as ‘it is worse than methamphetamine’ and many other participants echoed the belief that synthetic cannabis is ‘worse than P’ (methamphetamine).

In this section, multiple participants also reported other harms experienced from the use of synthetic cannabis that were not captured earlier in the survey questionnaire. A common theme was that synthetic cannabis had impacted the well-being of individuals and their families, with participants reporting that ‘synthetic cannabis destroys families’ and that it had ‘ruined the lives of my friends and family’. For one participant, it only took his/her peer ending up in hospital from synthetic cannabis intoxication to stop using synthetic cannabis. An individual insight that gangs now control the production and sale of synthetic cannabis was also disclosed. Finally, some participants commented on their use of synthetic cannabis in the context of their drug use history and reported that it was the ‘worst drug I’ve tried’ and ‘worst experience with drugs’.

As a final note on further findings, as already noted, there was some concern from the Ethics Committee that a gift voucher being offered for compensation might compromise voluntary consent and lead to the presence of coercion. Interestingly, an observation made during data collection was that a number of participants reported that their research participation was motivated by their own and other family and peers’ negative experiences with synthetic cannabis use. They desired to offer information to help with the project and saw the benefits of awareness raising, as opposed to solely focusing on the monetary reward for participation. This provides some support against

compensation leading to the presence of undue influence over respondents to participate in the study.

### **Research Implications**

In terms of the value of the current study, the results provide some insight into the drug-related harm associated with synthetic cannabis use. Health professionals need to be cognizant and responsive to novel drug trends. If they have an awareness of the possible physical and psychological consequences of synthetic cannabis use, then they are better able to formulate treatment options for the toxic effects of consumption and counsel their patients accordingly.

Given some of the negative outcomes reported in the study regarding the use of synthetic cannabis, it is hoped that the results of the study are reinforcing to the decision that the New Zealand government has made about prohibiting psychoactive substances, and it is hoped that their plans to conduct safety testing to reintroduce synthetic cannabinoids is carefully considered. The results of the study may also provide additional evidence to support the introduction of regulatory laws prohibiting synthetic cannabis use in overseas countries. Alternatively, countries that are examining the consequences of introducing more liberal regulations regarding the sale of synthetic cannabis may also benefit from the results of this preliminary research.

### **Limitations of the Study**

As with most research methods, the current study is not without its limitations and is open to improvement. It is in the interest of capturing the experiences of participant drug use in this preliminary research, which the current method recognizes that there are some factors that cannot be controlled for. The following is a discussion about the anticipated limitations of the method and some of the measures that were taken to reduce the impact of potential confounds.

#### *Limitations of Self-Report Measures*

Self-report questionnaire research is a popular psychological research method. However, such a method is associated with difficulties regarding the honesty and accuracy of participant responses, including social desirability bias and the accuracy of retrospective recall. Because of the difficulty in being able to execute a longitudinal

study and measure data pre- and post-prohibition, the only practical alternative was to conduct the study retrospectively. Such a compromise was made in order to carry out the research successfully but meant that the study was, therefore, partially dependent on participant's memories, which makes the results vulnerable to recall bias.

### *Recall Bias*

Self-reported studies have validity concerns due to recall bias and errors caused by differences in the accuracy of the information recalled by participants regarding past experiences and events (Bradburn, Rips & Shevell, 1987; Bradburn & Sudman, 1979). The recall of information in the current study on current and past drug use and drug-related experiences does depend entirely on memory and participants may have either exaggerated symptoms or under-reported the frequency or severity of symptoms due to poor memory recall. While we cannot definitively determine whether some survey respondents were systematically underreporting exposure or over-reporting exposure, the case may be that both add error to the measure but consequently neutralize each other.

Recall bias cannot be corrected or controlled for following the completion of data collection. Therefore, it was important that during the planning phase of research, the possibility of recall bias was addressed and strategies were implemented to minimize it. It was considered that an important step in the process of minimising recall bias was to clearly define the research questions. In turn, this informed the research method and survey design.

In an effort to limit recall error, participants were asked to recall their substance use over a period of up to 12 months. This timeframe is common, if not shorter, than other drug use surveys, which generally ask respondents to recall their drug use over a 12-month period (Alcohol, Smoking, and Substance Involvement Screening Test; Drug Abuse Screening Test). Research has indicated that 20% of details of life experiences are irretrievable 1 year after occurrence, and 50% of this information is irretrievable after 5 years (Bradburn, Rips, & Shevell, 1987). Therefore, using the 12-month limit for recall should have substantially served to minimize recall bias. The design of the questionnaire also limits the range of participant responses due to its categorical answer set and likely further aids memory processing and recall. While not being able to entirely eliminate recall bias, this was the compromise made when selecting the study

procedure since inferring information from observing participants and their drug use was not an option due to legal and ethical concerns.

### *Social Desirability Bias*

Social desirability bias can also be problematic with self-report measures where participants purposefully answer questions in a way that portrays them in a positive light. Survey questions regarding drug use have been found to produce larger nonresponse rates or increased measurement error than responses to other research study topics (Tourangeau & Yang, 2007), which is potentially due to respondents being more likely to underreport the use of illicit drugs in drug research (Fendrich & Vaughn, 1994; Johnson & O'Malley, 1997). Socially desirable responding in survey research can confound research results by creating false or obscured relationships between variables.

