Prevalence and Predictors of Tobacco Use in Parental and Prenatal Environments

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Abstract

Smoking is deleterious to health and dyadic smoking facilitates increased tobacco consumption. In this investigation, a secondary analysis was preformed on a Canadian database of 473 and 128 adoptive families. The purpose of this study was to delineate the role of demographic, personality, family environment, and partner smoking in predicting smoking cessation in a sample of Vancouver couples. Two specific temporal environments were explored: (a) general co-habitation smoking patterns and (b) couples' smoking patterns during pregnancy. The data were extracted from the Vancouver Family Study, and the prevalence and predictors of smoking behavior were investigated through correlational and hierarchical logistical regression techniques. Partner smoking was a significant predictor of smoking behaviors for each gender. Specifically, women's weekly smoking consumption was completely mediated by partner smoking. The results of this study
highlight the importance of dyadic smoking in continued tobacco consumption.
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INTRODUCTION

Rationale

Tobacco consumption in family environments is a significant predictor of offspring smoking (Bricker, et al., 2006; Pilgrim, Abbey, & Hendrikson, 1998; Voorhees, Schreiber, & Schumann, 2002). Further, parental modeling effects have a potent impact on youth smoking behavior (Bricker, et al., 2006; George, Barnes, & Patton, 2004; Kandel & Udry, 1999). Therefore, decreasing the level of smoking in couples will facilitate primary prevention of youth smoking by eliminating negative role models. Additionally, delineating the factors necessary to help women quit smoking during pregnancy will support the positive development of children, youth, and their families. Specifically, this thesis will:

1. Provide an overview of the deleterious effects of women’s tobacco use and the impact of fathers’ smoking on the developing fetus.
2. Explore the role of demographic, personality, family environment factors, and partner smoking in parental tobacco consumption and cessation.
3. Probe the role of demographics, personality, family environment factors, and partner smoking in parental tobacco consumption during pregnancy.

Overview

A national tobacco consumption survey reported that 14 percent of Canadian women smoke throughout the duration of their pregnancy (Health Canada, 2003). Smoking during pregnancy increases complications for both the fetus and mother (DiClemente, Dolan-Mullen, & Windsor, 2000; Grange, et al., 2005; Severson, et al., 1995). Previous research has linked infant physical health outcomes with in-utero
exposure to tetratogenic substances, such as alcohol, tobacco and marijuana (Cornelius, Goldschmidt, Day, & Larkby, 2002; Covington, Nordstrom-Klee, Sokol, & Delaney-Black, 2002; O’Callaghan, O’Callaghan, Najman, Williams, & Bor, 2003). For instance, prenatal exposure to tobacco has produced increased skinfold thickness, a measure of obesity, in a sample of six year old children (Cornelius, et al., 2002). Kahn, Zuckerman, Bauchner, Homer and Wise (2002) explored the relationship between women’s postnatal health and children’s overall health. Multiple health outcome measures, including instruments designed to assess general health, asthma rates, lingual development, and behavioral indices, were administered to the children at age three. Results revealed that mothers’ who had decreased physical health, increased depressive symptoms, and increased smoking were associated with more deleterious effects on the offspring’s development (Kahn, et al., 2002). In sum, there is a growing body of research documenting the association between maternal smoking and long term growth retardation in offspring.

Epidemiological and animal models of in-utero and early exposure to tobacco smoke have been robustly associated with neurotoxicity (Weitzman, Byrd, Aligne, & Moss, 2002). Neurodevelopmental interruptions, in-utero, later manifest in behavioral problems and subtle intellectual and information processing disturbances due to chronic hypoxia (Howard, Hosokawa, & Maguire, 1987). Experimental work with animal models of nicotine exposure has demonstrated decrements in attention and memory during maze learning tasks (Levin, Briggs, Christopher, & Rose, 1993; Wietzman, et al., 2002).
Reduced performance on measures of intelligence has been extensively linked to exposure to in-utero and postnatal exposure to nicotine (Fergusson, Horwood, & Lynskey, 1993; Fogelman & Manor, 1988; Fergusson, Woodward, & Horwood, 1998). Fried and Watkinson (1988) investigated the role of nicotine exposure in infants during auditory learning tasks. The sample of infants exhibited statistically significant declines in auditory habituation, the earliest form of learning in human infants (Fried & Watkinson, 1988). Olds, Henderson, and Tatelbaum (1994a), explored the relationship between intellectual impairments of children and mothers’ consumption of tobacco during pregnancy. Within the sample, children’s average Stanford-Binet IQ score decreased 4.35 points when mothers consumed over ten cigarettes per day during pregnancy. In a subsequent study, Olds, Henderson, and Tatelbaum (1994b) found that intellectual impairments in offspring can be negated through smoking cessation interventions during pregnancy. In conclusion, smoking during pregnancy may produce significant intellectual deficits in offspring, which later manifest into the behavioral problems that child and youth care practitioners encounter when working with families.

Wietzman, Byrd, Aligne, and Moss (2002) reported increased behavioral problems in a sample of 2256 school aged children in the United States with early exposure to nicotine. Interestingly, the experimenters found a dose-effect with respect to nicotine exposure, that is, the more a mother smoked the greater the behavioral problems a child exhibited throughout childhood. The relationship between nicotine exposure and behavioral problems has been replicated in other longitudinal studies of problem behaviors (Fergusson, et al., 1998; Wakschlag, et al., 1997). Hill, Lowers, Locke-Wellman and Shen (2000) examined the role of prenatal smoking and alcohol use, and
the occurrence of offspring psychiatric symptoms. The researchers found increased odds between maternal smoking while controlling for familial/genetic background and specific externalizing disorders, conduct and oppositional disorder. In addition to increased behavioral problems, prenatal exposure to nicotine may produce increased susceptibility to adolescent smoking (Wakschlag, et al., 1997).

Previous research has revealed a relationship between maternal smoking during pregnancy and offspring tobacco consumption, particularly for female offspring (Buka, Shenassa, & Niaura, 2003; George, Barnes, & Patton, 2004; Kandel & Udry, 1999; Kandel, Wu, & Davies, 1994). Kandel, et al., (1994) found intergenerational effects on substance use in a cohort of adolescents longitudinally followed for 19 years. Specific correlational results revealed that young women whose mothers smoked during pregnancy were four times as likely to become smokers. Kandel and Udry (1999) suggest that nicotine crossing the placenta barrier may be more noxious for female fetuses. In-utero alterations in neuroplasticity may be an integral component in producing addiction prone characteristics in adolescent females. Specifically, Kandel and Udry (1999) reported that mothers’ smoking did not significantly alter their sons’ smoking behavior, however, the underlying mechanisms producing these gender differences are still undetermined. Kandel and Udry (1999) speculated that fetal levels of testosterone may produce increased neural protection from degrading of the developing dopamergic system. Recently, George and Barnes (2005) found similar gender differences in a sample of Vancouver families. Specifically, girls within the sample were almost twice as likely as males to smoke if they were exposed to nicotine during gestation. Female susceptibility to nicotine addiction may be further enhanced by same-
sex modeling effects. In sum, the maternal environment provides an integral foundation for offspring’s substance use behavior and health later in life.

Girls’ adolescence and successful transition to the childbearing years, from 14 to 45, are influenced by factors such as family support, expanding education, and financial resources (Schoeni & Ross, 2004; Stantock, 2002). During the childbearing years, young women make many life-shaping decisions that often involve substance use and reproductive health. Unintentional pregnancy, especially during adolescence, is a circumstance which has increased risk factors for the mother and fetus (Lin, 2001). Specific risks factors include engaging in substance or tobacco use while the fetus is undetected in the womb (Hill, Lowers, Locke-Wellman, & Shen, 1999). McBride, et al., (2004) stated that the majority of pregnant women that spontaneously quit smoking do so when they discover they are pregnant. However, potential birth defects can occur early within the pregnancy, in the first trimester, due to tobacco use (Chiriboga, 1993; Fergusson, Horwood, & Lynskey, 1993; Fogelman & Manor, 1988; Wakschlag, Leventhal, & Pine, 2006; Weitzman, et al., 2002). In order to prevent birth defects and disabilities, it is imperative to decrease tobacco consumption during the childbearing years and increase women’s overall health. Articulating the factors that affect women’s smoking during the childbearing years and particularly during pregnancy is important to help in the development of effective interventions. Factors that will be examined in the current investigation include personality traits and various aspects of the family environment that are significant in women’s health.

Further deleterious effects of smoking include increased exposure of youth and family members to the virulent substances produced by second hand smoke (Weitzman,
Byrd, Aligne, & Moss, 2002). Klerman (2006) estimates that 35% of American children are exposed to secondhand smoke throughout childhood. Exposure to environmental tobacco smoking increases the probability of upper respiratory illness, asthma, and sudden infant death syndrome (Klerman, 2006). Therefore, decreasing the level of environmental tobacco that is produced by parents is paramount to improving the health of families.

Finally, researchers have found that parental modeling of substance use during childhood is predictive of adolescent consumption levels (Barnes, Barnes, & Patton, 2005; Bricker, Peterson, & Leroux, 2006; Tewolde, Ferguson, & Benson, 2006). Bricker, et al., (2006) in a series of longitudinal studies of 4576 families investigated the role of parental and older sibling modeling in smoking acquisition. The researchers found that parental smoking behavior during childhood, grades three to twelve, significantly predicted adolescent smoking acquisition at the end of high school. Additional analysis by Bricker and colleagues (Peterson et al., 2006) found that having one parental smoker significantly increased the risk of the youth acquiring a daily smoking habit. The analysis revealed that these long-term modeling relationships were independent of the gender of the parent or child. Therefore, delineating the relevant factors of either paternal or maternal smoking, including personality traits and family environment influences, are highly relevant to developing effective multi-systemic interventions and decreasing youth smoking behavior (Hopfer, Stallings, Hewitt, & Crowely, 2003).

Research Objectives

The overall purpose of this study is to examine the role of demographics, personality, and aspects of the family environment in predicting smoking in adult women
and men. Smoking cessation patterns and predictors during pregnancy will also be examined. Specific research objectives are:

1. To examine the prevalence of tobacco use in a sample of Vancouver couples.
2. To examine the pattern of correlations between variables measuring socioeconomic status, family environment, personality, partner smoking, and smoking prevalence in a large representative sample of couples in Vancouver.
3. To develop prediction models to evaluate the role of socioeconomic, family environment, personality, and partner smoking in predicting smoking in both genders in a large representative sample of couples in Vancouver.
4. To investigate the prevalence patterns of smoking during pregnancy.
5. To examine the pattern of correlations between variables measuring socioeconomic status, and family environment characteristics, including family conflict and partner smoking, personality, and the reported prevalence of smoking during pregnancy in a representative sample of Vancouver women.
6. To develop a predictive model to examine the role of socioeconomic, family environment, and personality variables in predicting smoking during pregnancy in a representative sample of Vancouver women.
7. To examine the prevalence of fathers' smoking in a representative sample of Vancouver males.
8. To develop a predictive model to examine the role of socioeconomic, family environment, and personality variables in predicting smoking in a sample of Vancouver males.
9. To develop a predictive model to examine the role of socioeconomic, family environment, and personality variables in predicting smoking during pregnancy in a representative sample of Vancouver males.

In sum, the intent of this study is to understand the role of personality, family environment, and partner’s substance use on couples’ smoking behavior during different marital time periods, including pregnancy. A more comprehensive understanding of these behaviors will help researchers develop more refined clinical tools to aid couples in smoking cessation. For instance, family-focused substance abuse treatments, such as multisystemic therapy, attempt to decrease substance use through family-strengthening interventions.
LITERATURE REVIEW

Smoking Prevalence

It is estimated that over five million Canadians, or twenty one percent of the population, are smokers (Health Canada, 2003). In a recent survey, the average number of cigarettes smokers were having each day was approximately sixteen (Sullivan, 2001). The federal government’s goal is to decrease the number of smokers within the Canadian population to under twenty percent by the year 2011 (Health Canada, 2003). In comparison, Sweden’s smoking rate is below twenty percent and the state of California’s smoking rate is eighteen percent (Health Canada, 2003; Sullivan, 2001).

Demographic Domain Predictors of Smoking

Socio-economic status (SES) has been well documented as being a risk factor for cardiovascular disease, cancer, and negative behaviors, such as smoking (Dorsett & Marsh, 1998; Doescher, Melicent, & Goo, 2002; Frank, Elon, & Hogue, 2002; Santock, 2002). Integral components of SES are education and income level (Santock, 2002). Dorsett and Marsh (1998), report that smoking prevalence is related to the level of education of the smoker. The researchers analyzed survey data for three consecutive years of lone parents on social assistance in England. Specifically, the researchers found that individuals who attend school after their eighteenth birthday were less likely to become addicted to cigarettes (Dorsett & Marsh, 1998). Furthermore, a study of the transitional smoking behaviors of American college students reported that dissatisfaction with college education is significantly correlated with completing the transition from occasional to heavy smoker (Wetter, Kenford, & Welsch, 2004).
Income level is related to smoking behavior in an inverse fashion (Williamson, 2000). In other words, the more money or resources an individual has access to the less likely the person is to engage in tobacco use (Dorsett & Marsh, 1998; Phung, Bauman, & Young, 2003). Researchers have postulated that increased income level provides individuals with access to more resources, such as counseling and nicotine replacement therapy (Doescher, Whinston, & Goo, 2002; Landsbergis, Schnall, & Pickering, 2003). Additionally, disparity in mortality and morbidity rates created by lower SES levels often accompany increased smoking behavior (Frank, Elon, & Hogue, 2002).