Misreporting on sensitive topics, such as drug research, is often the result of respondents filtering the information they report to avoid embarrassment or to avoid repercussions from third parties (Tourangeau & Yang, 2007). Currently, possession and use of synthetic cannabis and other illicit drugs are not only socially undesirable; it is now illegal, and the possession and sale of synthetic cannabis are punishable through the adult criminal justice system (New Zealand Legislation, 2014). Participants may misreport responses as a protective measure to avoid legal consequences, rather than simply to avoid providing a socially undesirable impression.

Measures were taken in the current study in an attempt to improve reporting of sensitive information. Firstly, there was no presence of an interviewer, and each participant completed his or her responses autonomously on computerised survey software. Therefore, the threat of repercussion(s) from a third party was removed. It was also made clear on the recruitment flier and participant information sheet that all responses were kept anonymous and confidential and that the researcher guaranteed nondisclosure. The intention was that confidentiality assurances would alleviate respondents' concerns that the data would end up in the wrong hands. Finally, during survey construction, efforts were made to ensure that the wording of survey questions and response options were straightforward, as there is some evidence that using familiar and straightforward wording can increase reporting on sensitive topics (Bradburn et al., 1979). Respondents were therefore not given any cause to construct a biased version of

their experience, as they were not required to self-identify as a drug user. This lends to the credibility of the research and degree of confidence that can be vested in the research outcomes.

The mode of survey administration was also changed to improve the validity of participant self-report. Initially, the survey was going to be administered in a participant interview format by the researcher. For research on a sensitive topic, such as illicit drug use, self-administration of the survey was preferred given that self-administered surveys have a greater chance of eliciting more accurate and unbiased information, since it provides detachment and reassurance to research candidates. Tourangeau and Yan (2007) have reviewed the results of multiple randomised field experiments that compare different methods for collecting data on illicit drug use and found that a significantly higher number of respondents reported illicit drug use when the survey questions were self-administered, compared to when they were administered by an interviewer. An essential feature of self-administration is that the researcher, or party present during data collection, remains unaware of the respondent's answers; this was an important and intentional part of the current study.

As well as response accuracy, there are other consequences to asking participants sensitive questions on drug use and survey outcomes, including being able to recruit a sufficient number of participants and reducing nonresponse rates from participants who do agree to participate in the survey. Response rates to the recruitment flier were very good, and 94 participants were recruited for the study, so recruitment was not an issue. There were also no participants who withdrew from the study following survey commencement.

Social desirability scales can be used to detect socially desirable responding. However, this was not incorporated into the study due to time limitations. Instead, other measures were implemented to reduce the threat of social desirability bias.

#### *Limitations of a Non-Random Sample*

Another limitation of the research design is that a nonprobability and self-nominating sample was employed, rather than a true random sample, which is considered less desirable for drawing inferences. A self-nominating sample is not random and cannot be said to be representative of the general population. Participants in the current study were

considered to represent a group of people who had an interest in substance use and came from a diverse range of backgrounds, as is outlined in the demographic results of the study. Due to the study also relying on individuals to come forward and participate in the study, the fact that they were able to accept or decline participation based on the topic and conditions placed upon them meant that representing a sufficient range of views and experiences is difficult.

#### *Limitations of Instrumentation*

Few disadvantages of using a computerised survey have been identified, other than participants requiring access to the Internet and a computer to be able to complete the survey; this was provided to each participant during data collection. Participants also required the skill level to be able to operate a computer and complete the survey independently. Inclusion criteria served to ensure that participants had this capability.

A major disadvantage considered in utilising the BSI self-report measure is that participants were relied upon to be able to accurately and honestly identify psychological symptoms experienced. They must also have been able to describe the degree of their symptomology, and this might have introduced distortions in reporting. Another disadvantage identified in using the BSI is that there are no culture-specific norms for this instrument, which are relevant to New Zealand's bicultural context. However, there is no existing alternative *brief* psychological screen that has culture-specific norms for the New Zealand population.

A further limitation of the BSI for consideration is that the instrument measures psychopathological symptoms only from the preceding seven days. Due to the survey being administered many months post-prohibition, if participants stopped or reduced their synthetic cannabis use, their psychological symptoms may have subsided and the extent of the psychological effects experienced by previous users would not have been captured. For this reason, information was gathered about participants current drug use patterns so a comparison could be made between the psychological symptom status of current synthetic cannabis users and non-drug users.

#### *Timing of Data Collection*

Another limitation of the study is that the timing of data collection was not ideal; the researcher would have preferred to collect data on participants' frequency of synthetic



cannabis use *prior* to prohibition to gain more accurate information, rather than retrospectively and up to one year following prohibition. This was not possible due to the planning of the study occurring post-prohibition. The potential for recall bias has been addressed. It is also important to bear in mind that the use of synthetic cannabis, along with other illicit drugs, can produce a range of different outcomes for users that generally unfold over time and in complex ways, not simply over the space of one year.

### *Other Confounding Variables*

The impact of policy on synthetic cannabis use and investigation into synthetic cannabis-related harm has been conducted under real-world conditions, which have not allowed for the control of other alternative explanatory and external factors. The design of the study and data set also do not allow for any interpretations to be made regarding causation. Therefore, the precise causal influence of policy intervention in itself remains a matter of contention. Due to potential unobserved factors not being accounted for, the results and interpretations indicated for each of the research questions are only suggestive, and necessarily tentative.