There are also differences in smoking behavior due to gender. Within the Canadian population men smoke more than women (Sullivan, 2001). Specifically, men smoke over 3 more cigarettes than their female counterparts per day (Health Canada, 2003). However, researchers have now concluded that the fastest growing sub-group of smokers is young women (Richmond, 2003). Within the mainstream culture, it was socially unacceptable for women to smoke until the women's liberation movement in the 1970's (Richmond, 2003; Worell & Remer, 2003). Health researchers have only begun to study the predictors of women's smoking (Richmond, 2003). Moseley, Landrine, and Klonoff (2004) found that women's experiences with sexual abuse were better predictors of smoking behavior than other status variables, such as educational level. In conclusion, these studies suggest that demographic variables are significantly associated with smoking behavior. However, other research suggests individual personality traits are also relevant in predicting smoking behavior.
Personality Domain Predictors of Smoking

Eysenck’s Three Factor Model

Personality traits can be defined as enduring dispositions which determine behavior outcomes (Terracciano & Costa, 2003). Eysenck (1980), stated that there are three main personality dimensions, psychoticism, neuroticism, and extraversion, all which have differential effects on tobacco use (Barnes et al., 2000; Eysenck, 1980; Nawakami, Takai, & Takatsuka, 2000; Santock, 2002; Trull, Waudby, & Sher, 2004). Eysenck based his three factor model on emerging evidence from brain research and Pavlov’s learning theory (Cale, 2006). Eysenck postulated that individuals high on extraversion (E) have low levels of cortical arousal and seek out stimulating conditions in order to increase cortical activation (Barnes, et al., 2000; Eysenck, 1980; Cale, 2006). Specifically, Eysenck states that under low sensory input conditions or low autonomic involvement, extraverts are characterized by low cortical activity while introverts produce high levels of activity (Cale, 2006; Eysenck, 1980; Patton, Barnes, & Murray, 1993). Under low cortical arousal conditions extraverts smoke to increase internal stimulation levels. In contrast, introverted individuals tend to smoke to reduce tension or anxiety. (Cale, 2006; Eysenck, 1980; Patton, et al., 1993; Terracciano & Costa, 2003). In sum, extraverted and introverted individuals smoke in order to gain an optimal level of stimulation and may be considered different types of smokers (Patton, et al., 1993).

Patton, Barnes and Murray (1993) examined the relationship between Eysenck’s personality traits and smoking behavior in a random sample of 1257 adults. Consistent with Eysenck’s model, the researchers found that levels of extraversion differed for both male and female smokers, quitters, and non-smokers. Female and male smokers scored
the highest on measures of extraversion and these results have been replicated by other researchers (Cale 2006; Tate, Pomerleau, & Pomerleau, 1994; Wauby & Sher, 2004;). In addition, Patton, et al., (1993) found smokers scored higher on measures of psychoticism when compared to quitters and non-smokers. Furthermore, the researchers found that male smokers scored higher on the neuroticism domain (Patton, et al., 1993). However, there were no significant differences between scores on neuroticism for females within the sample. Finally, Patton, et al., (1993) report that quitters within the sample did not differ from either smokers or non-smokers on measures of neuroticism, however, this group was less extraverted and less need for stimulation may produce a greater ease in quitting smoking.

The mixed results found by tobacco researchers with respect to personality traits may be due to the fact that smokers are not a heterogeneous or static group (Patton, et al., 1997; Patton, et al., 1993; Terracciano & Costa, 2003). Patton, et al. (1997) further investigated the role of Eysenck’s personality domains in the nature of tobacco addiction. Two clusters or types of smokers were revealed through cluster analysis of 346 smokers. The larger cluster, 75% of the sample, were older, more financially secure and had less drinking problems. The smaller cluster scored higher on measures of neuroticism, psychoticism, and were more field dependent. The smaller, younger group also significantly differed in the level of alcohol-related problems even though they did not consume more alcohol than the older cluster. The researchers speculate that these smokers may have a more difficult time giving up the habit because they have decreased ego strength, low self-esteem, and tend to smoke under environmental stress (Patton, et al., 1997).
**Five Factor Model**

Costa & McCrae (1992) developed the Five Factor Inventory (FFI) model of personality traits, which expands on Eysenck’s three factor model. The FFI is a general measure of personality traits that uses five personality domains and this measure has gained increased use in substance abuse research (Anderson, et al., 1999). The FFI has five broad categories: Neuroticism (N), Extraversion (E), Psychoticism (P), Openness to experience (O), and Conscientiousness (C). Within each broad trait domain, there are 6 “lower order” traits or facets (Costa & McCrae 1992; McCrae & Costa, 2003; Terracciano & Costa, 2003). McCrae & Costa (2003) have tested the validity of FFI in various multiple cultural settings and the personality battery has been found to be a reliable indicator of general trait disposition. Furthermore, the researchers developed shortened versions of the FFI, the NEO Personality Inventory (NEO-PI) and the NEO Five Factor Inventory (NEO-FFI). These abridged versions of the FFI have also been validated in multiple settings and cross-sections of the general population (McCrae & Costa, 2003). However, the role and results of the FFI in addictions research are still mixed with respect to tobacco research (Anderson, et al., 1999; Shadel, Cervone, Niaura & Abrams, 2004).

Shadel, Niaura, and Goldstein (2004) investigated the relationship between the FFI dimensions of personality and smoking habits of 130 regular smokers. The researchers found that the majority of the correlations between smoking behavior and the FFI did not reach statistical significance. Specifically, the only two significant correlations were the association of intellect scores (or Openness to Experience) with the number of 24 hour quitting attempts in the past year and the motivation to quit smoking
(Shadel et al., 2004). The insignificant results obtained by Shadel, et al., (2004) could be produced by the small sample size. Further research with large representations of the general population is needed to conclusively determine the role of the FFI in addictions research.

Terracciano and Costa (2003) state that the most reliable trait predictors of smoking behavior are psychoticism and neuroticism. Specific latent facets of psychoticism that smokers differ from the general population include sensation seeking and increased impulsive behavior (Patton, et al., 1997; Terracciano & Costa, 2003).

Addiction Prone Personality

The major aim of the Winnipeg Health and Drinking Survey was to determine if personality traits predicted the development of alcohol abuse and smoking. A secondary aim was to develop a measure of Addiction Prone Personality (Barnes, et al., 2000). The results of this project indicated a strong link between personality characteristics and the development of addiction.

Specifically, Barnes, et al. (2000) found that high levels of psychoticism predicted smoking behavior within the sample of 1257 adults during the first wave of the study and this characteristic contributed indirectly to the prediction of smoking at the third wave of the study, seven years later, through the effect of psychoticism on smoking at Wave 1.

Following these results, Barnes et al. (2000) developed the Addiction Prone Personality scale (APP-21), which is a revised 21 item measure. Two items were deleted from the APP-23: 1) “Would you take drugs which may have strange or dangerous effects” and 2) “Have you had blank spells in which your activities were interrupted and you did not know what was going on around you?” The researchers validated the APP in
a sample of 473 biological and 128 adoptive families. Barnes, et al. (2000) found that the APP is reliable and valid in predicting substance misuse behavior, such as alcoholism and smoking.

Anderson, et al. (1999) employed the APP and the FFI to predict smoking and other addictive behavior in four sub-samples of the Vancouver Family Study (VFS). The researchers found a stable pattern of associations between measures of susceptibility to substance abuse and personality variables for both genders. The APP did intercorrelate with the FFI variables and was highly correlated with neuroticism, low agreeableness, and conscientiousness (Anderson, et al., 1999). The researchers ran further analyses to test if additional prediction paths would become significant with the removal of the APP. Additional paths between the five factor measure and substance use did occur. However, the APP provided a more stable pattern of association across intrafamily structural equation models when predicting smoking behavior. For each family member model of mother, father, son, daughter, the APP was consistently related to smoking behavior. Specifically, for both fathers’ and daughters’ structural equation models for personality variables, the APP accounted for 2.5% of the variance with respect to smoking behavior.

In conclusion, there appears to be a set of personality traits which predispose individuals to addictive behaviors, regardless of age or gender (Anderson, et al., 1999; Barnes, et al., 2000; Barnes, et al., 2005).

*Family Environment Predictors of Smoking*

The family environment is complex and can be viewed as an interdependent system of individuals (Prest & Protinsky, 1993; Prevatt, 2003; Santock, 2002). Two major structural variables of the family environment that have been extensively studied
are family adaptation and cohesion. Olson (1985) developed the Circumplex Model of Marital and Family Systems to explain family functioning and this model was operationalized in the Family Adaptability and Cohesion Evaluation Scales (FACES) assessment scale, which has been revised three times. Family cohesion can be defined as the degree of emotional bonding that couples and children produce with one another (Olson & Gorall, 2003). In other words, how families balance being together and separated. Specific facets of cohesiveness include emotional bonding, boundaries, time, decision making, and recreation (Olson, 1985, Olson & Gorall, 2003).

Olson (1985) states the dimension of cohesion lies on a continuum, which includes four major domains: Disengaged (very low cohesion), separate (moderate cohesion), connected (moderate to high cohesion), and enmeshed or overly connected (extremely high). Olson (1985) hypothesized that the middle ranges of cohesion or balanced levels are those that produce optimal family environments. While the anchors of the continuum, disengaged, and enmeshed, are viewed as being symptomatic of dysfunctional interpersonal relations, disengaged relationships can be characterized by extreme emotional separation (Olson & Gorall, 2003). For instance, there is limited family interaction, and members often engage in separate activities without support of family members (Olson & Gorall, 2003). Conversely, enmeshed families are overly bonded, that is, family members are concerned with the reaction of the group to their actions and the family demands loyalty (Olson, 1985; Olson & Gorall, 2003). Conrad, Hay and Hill (1992) performed an extensive review of the literature in the 1980s and found that family bonding predicted smoking onset in 60 percent of the studies on adolescent substance use. Salient aspects of family bonding that predicted smoking
included a lower quality of attachment to parents, lower levels of supervision, and decreased parental expectations (Conrad, et al., 1992). Hill, Hawkins, and Catalano (2005) investigated the relationship of developmental patterns and the role of family influences on the daily smoking in adolescents. The researchers utilized a prospective design in order to follow the development of daily smoking from ages 10 to 21 in a sample of 808 children. Specific family influences on teen smoking through direct correlational effects included low levels of family monitoring and family bonding. In sum, the results of this longitudinal study suggest that family influences are important in experimentation and habitual tobacco use by teenagers.

Previous researchers have found that levels of family cohesion significantly predict adolescent smoking (Voorhees, Schreiber, & Schumann, 2002; Pilgrim, Abbey, & Hendrikson, 1998). However, the role of family cohesion in predicting partner smoking has not been delineated by tobacco researchers. Alcohol researchers have found inconclusive results with respect to the role of family cohesion in recovery studies. Zucker (2005) and colleagues measured individual and social predictors of alcohol recovery in a sample of alcoholic married men. The researchers found that non-drinking variables, such as the number of social supports of a couple, played significant roles in predicting and maintaining abstinence. However, the degree of family cohesion was not a significant predictor in the long-term model of alcohol recovery in the sample of 134 couples. In conclusion, substance abuse researchers have neglected to recognize and delineate the role that family cohesion plays in adapting to spousal substance use.

Family adaptability can be defined as the degree of flexibility of family power structures, roles, and relational rules. In other words, how families balance stability when
changing environmental conditions are encountered by the group. Olson (1985) stated that family flexibility also lay on a continuum which can be divided into four main areas: Rigid (very low ability to change), structured (mid to low change), flexible (mid to high), and chaotic (very high rates of change). Similar to family cohesion, Olson (1985) hypothesized that a curvilinear relationship between flexibility and family functioning will occur; the more rigid or chaotic a family, the more dysfunctional the interpersonal relationships. For instance, Higgins & McCabe (2003) found that family traditionality and decreased adaptability were predictive of a higher level of maltreatment and psychopathology in children.

Researchers have found better functioning families score higher on both dimensions of the family environment (Olson & Gorall, 2003; Barnes, et al., 2005). In fact, a linear relationship between high functioning families and decreased substance abuse may be occurring instead of a curvilinear relationship. For instance, Barnes et al., (2005) found that youth raised in an environment were there is parental alcoholism, high stress, and low family cohesion were more likely to engage in heavy marijuana smoking. Specific results from regression analysis found that family, personality, and peer domains all had statistically significant impact on predicting heavy marijuana use in the youth sample (Barnes, et al., 2005). Furthermore, many studies have concluded that there are other various facets of family environments that are predictive of adolescent substance abuse, disordered eating, and engagement in deviant behavior (Cachelin, Weissss, & Garbanah, 2003; Fergusson & Horwood, 1999; Reifman, Barnes, & Dintcheff, 1998). Additionally, family factors that predict engagement in dysfunctional adolescent behavior include risk factors, such as high family system stress and modeling of substance abuse.
(Barnes, et al., 2005; Hill, et al., 2005; McCubbin, Neddle, & Wilison, 1985; Miller & Volk, 2002; Prevatt, 2003).

Researchers have found that parental modeling of tobacco use significantly contributes to adolescent smoking patterns (Hill et al., 1992; Hill et al., 2005; Wetter et al., 2004). Wetter et al. (2004), found that parents’ smoking behavior is predictive of college students’ use of tobacco products. The majority of smokers acquire the deadly habit before the age of twenty (Tucker, Ellickson, & Klein, 2002). Therefore, interactions within the family of origin are paramount at predicting and preventing smoking acquisition (Prevatt, 2003; Tucker, et al., 2002). Some researchers have speculated that the family environment may provide ample access to cigarettes and increase the possibility youth attempt smoking at an early age (Conrad, et al., 1992). In terms of family system theory, risk factors, such as modeling substance abuse and high family stress, produce family anxiety, which is positively correlated with substance abuse (Barnes, et al., 2005; Cook, 2001; Farrell & Barnes, 1993). Tucker, et al. (2002) investigated the predictors of youth transitioning from occasional to committed smoking behavior using longitudinal data. The researchers found that youth were more likely to become committed smokers if they were enmeshed in prosmoking environments and that parental approval of smoking was a risk factor during adolescence and young adulthood. However, researchers have neglected to analyze how familial anxiety effects the microsystem within the family, including the intimate relationships between the parents.