The chemical constituents of the synthetic cannabis products used by survey participants cannot be known and may be varied. Therefore, effects reported in the study might not be attributed to synthetic cannabinoids alone, but may be influenced by other non-cannabinoid constituents contained in synthetic cannabis products. This might be particularly problematic with synthetic cannabis products that are being sold on the black market as there is no requirement for producers to measure or outline the chemical compounds of their products on the packaging. There is also no control over the quantity or purity of any of the synthetic cannabis products consumed by participants so we cannot describe with absolute confidence the relationships and trends observed in the current study, or in any future research, without rigorous testing. High levels of polydrug use in the sample and effects from other substances are also potential confounds in the current study. Finally, both short and long-term physiological and psychological effects of synthetic cannabis use might vary with differing routes of administration (i.e. oral vs. intravenously). It is also likely that the effect profile of synthetic cannabis use will vary with repeated episodes of use.



### *Generalisability of Findings*

It is accepted that the findings will unlikely be generalised to other populations beyond that of the current sample obtained since a target audience was sought. The results of the study can also only be analysed within the context of the noted limitations and compromises made throughout the research process. The focus of the study was more on depth, and determining a great deal of information on a new drug with a smaller sample size, which generally decreases the extent to which findings can be generalized. The decision to ascertain a depth of information was deliberate and influenced by the limited accessibility of the target population and sensitive nature of the study. The study's representativeness is, therefore, hard to assess, which is quite common in survey research where drug user groups are under-represented. It is considered that with a greater number of studies carried out generating similar findings, this will indicate a higher level of internal validity.

### *Conclusion*

On the whole, it is believed that the survey design for this type of preliminary research was appropriate and that data collection and the implementation of the method was successful. No limitations that should have been foreseen at the design stage arose unexpectedly during the conduct of the study. Nevertheless, interpretation of the survey results must be considered with caution due to the identified methodological limitations, but are still assessed as valuable in generating knowledge about a drug that has not previously been researched in New Zealand. In the early stages of the appearance of a new drug, approaches such as the one taken in this preliminary study are often the most helpful way of accessing data efficiently, and the results of this study can be useful in guiding other research in this area.

### **Recommendations for Future Research**

The value of the current study is that the findings indicate that synthetic cannabis is a harmful substance that has been legally available to New Zealand consumers for an extended period of time. The preliminary findings have confirmed that synthetic cannabis has a high addictive potential and that users are likely to experience a wide range of harmful physical and psychological effects from use. Avenues for future research in this area might continue to monitor rates of synthetic cannabis use and other illicit alternatives, to further assess the impact of banning a previously used, legal

substance. As with all novel psychoactive drugs, ongoing research is required to monitor the evolution of harms and patterns of use. Research might also better document the impact of prohibition on the availability, price, and level of harm associated with synthetic cannabis use.

The current study examined the physiological and psychological effects of synthetic cannabis consumption, but did not address the psychosocial consequences of use. It would be helpful for future research to investigate the social effects of synthetic cannabis use, including the social cost(s) to individuals, and the effects of use on peer and familial relationships. It would also be helpful to examine the link between synthetic cannabis use and violence, and other anti-social behaviour. This would provide a broader picture of the harms associated with synthetic cannabis use.

As already noted, improvements can be made to the current study. Factors associated with drug use have not been controlled for, and future research might introduce more control for aspects such as individual characteristics, education, peer relationships, and family context. These are a few of many influential characteristics associated with the onset and maintenance of drug use, and further studies could introduce more statistical and methodological control, which was outside the scope of the current study.

Since only a limited amount of information can be extracted from the results of the study, the ultimate goal for future research could be replication of the results along with carrying out the study in a different locale to determine if similar findings are applicable to other parts of New Zealand. This highlights the importance of replication to maximize the generalisability of the findings and ongoing studies are necessary to ensure the completeness of data.

Finally, it is recommended that future research also gives consideration to the long-term effects of use and impact of chronic exposure to the adverse toxicities of synthetic cannabis. Overall, the more studies that are completed in this area that demonstrate synthetic cannabis harm and associations between legal highs and further illicit drug use, the more likely there are pressure and influence on drug policy and legislation. It is unrealistic to expect policy change from preliminary research and it is likely that the

safety testing on synthetic cannabis products for marketing will progress until more overwhelming research is available to inform decision-making around this process.

## **Conclusions**

The objectives of the current study were to examine the prevalence of synthetic cannabis use and how previous users have responded to prohibition and to assess the physiological and psychological harms associated with consumption. In summary, results indicated that there was a significant decrease in the frequency of synthetic cannabis use following prohibition, although a large number of participants reported that they would continue to source synthetic cannabis illegally. While most participants reported fairly minor problems from use, some respondents noted more serious physiological and psychological problems, with nearly one-quarter of participants reporting that they required emergency care following synthetic cannabis intoxication. High rates of synthetic cannabis dependency were detected in the sample and participants' average psychological symptom profile was of a magnitude to be considered in the clinical range for psychological distress, although there were no significant differences in psychological well-being between current synthetic cannabis users and current non-drug users. Following synthetic cannabis prohibition, there was a significant decrease in illicit substance use across all drug categories and only a small number of participants had started using legal synthetic cannabis and progressed to using other illicit drugs. Of concern is that one-third of participants reported using methamphetamine and not having used this substance in the past, with a considerable number of participants progressing to use methamphetamine regularly as an alternative to synthetic cannabis. Overall, the research indicates that the harms associated with synthetic cannabis use are similar to, if not more severe than, other abused drugs. The manner in which synthetic cannabinoids are used and consequences of use vary widely among users.