**Partner’s Smoking**

To date, there has been scant research on a subgroup of smokers, the smoking couple. Tobacco researchers have found that married couples are less likely to smoke
when compared to their single counterparts (Franks, Pienta, Meharaban, & Wray, 2002; Pollak, McBride, & Baucom, 2003; Rohrbaugh, Shoham, & Trost, 2001). Researchers have speculated that the differences in tobacco consumption with respect to marital status may be due to the social selection pressures exerted during the dating process of a relationship (Franks, et al., 2002; Pollak, et al., 2001). That is, many individuals will give up smoking while dating in order for their behavior to become congruent with their potential mate. However, if a smoker marries they are more likely to partner with an individual that is addicted to cigarettes (Franks, et al., 2002; Pollak, McBride & Baucom, 2001; Rohrbaugh, Shoham & Trost, 2001). Compatibility theories of courtship and marriage assert that partners with similar characteristics have an increased likelihood of obtaining relationship harmony (Farrell & Barnes, 1993; Franks et al., 2002). For instance, researchers have found that non-smoking partners will consume a higher fat and alcohol diet when romantically paired with a smoker (Osler, 1998). Poorer dietary standards by association puts partners at risk for acquiring illnesses, such as cardiovascular disease. Similarly, Osler and Prescott (1998) found a significant relationship between cohabitating with a non-smoker and successful quitting. In sum, the intimate social network constructed by couples seems to predict food intake and tobacco use patterns.

Mudar, Leonard, and Soltysinski (2002) studied the marital satisfaction of newlywed couples with respect to substance abuse. The researchers found that newlyweds were unhappy in their marriage if their substance abuse pattern, including smoking, significantly differed from their partner’s substance use. Homish and Leonard (2005) investigated spousal influence on smoking behaviors of newly married partners.
The researchers questioned couples while they were applying for marriage licenses and the participants were followed until their second wedding anniversary. Interestingly, the researchers found a unidirectional relationship with respect to gender. That is, men’s smoking behavior was not influenced by marrying a smoking woman, however, women who married smokers were more likely to begin (or relapse) into smoking. Specifically, the amount that women were smoking in the second year of marriage was predicted by the amount cigarettes her husband consumed during the first year (Homish & Leonard, 2005). Conversely, the non-smoking partner could positively influence the smoker to quit due to their union. Specifically, the likelihood of quitting smoking was significant for either gender if they married a non-smoker.

A similar study examined late onset smoking initiation, smoking initiated after 17 years of age, in women whose partners smoke when compared to smoke-free controls (Daly, Lund, Harty & Ersted, 1993). Daly, et al. (1993) found that peer influences were also predictive of late initiation smoking, and that delayed instigation in young women may be due to a combination of environment, personality, and family influences. Monden, van Lenthe, de Graaf, & Kraaykamp (2003), studied the significance of parents and partners for smoking cessation of individuals across the lifespan. The social determinants were studied through event history analysis, and the mere presence of a partner had a positive effect on cessation rates. The most optimal pairing for predicting cessation was living with an ex-smoker. Living with a smoking partner significantly reduced the chance of successful cessation. Parents’ greatest influence was on initiation rates of teens, that is, having a parent that smoked was associated with adolescent smoking (Monden, Kraaykamp, & Graaf, 2003). The researchers did not find significant
differences between male and female cessation rates. However, the investigators report that lack of significance was probably due to small sample size. Finally, Monden, Kraaykamp, and Graaf (2003) suggest that future researchers explore the relationship between residing with an ex-smoker and increased cessation rates. Speculatively, ex-smokers may produce the most supportive environment, non-smoking house, and role modeling cessation for motivated or contemplating smokers to permanently quit.

Social support is integral in aiding individuals to successfully complete a smoking cessation program (Rohrbaugh, Shoham, & Trost, 2001; Waldron & Lye, 1989; Wilson, Taylor, & Roberts, 1995). A Dutch study of the influences of social environment in the workplace and at home found differential effects due to social location (Willemsen, De Vries, Van Breukelen, & Oldenbury, 1996). Workplace socialization did not influence participants’ intention to quit smoking. Instead, partner and children’s influence accounted for almost three percent of the variance for intention to quit in the sample of Dutch workers. Cohen and Linchistenstien (1990) have found that behaviors, such as praising and participation in the cessation program, were beneficial in aiding a partner in quitting smoking. In particular, the researchers found that the most significant factor was the ratio of positive (i.e. complementing) to negative (i.e. nagging) behaviors a non-smoking partner engaged in during a 13 week cessation program.

A survey of smoking Kuwaiti couples examined the prevalence of smoking Kuwaiti women and if these rates compared to those in the Western hemisphere (Radovanovic, Shah, & Behbehani, 1999). The researchers hypothesized that women’s tobacco consumption would be influenced by their husbands’ smoking behavior due to the socio-cultural climate of Kuwait. The divorced or widowed Kuwaiti women in the
sample fell within the Western average for female smoking, approximately ten percent. However, less than one percent of presently married Kuwaiti women in the sample smoked, which is far less than the Western average. In contrast, 37.4 percent of Kuwaiti males in the sample engaged in smoking behavior and younger males consumed more tobacco products. The researchers suggest that gender differences in prevalence rates may be due to women under-reporting their smoking behavior as it is a taboo in their culture.

Japanese researchers studied the concordance rates of cancer in couples with respect to shared environmental factors (Izumi, Imai, & Nakachi, 2004). Cancer rates of couples were correlated with various lifestyle factors, such as smoking and alcohol habits. Long term cohabitation was found to produce similar lifestyles in dietary habits, smoking, and alcohol consumption and cancer rates. Specifically, women were more likely to receive a diagnosis of cancer if their partner was diagnosed. Finally, the researchers postulate that the strong associations between shared lifestyle factors and cancer rates make it imperative to study environmental factors in couples’ environments as these may be more salient than genetic factors.

Brazilian researchers examined spousal concordance rates with respect to hypertension, obesity, and smoking rates in a sample of over five hundred households (Bloch, Klein, de Souza e Silva, Nogueira, & Salis, 2003). An aggregation of risk factors, such as blood pressure, was more homologous with partners of similar educational levels. The researchers state that developing smoking interventions for couples will aid in decreasing cardiovascular disease in Brazil.
In a prospective study, Frank, et al. (2002) found that over a two year period when one partner quit smoking, their abstinence was a valid predictor of corresponding partner abstinence in the sample. The researchers hypothesize that factors, such as changes in behavioral cues and social support, could be producing the congruence in partners' quitting (Franks, et al., 2002). Interestingly, the researchers found that when males had a partner that was a non-smoker they were more likely to quit. Frank, et al. (2002) state that the smoking couple may be the most resistant subgroup of smokers within the population. In sum, the above literature discusses the complexity of smoking couples and the need for smoking interventions designed for couples.

_Pregnancy and Smoking_

In the United States, it is estimated that 13.6 percent of pregnant women self-report smoking at their first obstetric appointment (DiClemente, et al., 2000). Many women will spontaneously quit when knowledge of their pregnancy is revealed and report that abstinence occurs to protect the fetus (DiClemente et al., 2000; Pollak & Dolan-Mullen, 1997). Severson, et al. (1995) reported that spontaneous quitters were younger, more educated, had a non-smoking partner, and did not consume alcohol. The relapse rates for spontaneous quitters are extremely high, approximately 70 percent of new mothers return to smoking within the first six month (DiClemente, et al., 2000). Factors that effect relapse include lower SES and having a partner that smokes (DiClemente, et al., 2000; McBride, et al., 2004; Pollak & Dolan-Mullen, 1997). Interestingly, when compared to non-pregnant quitters at the same stage of abstinence the spontaneous quitters resemble smokers who are in the process of preparing or contemplating stages of change (DiClemente, et al., 2000). Essentially, the majority of
spontaneous quitters are suspending their smoking while pregnant and no interventions are presently tailored to protecting women from relapsing.

Women who smoke throughout pregnancy seem to be the youngest, heaviest, and least educated smokers (DiClemente, et al., 2000; Pollak & Dolan-Mullen, 1997). Grange, et al. (2005) report that women who continue to smoke during the first trimester of pregnancy are more invulnerable to withdrawal methods and they require multiple methods. DiClemete, et al. (2000) speculate that these smokers constitute an especially difficult to reach subgroup as they have low financial resources, and tend to reside in emotional, familial and residential turbulence.

*Smoking Interventions*

Numerous types of interventions have been created to aid women ceasing smoking during pregnancy. Doherty and Whitehead (1986) introduced the concept that social dynamics of marriage affects tobacco consumption rates. The researchers employed a family systems model that emphasized the communication and emotional regulatory effects that smoking offers couples. The authors conceptualized smoking behavior as a form of interpersonal communication in long term relationships. Smoking together symbolizes relaxation or a period for communicating and by giving up these rituals, tension enters the relationship as new behaviors must be established as norms. Systemically, the researchers argued that it is imperative to include partners in smoking cessation interventions especially during periods of vulnerability, such as pregnancy.

Thompson, Parahoo, McCurry, O’Doherty, & Doherty (2004) employed a mixed method design to investigate perceptions of partners’ support during cessation. Within the sample, over half of the men smoked and did not change their smoking patterns
during pregnancy. The majority of women, 66.7%, reported in the questionnaire that an important factor contributing to their cessation would be if their partner quit smoking. Supportive behaviors that contributed to cessation included partners’ smoking outside and rolling down the window in the car. However, when interviewing the committed smokers who began smoking at an early age, the support was revealed to be more potential as opposed to real. Other researchers have developed smoking cessation interventions directed exclusively at the men whose partners are pregnant (Stanton, Lowe, Moffatt, & Del Mar, 2004; Wakefield, Reid, Roberts, Mullins, & Gillies, 1998). For instance, Stanton, et al. (2004) focused on providing men with free nicotine patches and minimal support yielding a quit rate of 21% in six weeks. However, a limitation to this study was that the researchers did not compare men’s cessation rates to those of their female counterpart. Wakefield, et al. (1998) found that many partners were unaware that exposing women to second hand smoke was deleterious to the growth of the fetus. The researchers found that when probed about the support they would provide for their partners, the men responded that they would provide verbal encouragement (Wakefield, et al., 1998). These responses are similar to the potential verses real supportive behavior reported by Stanton, et al., (2004). In sum, these studies reveal the importance of enlisting and developing couples’ smoking interventions.

Bottorff, et al. (2005) attempted to delineate couples’ smoking dynamics prior to pregnancy in order to develop effective interventions. Specifically, the researcher’s interview questions addressed couples tobacco consumption, and the routines couples engaged in while consuming tobacco products. Narrative themes Bottorff, et al. (2005) encountered during the interviews included regulation of smoking, acquisition and
handling of tobacco, communication, and responding to slips or relapses. The researchers concluded tobacco consumption allowed couples to express their identity, convey feelings, and support each other. Finally, the themes of the interviews pointed to women’s vulnerability to the impact of their partner’s smoking.

McBride, et al. (2004) have performed the first randomized controlled trial to evaluate the effectiveness of incorporating partner support into cessation interventions during pregnancy. The researchers randomly assigned 583 smoking dyads to a usual care (UC), a woman only (WO), or partner-assisted group (PA). Prevalence of smoking and degree of partner support was assessed at four intervals: 28 weeks pregnant and 2, 6, and 12 months postnatal. The UC group consisted of women receiving a self-help guide and health-care provider advice to quit smoking. The WO adjoined a late pregnancy relapse prevention kit (book and gift), and six counseling phone calls from graduate level counselors with the UC intervention. In the PA group, partners received six counseling phone calls from graduate level counselors, a guide for supportive behavior during smoking cessation, and nicotine patches, in conjunction with the WO intervention. McBride, et al. (2004) found no significant differences between the intervention groups and the controls. The researchers postulate that threshold treatment intensity and other significant factors in smoking cessation must be delimitated in order to yield significant treatment effects.

A fatal design flaw could potentially have produced the nonsignificant results in the first randomized trial performed by McBride, et al. (2004). Specifically, the researchers assumed that partners’ support would be comparable regardless of their smoking habits. However, the above literature review, specifically the work of
Thompson, et al. (2004), illustrates that differential support occurs in smoking relationships. Recently, in a preliminary investigation by Murasco, et al. (2006) a randomized psychotherapy trial was conducted for spontaneous quitters of an ethnic minority, Hispanic women. The researchers found a statistically significant difference in the smoking rates of spontaneous quitters’ partners when compared to couples who continued to smoke during pregnancy. The generalizability of these results is limited due to the large Hispanic composition of the sample and the low number of spontaneous quitters enrolled in the intervention. In sum, these initial results suggest that smoking cessation during pregnancy may be due to a complex interaction between smoking dyads and environmental factors.

*Theoretical Perspective*

A multi-level perspective will be utilized to frame couples smoking behavior. For the purpose of the current study, a modified version of Bronfenbrenner’s ecological model will be employed to examine dyadic smoking. According to the ecological model, there are multiple environmental systems in an individual’s ecosystem and inherent biological conditions interacting to produce the ecological milieu of an individual (Bronfenbrenner, 1986). Factors from three different contextual levels will be used to predict smoking behaviors. The perspective of multi-level influences on behavior is congruent with the dynamic nature of tobacco addiction (see Figure 1). First, the structural system reflects the socio-demographics of the individual and indirectly captures some of the cultural characteristics in which an individual is enmeshed. Second, the individual exerts intrapersonal influences on their smoking behavior, such as personality
and biological factors. Finally, the microsystem is the immediate environment of the smoker. These influences include family environment and partner smoking.
Figure 1 Multi-level model of smoking and associated factors.
METHODOLOGY

Design

The data for this secondary analysis study will be extracted from the Vancouver Family Survey (VFS). Employing secondary data analysis provides the researcher with several advantages, such as access to data from large representative samples. Specifically, data on 601 females and 601 males was obtained by employing the VFS. For the purpose of this research, the youth data were excluded from the analysis. Procuring data from expert researchers, with considerable experience in questionnaire design, provides increased validity to the study (Hinde, 1991; Hofferth, 2005). Finally, secondary data analysis provides considerable temporal and financial savings. For instance, obtaining highly detailed data about family structure, with multiple participants reporting on substance use behaviors and marital satisfaction, would take considerable time and financial resources.

Disadvantages to secondary data analysis include data mining, using datasets for purposes not congruent with the objectives of the initial study purpose. Issues of construct validity arise in secondary data analysis, as variables in the original data set may not comprise an accurate representation of new topics (Hinde, 1991; Hofferth, 2005). For example, asking couples questions such as “How many cigarettes did you smoke with your spouse would?” would provide the most accurate estimation of dyadic smoking.

The purpose of this secondary analysis is to employ a large representative sample of the Canadian population to determine the influence of demographic, personality, the family environment, and partner smoking on individual tobacco consumption during two
temporal periods: Normal co-habitation and pregnancy. This study uses data collected from the VFS adult sample as outlined in the Vancouver Family Survey (Barnes, et al., 1997).