The study's most important achievement is that it is one of the first to be implemented in New Zealand examining synthetic cannabis harm. To date, no strong conclusions have been made about synthetic cannabis or the public health implications of consumption in New Zealand; concern and effects reported have predominantly been media-based. Many overseas studies also have relied on anecdotal data rather than surveying individuals directly to examine patterns of use and associated harms. This preliminary study was focused on gaining an introductory understanding of the effectiveness of

synthetic cannabis prohibition and harms associated with use, and gave less attention to the implementation of research with a high level of control and precision. However, the research was productive, resulting in all five research questions being addressed, although not all areas were answered with the same level of confidence. In particular, the role that synthetic cannabis has played in the initiation of other illicit drug use (i.e., research question five) was examined, but the design of the study was not effective in providing convincing results to address the research objective adequately. Overall, the understanding of synthetic cannabis harm and the current status of availability can provide us with some insights that are useful in the design of effective drug intervention and counselling programmes. Given the noted limitations of the study, replication of these results is required using more sophisticated survey methods.

One important finding that the study has highlighted is the role that synthetic cannabis accessibility has played in the level of synthetic cannabis use among users. More specifically, having a psychoactive drug legally available on the market has influenced some users to consume synthetic cannabis, and that the subsequent prohibition of synthetic cannabis appears to have discouraged use. It is also considered that for some individuals, legal synthetic cannabis has influenced drug use behaviour and the progression to harder drug use. Since there is no evidence to confirm that synthetic cannabis has *not* been found to reduce substance-related harm in terms of the effects experienced by users, levels of dependency, and psychological well-being of users, prohibition of the drug itself has served to reduce substance-related harm by reducing the number of substances legally available to the public and consequently the number of users.

Given that there are plans for testing to take place to allow synthetic cannabis products to be reintroduced to the New Zealand market, it is important to highlight that the results of the current study do not support the cause for the future sale of synthetic cannabis. An important contribution of this research is providing information on the harms associated with synthetic cannabis use, and consequently, the evidence and rationale for a stance against legalisation. All psychoactive substances have been removed from the market until further testing confirms that they present a low risk of harm to consumers and the findings from the current study, in general, do not support that synthetic cannabinoids pose a low risk of harm to consumers. The level of synthetic cannabis dependency detected in the sample was alarming, and the adverse

psychological, and physical symptoms reported by users were also of concern. There is also evidence to suggest that the previous legal status of synthetic cannabis introduced some participants to regular illicit drug use. There is a cause for ongoing concern if the view is adopted that synthetic cannabis should simply be viewed as a consumer product, especially if synthetic cannabis products are untested, and the chemical constituents are unknown, which was evidently the case up until prohibition on 8th May 2014.

Regardless of the intention for safety and risk assessments to occur for synthetic cannabis product approval, it is important to respect that all psychoactive substances, including “low risk” products, have the potential for abuse and can cause serious harm. Such outcomes can be due to abusive consumption patterns, interaction effects with other substances, and overdose or misuse.

Synthetic cannabis prohibition does not necessarily indicate the end of synthetic cannabis use and it being legally available in the near future. Testing will introduce its own and ongoing challenges for monitoring, toxicological identification, risk assessment, and development of possible control strategies, for products that are approved through the new regulatory system. Therefore, it will also pose difficult questions for drug policy such as how to monitor the products sold, how to identify the chemical constituents of approved products, and how to accurately assess and monitor health risks.

In terms of placing the findings of the study in a broader context, a judgment can be made that the New Zealand government were too slow to respond to prohibiting synthetic cannabis, as they have previously been with other psychoactive substances such as benzylpiperazine party pills and nitrous oxide. There appears to be a tendency that New Zealand does not follow overseas trends with banning harmful substances and tend to take action a number of years following the prohibition of particular drugs in other leading countries. There was no unified international response to the prohibition of synthetic cannabis, despite the rapid increase in use and problems identified at an early stage both overseas and within New Zealand. An attempt to develop legal alternatives to illicit drugs is not a new phenomenon, and psychoactive substances have been an ongoing challenge facing the market; the New Zealand government need to be more proactive in identifying new drug trends and act accordingly. The true extent of damage from legal synthetic cannabis in New Zealand remains unknown.

## **Postscript**

The Psychoactive Substances Retail Regulations that allow for the licensing and sale of synthetic cannabis, which was planned for June 2015, is now due to come into force in November 2015 (Ministry of Health, 2015). Manufacturers are still required to apply to the Psychoactive Substance Regulatory Authority for full product licences and need a comprehensive set of robust data on the safety and quality of their product if they wish to sell it on the New Zealand market. The Authority will undertake assessments to approve or decline an application based on a risk of harm score and only those assessments that demonstrate a ‘low risk of harm’ will be granted product approval under the Psychoactive Substances Amendment Act (2014). If a product is approved for sale, the applicant will be subject to conditions within his/her license to undertake regular safety monitoring. To date, no applications for product approvals under the full regulatory regime have been received (Ministry of Health, 2015).

Regions throughout New Zealand have been given the opportunity to establish Local Approved Product Policies (LAPPs), which allow them to devise policies about where synthetic products can be sold within their area (Ministry of Health, 2015). This offers regions the advantage of having the community’s input and view when considering retail licence applications. As of June 1, 2015, 37 local authorities have adopted LAPPs for the sale of psychoactive substances.