*VFS Selection Procedures*

*Research Participants*

The aim of the VFS was to provide researchers with a large representative sample of intact families with children ranging in ages from 14 to 25. Researchers employed the Greater Vancouver area telephone directory for listings of the original wave of data collection. An original research objective was to recruit a large number of intact adoptive families. After contacting 19,253 families, it became evident that the frequency of adoptive families with children in the appropriate age bracket was quite low. Geographically, the number of intact adoptive families from the west side of the Greater Vancouver area was very low. Therefore, the east side of Vancouver became the focal point of participant screening. The final sample resulted in a large (*n* = 5120) sample of biological families, however, only 177 adoptive families were found to meet the initial selection criteria.

Additional selection criteria were based on the willingness of all three family members to participate, and the English fluency of family members, as the surveys were completed in English. An average time for questionnaire completion was one hour. The final sample size was 473 biological and 75 adoptive families were sampled with an overall response rate of 47 percent. An additional 57 adopted families were recruited through newspaper advertisement and referrals to increase the sample size. This produced a final sample of 601 families completing 1803 questionnaires (601 Mothers, 601
Fathers, and 601 Offspring). For the purpose of this secondary analysis, the adoptive families were excluded for the pregnancy portion as the mothers’ never biologically conceive.

**Measures**

A variety of measures were used in the VFS sample. The instruments included measures to identify family influences, personality traits, and alcohol and tobacco consumption. For the purpose of this secondary analysis on the smoking behavior of couples, these measures are expected to generate information about the dynamic nature of dyadic smoking. These measures are described in detail in the demographic, family, personality, and relationship domain sections below.

**Demographics Domain**

Demographics captured by the VFS survey and measures of socio-economic status, including gender, income, and education level, reported by both the mother and father.

**Family Domain**

Perceptions of family environment were measured with four instruments. The Family Adaptability and Cohesion Evaluation Scales (FACES II) is a 5-point Likert-type self-report measure developed to examine 16 variables associated with family cohesion and adaptability: Family finances, family recreation, religious matters, demonstration of affection, friends, conventionality, philosophy of life, dealing with parents and in-laws, aims and goals, amount of time spent together, making major decisions, household tasks, leisure time interests and activities, and career decisions (Olson and McCubbin, 1982).
The Cronbach alpha reliabilities for the FACES II in the VFS were .86 for cohesion and .74 for adaptability in the parents.

*Family Inventory of Life Events*

The second measure of family environment instrument, the Family Inventory of Life Events (FILE), examines acute stressors in the family contexts in the last year (McCubin and Thompson, 1991). The FILE is a 71 item self-report instrument grouped into six subscales: family development, extended family relationships, health, work, finances, management, social activities, and law (O’Brien & Brown, 1994). The test-retest reliability for the complete measure was $r = .80$. The overall internal consistency of the FILE within the VFS sample was .79 for both parents (Barnes, et al., 2005)

*Family Inventory of Resources for Management*

The third measure of the family environment was the Family Inventory of Resources for Management (FIRM) developed by McCubbin, Comeau, & Harkins (1979). The FIRM is a 69 item self-report questionnaire developed to assess the degree of intra-familial and extrafamilial resources present for each family member (Halverson, 1991). The overall internal consistency of the FIRM within the VFS sample was high, Cronbach alpha = .92 for both parents (Barnes, et al., 2005)

*Marital Satisfaction*

The degree of marital satisfaction within the VFS sample was assessed using two assessment tools. The Dyadic Adjustment Scale (DAS) is a 32 item self-report questionnaire focusing on martial conflict. The DAS has a score range of 0 to 151 with higher scores indicating more positive romantic partner adjustment (Graham, Liu, &
Jeziorcki, 2006). Furthermore, the internal consistency for the total DAS scale was very high (Cronbach alpha = .96).

*Physical Violence Scale*

The second measure of marital satisfaction administered to the VFS sample was the Physical Violence Scale (PVS). Barnes, Greenwood, & Sommer (1991) developed the PVS as an abridged estimate of physical violence based on the Conflict Tactic scale. The CTS has been used by researchers to assess the incidents of assault between spouses (Browning & Dutton, 1986). Specifically, the CTS consists of an inventory of actions that a family member might employ during a conflict (Straus, 1979). Barnes, et al. (1991) administered the CTS to a sample 245 of young men. The researchers found that none of the men in the sample reported perpetrating the eight most violent behaviors against their partners. Therefore, the 7 remaining mildly violent items, such as, wrestling with her, encompassed the PVS. The 7 items comprised a highly reliable scale, with a Cronbach alpha score of \( r = .88 \) (Sommer, 1990).

*Personality Domain*

*NEO-Five Factor Inventory*

The abridged version of the NEO Personality Inventory (NEO-PI), the NEO Five Factor Inventory (NEO-FFI), was administered the VFS sample. The 60 item NEO-FFI measures five domains of personality: Neuroticism, Extroversion, Openness, Agreeableness, and Conscientiousness. The items were rated on a 5 point scale ranging from 1 (not true to me) to 5 (true to me) (Costa & McCrae, 1992). Specifically, Costa & McCrae (1992) reported the Cronbach alpha reliabilities were .86 (Neuroticism), .83 (Extroversion), .76 (Openness), .68 (Agreeableness), and .83 (Conscientiousness). The
NEO-FFI, the shortened version, predicts approximately 85% of the variance when compared to the elongated personality inventory (Costa & McCrae, 1992). Within the VFS sample, the internal consistency ranged from .66 to .87.

Addiction Prone Personality Scale

The Addiction Prone Personality (APP) measures the development of personality characteristics that predispose an individual to substance abuse (Barnes et al., 2000). The refined instrument is comprised of 21 items testing predisposition to addictive behavior. Operationally, higher scores on the APP describe sensation-seeking behavior and inability to self-regulate behavior producing greater risk for substance abuse. The APP has an internal consistency of .76, a two year test-retest reliability of .82, and a seven year test-retest reliability of .74 (Barnes, et al., 2000). The APP encompasses two potential pathways of addiction, sensation seeking and high levels of Psychoticism into one general measure of substance use vulnerability (Barnes, et al., 2000). The APP measure has high validity in predicting alcohol and substance use across age and gender (Barnes, Barnes, & Patton, 2005). Within the VFS sample, the internal consistency was .63 for the mothers and .66 for the fathers.

Partner Smoking Domain

The smoking behavior of spouses was coded in the VFS survey employing questions about prevalence, age of first cigarette, and daily smoking behaviors. Within the survey, males were asked to assess the daily tobacco consumption rates of their spouse during pregnancy. George, Barnes, & Patton (2004) found a significantly high correlation, (r = .87), between the self-reports of smokers and those of their spouses,
replicating findings by other tobacco researchers (McBride, et al., 2004) and confirming the validity of self-report smoking data.

**Dependent Variables**

1. General smoking measure: Self-reported weekly smoking rates will be assessed by the following question: “Think back over the last seven days, starting with yesterday, how many cigarettes did you smoke?”