There have been new psychoactive substances that have been reported in the media to be problematic since the banning of synthetic cannabis. A new cannabis compound, which has been linked to two deaths in Germany, has been attributed to over 30 hospitalisations in Auckland regional hospitals (3 News, 2015). There are not currently any psychoactive products that have been approved for sale on the New Zealand market. Therefore, these products and their sale, distribution, and possession are still illegal. Further to this, the New Zealand Police have advised that they are still seizing many synthetic cannabis products and that synthetic cannabinoids are now being sold as incense and in powdered forms marketed as plant food (Brown, 2014).

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## Appendices

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## **Appendix 1.**

### **Research Recruitment Advertisement**

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#### **HAS THE DAMAGE BEEN DONE? EXAMINING THE EFFECTS OF LEGAL SYNTHETIC CANNABIS AND SUBSEQUENT IMPACT OF PROHIBITION ON SYNTHETIC CANNABIS AND OTHER ILLICIT DRUG USE.**

*You are invited to participate in a research study evaluating the harms associated with synthetic cannabis use.*

#### **Who is doing this research?**

Kristy Edmondson, a Master's student in Psychology at Massey University and Department of Corrections employee. The research is being supervised by Dr. Ian de Terte.

#### **What is involved?**

Completion of the survey will take approximately 15 minutes. The questions asked will be focused on self-reported drug use and effects of use. Each participant will receive a \$10 supermarket voucher prior to commencing the survey.

#### **Who can participate?**

We are interested in responses from all sorts of people. You must be 16 years or older to participate. You must be proficient in speaking and reading English, and be able to operate a computer. Most importantly, you must have used synthetic cannabis two or more times before it was made illegal in New Zealand on May 8<sup>th</sup> 2014. You must not have been diagnosed by a psychiatrist or clinical psychologist with any known psychiatric disorder or mental illness (e.g. schizophrenia) *prior* to trying synthetic cannabis.

#### **Your rights as a participant:**

Participants must be aware that survey questions concern self-reported drug use and in some cases illegal behaviour. Your privacy and right to confidentiality will be protected at all times. The survey is kept completely anonymous and you will not be identifiable since you will not be asked to provide your name.

#### **Contact Information:**

If you are interested in learning more about this study, please contact the researcher:

**Kristy Edmondson**  
**Phone: 02108631582**  
**Email: [contactkristye@gmail.com](mailto:contactkristye@gmail.com)**

*We would really appreciate your contribution to this research.*



Massey University School of Psychology – Te Kura Hinengaro Tangata  
PO Box 756, Wellington 6140, New Zealand  
T +64 4 801-5799 ext 62165 : W [psychology.massey.ac.nz](http://psychology.massey.ac.nz)

This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application 14/053. If you have any concerns about the conduct of this research, please contact Dr Andrew Chrystall, Acting Chair, Massey University Human Ethics Committee: Northern, telephone 09 414 0800 x43317 email [humanethicsnorth@massey.ac.nz](mailto:humanethicsnorth@massey.ac.nz).

## **Appendix 2.**

### **Screening Questionnaire to Determine the Approval Procedure**

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1. Are you over 16 years of age? *(must answer yes)*
2. Have you used synthetic cannabis two or more times before it was made illegal in New Zealand on 8<sup>th</sup> May 2014? *(must answer yes)*
3. What synthetic cannabis products did you use? *(brand(s) must be listed on the synthetic cannabis product list)*
4. Are you proficient in speaking and reading English? *(must answer yes)*
5. Can you operate a computer? *(must answer yes)*
6. Have you suffered from any diagnosed psychiatric disorders prior to trying synthetic cannabis? *(must answer no)*



### Appendix 3.

#### Synthetic Cannabis Product List

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Various Street and Commercial Names for Synthetic Cannabis Products Previously Sold In New Zealand
Anarchy
Voodoo
Spice
Kush Pink
Kronic Pineapple Express
Kronic Tropical Explosion
Kronic Skunk
Kryptonite Green
Kryptonite Red
G-13
Ziggy
Radiation
Choco Haze
Lemon Grass
Mind Trip
WTF
Master Kush
Tai High Afghan Kush
Tai High Bubble Berry
Karma
Apocalypse
Tai High Code Red
Tai High Purple Passion

Haze
B-52 Berry Bomb
Northern Lights Primo
Puff Super Strength
Puff Southern Lights
DC-3 Purple
Amsterdam Long Island Tea
Blueberry Crush
Jungle Juice
Amsterdam Havana Special
Illusion Colossus
Illusion Peak
Illusion Connoisseur
Illusion Massif
Stargate
PURE-GOE
K2
POW
Nirvana
Pepe
Dr Feelgood
White Rhino
Diablo
Giggle
4:20
SGT-24
Red x

AK47
XT
Outbreak

## Appendix 4.

### Participant Information Sheet (web-based questionnaire)

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**MASSEY UNIVERSITY**  
TE KUNENGA KI PŪREHUROA  
UNIVERSITY OF NEW ZEALAND

#### **HAS THE DAMAGE BEEN DONE? EXAMINING THE EFFECTS OF LEGAL SYNTHETIC CANNABIS AND SUBSEQUENT IMPACT OF PROHIBITION ON SYNTHETIC CANNABIS AND OTHER ILLICIT DRUG USE.**

##### Participant Information Sheet

*Thank you for your interest in this study exploring the harms associated with synthetic cannabis use and how previous users have responded to synthetic cannabis prohibition.*

##### **Who is doing this research?**

Kristy Edmondson, a Master's student in Psychology at Massey University and Department of Corrections employee. The research is being supervised by Dr. Ian de Terte.

##### **What is involved?**

Completing the survey will take approximately 15 minutes. Each participant will receive a \$10 supermarket voucher prior to commencing the survey. Your responses will contribute to research on synthetic cannabis harm within New Zealand.

##### **Who can participate?**

Participants must have used synthetic cannabis two or more times before it was made illegal in New Zealand on May 8<sup>th</sup> 2014. You must be 16 years or older to participate. You must be proficient in speaking and reading English, and be able to operate a computer. You must not have been diagnosed by a psychiatrist or clinical psychologist with any known psychiatric disorder or mental illness (i.e., schizophrenia) *prior* to trying synthetic cannabis.

##### **Your rights as a participant:**

You are under no obligation to accept this invitation. You have the right to decline to answer any particular question and withdraw from the study at any time. By clicking on the link below to start the questionnaire, you are indicating your consent to participate in the study.

Participants must be aware that survey questions concern self-reported drug use and in some cases illegal behaviour. Your privacy and right to confidentiality will be protected at all times. The survey is kept completely anonymous and you will not be identifiable since you will not be asked to provide your name.

Data resulting from this research will be securely stored privately for 5 years after which it will be destroyed. The information you provide will be used in a Master's thesis and

submitted for assessment. In addition, there is a possibility that the findings from this study will be published in an academic journal, but no information that identifies you as an individual will be utilised.

### Contact Information

If you have any further questions, please feel free to contact the researcher or supervisor. A detailed report outlining the findings of this research study will be available to all participants, on request, in December 2015.

#### Researcher:

Kristy Edmondson  
Ph 02108631582  
Email  
contactkristye@gmail.com

#### Supervisor:

Dr. Ian de Terte  
School of Psychology  
Massey University  
PO Box 756  
Wellington 6140  
Ph 04 8015799  
Email i.deterte@massey.ac.nz

There are a number of helpful organisations with confidential support services you can contact if you have any concern about your substance use. These are:

- Community Mental Health and Addictions Services  
Napier 06 878 8109 ext 4220  
Hastings 06 878 8109 ext 5700  
Wairoa 06 838 7099 ext 4875  
Cental Hawke's Bay 06 858 9090 ext 5503
- Alcohol and Drug Helpline 0800 787 797

You are invited to take part in this study by clicking on the link below

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**Te Kunenga  
ki Pūrehuroa**

Massey University School of Psychology – Te Kura Hinengaro Tangata  
PO Box 756, Wellington 6140, New Zealand  
T +64 4 801-5799 ext 62165 : W psychology.massey.ac.nz

This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application 14/053. . If you have any concerns about the conduct of this research, please contact Dr Andrew Chrystall, Acting Chair, Massey University Human Ethics Committee: Northern, telephone 09 414 0800 x43317 email [humanethicsnorth@massey.ac.nz](mailto:humanethicsnorth@massey.ac.nz).

## **Appendix 5.**

### **Survey Questionnaire**

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#### **WEB-BASED SURVEY QUESTIONNAIRE**

##### **Demographic Information**

1. Age: (enter)
2. Gender: male/ female/ transgender
3. What ethnic group you most identify with: NZ Maori/ NZ European/Fijian/ Samoan/ Cook Islander/ Tongan/ Chinese/ Indian/ Other
4. What is your highest qualification: no school qualification/ bursary or NCEA level 1 and above/ trade certificate, professional certificate or diploma/ university degree or diploma.
5. Employment status: unemployed/ employed/ student/ retired
6. What source of income do you receive? Income from employment/ government benefit/ retirement pension/ student loan or allowance/ no source of income

##### **Prevalence of Synthetic Cannabis Use Prior to and Post-Prohibition**

7. How often did you consume synthetic cannabis prior to it being made illegal on 8th May 2014? Please only select one option which best describes your previous use. Less than monthly, 2-4 times a month, 2-3 times a week, 4+ times a week, daily.
8. How often do you consume synthetic cannabis now? Please only select one option which best describes your current use. Never, less than monthly, 2-4 times a month, 2-3 times a week, 4+ times a week, daily.
9. Was synthetic cannabis use your first experience with drug use? Yes/ No
10. Will you continue to source synthetic cannabis illegally? Yes/ No
11. What was your most common method for obtaining synthetic cannabis when it was legal? (Select only one option). Retail outlet (e.g. adult shop, dairy)/ internet/ friends or family/ drug dealer that is not a family member/ other: (please specify)
12. If you still use synthetic cannabis, what is your most common method for obtaining synthetic cannabis now? (Select only one option). I do not use synthetic cannabis now, retail outlet (e.g. adult shop, dairy)/ internet/ friends or family/ drug dealer that is not a family member/ other: (please specify)

13. How do you describe the current availability of synthetic cannabis? very easy/ easy/  
not easy/ not accessible

#### **Psychological and Physiological Effects of Synthetic Cannabis Use**

14. After using synthetic cannabis have you experienced any of the following  
outcomes? (You may select more than one option)

Physical:

- |  |   |                                      |
|--|---|--------------------------------------|
| <input type="radio"/> poor appetite        | <input type="radio"/> harmful effect on lungs           | <input type="radio"/> headaches      |
| <input type="radio"/> tremors/shakes       | <input type="radio"/> poor concentration                | <input type="radio"/> insomnia       |
| <input type="radio"/> loss of energy       | <input type="radio"/> stomach pains/nausea/<br>vomiting | <input type="radio"/> seizures       |
| <input type="radio"/> sweating             | <input type="radio"/> fainting                          | <input type="radio"/> breathlessness |
| <input type="radio"/> tiredness/drowsiness | <input type="radio"/> loss of consciousness             | <input type="radio"/> poor memory    |
| <input type="radio"/> dizziness            | <input type="radio"/> shortness of breath               | <input type="radio"/> teeth problems |
| <input type="radio"/> muscle aches         | <input type="radio"/> blurred vision                    | <input type="radio"/> skin problems  |
| <input type="radio"/> chest pain           | <input type="radio"/> coma                              |                                      |

Psychological:

- |   |  |                                    |
|---|--|------------------------------------|
| <input type="radio"/> paranoia                | <input type="radio"/> strange thoughts       | <input type="radio"/> mood swings  |
| <input type="radio"/> agitation               | <input type="radio"/> anxiety/panic          | <input type="radio"/> confusion    |
| <input type="radio"/> depression              | <input type="radio"/> hallucinations         | <input type="radio"/> irritability |
| <input type="radio"/> psychosis               | <input type="radio"/> feelings of aggression |                                    |
|   | <input type="radio"/> loss of sexual desire  |                                    |
| <input type="radio"/> Other: (please specify) |  |                                    |

15. Have you required emergency care following synthetic cannabis use? Yes/No

#### **Extent of Dependency Among Synthetic Cannabis Users**

**(Severity of Dependence Scale)**

The following questions are about your synthetic cannabis use. For each of the five questions, please indicate the most appropriate response, as it has applied to your synthetic cannabis use.

	Never/Almost Never	Sometimes	Often	Always/ nearly always
16. Do you think your synthetic cannabis use was out of control?	0	1	2	3
17. Did the prospect of missing a dose of synthetic cannabis make you anxious or worried?	0	1	2	3
18. Did you worry about your synthetic cannabis use?	0	1	2	3
19. Did you wish you could stop using synthetic cannabis?	0	1	2	3

	Not difficult	Quite difficult	Very difficult	Impossible
20. How difficult did you find it to stop or go without synthetic cannabis?	0	1	2	3

**Psychological Well-Being of Synthetic Cannabis Users and Other Drug User Groups within the Sample**  
(Brief Symptom Inventory)



<b>Within the last 7 days how much were you distressed by:</b>	<b>Not at all</b>	<b>A little bit</b>	<b>Moderately</b>	<b>Quite a bit</b>	<b>Extremely</b>
21. Nervousness or shakiness inside	0	1	2	3	4
22. Faintness or dizziness	0	1	2	3	4
23. The idea that someone else can control your thoughts	0	1	2	3	4
24. Feeling others are to blame for most of your troubles	0	1	2	3	4
25. Trouble remembering things	0	1	2	3	4
26. Feeling easily annoyed or irritated	0	1	2	3	4
27. Pains in heart of chest	0	1	2	3	4
28. Feeling afraid in open spaces or on the streets	0	1	2	3	4
29. Thoughts of ending your life	0	1	2	3	4
30. Feeling that most people cannot be trusted	0	1	2	3	4
31. Poor appetite	0	1	2	3	4
32. Suddenly scared for no reason	0	1	2	3	4
33. Temper outbursts that you could not control	0	1	2	3	4
34. Feeling lonely even when you are with people	0	1	2	3	4
35. Feeling blocked in getting things done	0	1	2	3	4
36. Feeling lonely	0	1	2	3	4
37. Feeling blue	0	1	2	3	4
38. Feeling no interest in things	0	1	2	3	4
39. Feeling tearful	0	1	2	3	4
40. Your feelings being easily hurt	0	1	2	3	4
41. Feeling people are unfriendly or dislike you	0	1	2	3	4
42. Feeling inferior to others	0	1	2	3	4

43. Nausea or upset stomach	0	1	2	3	4
44. Feeling that you are watched or talked about by others	0	1	2	3	4
45. Trouble falling asleep	0	1	2	3	4
46. Having to check and double-check what you do	0	1	2	3	4
47. Difficulty making decisions	0	1	2	3	4
48. Feeling afraid to travel on buses, subways, or trains	0	1	2	3	4
49. Trouble getting your breath	0	1	2	3	4
50. Hot or cold spells	0	1	2	3	4
51. Having to avoid things, places, or activities because they frighten you	0	1	2	3	4
52. Your mind going blank	0	1	2	3	4
53. Numbness or tingling in parts of your body	0	1	2	3	4
54. The idea that you should be punished for your sins	0	1	2	3	4
55. Feeling hopeless about the future	0	1	2	3	4
56. Trouble concentrating	0	1	2	3	4
57. Feeling weak in parts of your body	0	1	2	3	4
58. Feeling tense or keyed up	0	1	2	3	4
59. Thoughts of death or dying	0	1	2	3	4
60. Having urges to beat, injure, or harm someone	0	1	2	3	4
61. Having urges to break or smash things	0	1	2	3	4
62. Feeling very self-conscious with others	0	1	2	3	4
63. Feeling uneasy in crowds, such as shopping or at a movie	0	1	2	3	4
64. Never feeling close to another person	0	1	2	3	4
65. Spells or terror or panic	0	1	2	3	4

66. Getting into frequent arguments	0	1	2	3	4
67. Feeling nervous when you are left along	0	1	2	3	4
68. Others not giving you proper credit for your achievements	0	1	2	3	4
69. Feeling so restless you couldn't sit still	0	1	2	3	4
70. Feelings of worthlessness	0	1	2	3	4
71. Feeling that people will take advantage of you if you let them	0	1	2	3	4
72. Feelings of guilt	0	1	2	3	4
73. The idea that something is wrong with your mind	0	1	2	3	4

#### Association Between Synthetic Cannabis and Subsequent Use of Other Substances

74. What substances did you use before synthetic cannabis was made illegal on May 8th 2014? (You may select multiple options)

- ☐ Synthetic Cannabis
- ☐ Hallucinogenic Mushrooms
- ☐ GHB (gamma-hydroxybutyrate)
- ☐ Ecstasy (E, MDMA)
- ☐ Cocaine
- ☐ Other opiates
- ☐ Other hallucinogens (PCP, datura)
- ☐ Other: (please specify)
- ☐ Natural Cannabis
- ☐ Amphetamines (meth, P, pure)
- ☐ Rush (Amyl nitrate, Butyl nitrate)
- ☐ LSD
- ☐ Ice (crystal meth)
- ☐ Kava
- ☐ Nitrous Oxide

75. How often did you use the substance(s) outlined above?

Selected substance(s): Less than monthly, 2-4 times a month, 2-3 times a week, 4+ times a week, daily.

76. What substance(s) do you use now? (You may select multiple options)

- ☐ Hallucinogenic Mushrooms
- ☐ GHB (gamma-hydroxybutyrate)
- ☐ Amphetamines (meth, P, pure)
- ☐ Rush (Amyl nitrate, Butyl nitrate)

- Ecstasy (E, MDMA)
- Cocaine
- Other opiates
- Other hallucinogens (PCP, datura)
- Natural Cannabis
- Other: (please specify)
- LSD
- Ice (crystal meth)
- Kava
- Nitrous Oxide
- None

77. How often do you use these substances?

Selected substance(s): Less than monthly, 2-4 times a month, 2-3 times a week, 4+ times a week, daily.

78. Select the category that best describes your drug use:

- started using synthetic cannabis but now mostly use other illicit drugs
- use both synthetic cannabis and other illegal drugs
- have used illegal drugs but now use synthetic cannabis alone
- synthetic cannabis use only
- no drug use

79. Has your overall level of drug use changed since using synthetic cannabis?

Increased/ Decreased/ same level of use

80. Before synthetic cannabis was made illegal, did you use synthetic cannabis as an alternative to other illegal drug use? Yes/No

81. Since 8th May 2014 (when synthetic cannabis was made illegal), have you tried methamphetamine now that synthetic cannabis has been banned, but not used methamphetamine in the past? Yes/ No

82. Do you now regularly use methamphetamine as an alternative to synthetic cannabis now that synthetic cannabis is illegal? Yes/ No

83. Is there anything else you would like to add that you think is relevant to the study?  
If yes, please note this below.

## Appendix 6.

### Power analysis

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The power analysis was conducted using a correlation model. The graphs displayed show the necessary sample size based on different parameters (based on the desired effect size). Table 1 below shows the coordinates of the graph (Figure 1). An alpha level of 0.05 was used and a desired power of 0.80 (standards) and it was conducted for a low, medium, and high effect size. The medium effect size is generally accepted, especially in social science research. As such, the desired sample size is 84 (see Table 1). However, if this is increased to 100, the power of the study increases to about 0.86 which is even more favourable. One hundred participants will therefore be recruited for the purpose of the current study and will allow for a worthwhile effect to be examined.

Table 1

<b><u>Power</u></b>	<b><u>Medium Effect Size (0.30)</u></b>	<b><u>Small Effect Size (0.10)</u></b>	<b><u>Large Effect Size (0.50)</u></b>
0.60	53.5	488.5	18.5
0.61	54.5	500.5	18.5
0.62	55.5	511.5	19.5
0.63	56.5	523.5	19.5
0.64	58.5	535.5	19.5
0.65	59.5	548.5	20.5
0.66	60.5	561.5	20.5
0.67	62.5	574.5	21.5
0.68	63.5	587.5	21.5
0.69	64.5	601.5	22.5
0.70	66.5	615.5	22.5
0.71	67.5	629.5	23.5
0.72	69.5	644.5	23.5
0.73	71.5	659.5	24.5
0.74	72.5	675.5	24.5

0.75	74.5	691.5	25.5
0.76	76.5	708.5	25.5
0.77	78.5	725.5	26.5
0.78	79.5	743.5	26.5
0.79	81.5	762.5	27.5
<b>0.80</b>	<b>83.5</b>	<b>781.5</b>	<b>28.5</b>
0.81	86.5	801.5	28.5
0.82	88.5	823.5	29.5
0.83	90.5	845.5	30.5
0.84	93.5	869.5	30.5
0.85	95.5	893.5	31.5
0.86	98.5	920.5	32.5
0.87	101.5	948.5	33.5
0.88	104.5	978.5	34.5
0.89	107.5	1010.5	35.5
0.90	111.5	1045.5	36.5
0.91	115.5	1084.5	38.5
0.92	120.5	1126.5	39.5
0.93	125.5	1174.5	41.5
0.94	130.5	1229.5	43.5
0.95	137.5	1292.5	45.5

Figure 1