2. Quit smoking measure: Of the participants that smoked over a 100 cigarettes, self-reported cessation rates will be assessed by the following question, “If you have quit, when did you stop smoking?” The response scale for this question was a 4 point Likert-scale that included 1=less than a year ago, 2=one to five years ago, 3=more than five years ago, and 4=not applicable. The dichotomous variable, quit smoking, will be constructed by combining responses 1 to 3 into an affirmative, Yes (coded 1), response, while the rest of the sub-sample of smokers will be re-coded as No respondents (coded 0). This process was repeated for each male and female smokers within the VFS survey.

3. Pregnancy smoking measures: Self-reported cessation rates of women will be assessed by the following question: “Did you smoke during pregnancy?” The response scale for this question was a dichotomous Yes (1) or No (0) question. For the men, the variable smoking during pregnancy was constructed through the combination of the following questions: “If you quit, when did you stop smoking?” The response scale for this question was a 3 point Likert-type scale that included 1=less than one year ago, 2=one to five years ago, and 3=more than five years ago. If a participant responded with either of the first two responses, it
was rationalized that they smoked throughout the pregnancy of their child, approximately was 15 to 20 years ago. If the participant responded with quit smoking over five years ago, the cessation date was compared to the birth date of their child to assess if the father smoked throughout the pregnancy of their child.

Analytic Procedures and Data Analyses

The model described in Figure 1 will be tested in a series of statistical procedures. First, frequency analyses will be conducted to describe the characteristics of the sample in terms of demographic, personality, family, and partner smoking patterns. The second stage of the analytic sequence will involve computing bivariate correlations. Correlational analysis will determine the predictors from each domain that are significantly associated with the dependent smoking variables for each gender. The following hypotheses will be tested:

1. That significant correlations will occur between higher scores on smoking status measures (weekly smoking, smoking during pregnancy, and quitting vs. not quitting) and demographic characteristics (younger age, lower income, and lower education).

2. That significant positive correlations will occur between higher scores on smoking status measures (weekly smoking, smoking during pregnancy and not quitting vs. quitting) and personality measures (high APP scores, and high FFI scores within the Extraversion and Neuroticism sub-domains).

3. That significant negative correlations will occur between higher scores on smoking status measures (weekly smoking, smoking during pregnancy and not quitting vs. quitting) and lower scores on family environment predictors.
(family cohesion, resources, and marital satisfaction). Furthermore, significant positive correlations will occur between higher scores on smoking status measures (weekly smoking, smoking during pregnancy, and not quitting vs. quitting) and higher scores on measures of family stress and partner conflict.

4. That a significant positive correlation will occur between higher scores on smoking status measures (weekly smoking, smoking during pregnancy and not quitting vs. quitting) and higher scores on partners’ self-reported smoking behavior.

In the third stage, variables having significant univariate associations with smoking measures within each domain will be combined in a separate linear regression to predict smoking behavior. Domain specific predictors will be entered into a hierarchal regression model to test for significant mediating and moderating effects with respect to individual tobacco use in the following order: Demographics, personality, family environment, and partner smoking. Similar procedures will be followed with regard to quitting vs. non-quitting behavior and smoking during pregnancy, however, a binary logistic regression model will be employed due to the dichotomous nature of the later two dependent variables.

In order to determine mediating and moderating effects of partner smoking and family environment variables, the criteria delineated in the normal theory method of Baron and Kenny (1986) will be employed. Moderating variables can transform the strength and/or direction of the relationship between independent and outcome variables (Baron & Kenny, 1986). In other words, moderator variables influence the strength of
the relationship between predictor and outcome variables. Baron and Kenny (1986) state, "A basic moderator effect can be represented as an interaction between a focal independent variable and a factor that specifies the appropriate conditions for its operation." Mediating variables can be conceptualized as a variable that explains the relationship between two other variables. Baron and Kenny (1986) state, "In general, a given variable may be said to function as a mediator to the extent that it accounts for the relation between the predictor and criterion." Complete mediation occurs when the relationship between predictor and criterion variable, path c, is reduced to zero (see Figure 2).

Figure 2
*Theoretical Mediation Model (Baron & Kenny, 1986)*

![Diagram of mediation model]

The following explorative hypotheses will be investigated through hierarchical regression modeling:

1. That higher partner smoking and higher levels of family stress will both mediate the relationship between the partners’ scores on the APP and the amount of individual tobacco consumption.

2. That higher levels of family cohesion will moderate the relationship between partner smoking and individual tobacco consumption. In other words, partner
smoking will exert greater social influence on partners' smoking in more cohesive relationships
RESULTS

Demographic Characteristics of VFS Sample

The mean age of males in the VFS sample was 58.53 years for males and 46.69 for females. Over 82% of the male sample grew up speaking English, while 79.8% of the females reported growing up speaking English. The mean years of education for males within the sample was 14.20, and their mean income level was 85,700. The females within the VFS sample reported having a mean income level of 64, 300 and 13.92 years of education. Additionally, majority of the sample reported being Protestant (40.30% of males, 46.70% of females).

Prevalence of Smoking

Table 1 illustrates the frequency of tobacco use in the sample of male and female subjects in the VFS. 22.6% of males within the sample reported currently being a smoker, while 15.3% of the women within the sample reported daily tobacco use. The prevalence rate of women smoking during pregnancy was 15.3%. Furthermore, 18.1% of males reported smoking during their partner's pregnancy. A total of 646, or 53.7%, participants within the VFS reported smoking over 100 cigarettes in their life-time.
Table 1
*Tobacco Use by Gender*

<table>
<thead>
<tr>
<th>Category</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Currently Smoke</td>
<td>136</td>
<td>22.6</td>
<td>92</td>
</tr>
<tr>
<td>Smoked during Pregnancy</td>
<td>113</td>
<td>18.8</td>
<td>95</td>
</tr>
<tr>
<td>Ever Smoked over 100 Cigarettes</td>
<td>386</td>
<td>64.2</td>
<td>260</td>
</tr>
<tr>
<td>Ever Smoked Daily</td>
<td>371</td>
<td>61.7</td>
<td>254</td>
</tr>
<tr>
<td>Quit Smoking</td>
<td>265</td>
<td>68.7</td>
<td>173</td>
</tr>
</tbody>
</table>
Correlational Relationships with Smoking Behavior

Pearson's correlational analyses of the relationship between the smoking behaviour of each gender and predictor domains were performed. Specifically, correlations between smoking measures and demographic, personality and family environment variables were examined. Several transformations of the dependent variables were performed to construct dummy variables (i.e. quit smoking, No = 0, Yes = 1, and smoked during pregnancy, No = 0, Yes = 1). The new dichotomous variables were constructed in order to compute correlations and for use in later regression analysis.

Demographic Domain

The pattern of association between demographic variables and smoking was similar for each gender. For instance, the more education an individual had, the lower their average cigarette consumption was per day. Additionally, higher levels of education were correlated with increased quitting behavior in both genders.
Table 2
Pearson’s Correlations of Fathers’ Smoking and Socio-Demographics

<table>
<thead>
<tr>
<th></th>
<th>Weekly Average Smoking</th>
<th>Smoked During Pregnancy</th>
<th>Quit Smoking</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
<td>r</td>
<td>r</td>
</tr>
<tr>
<td>Age</td>
<td>.03</td>
<td>.05</td>
<td>.01</td>
</tr>
<tr>
<td>Income Level</td>
<td>.07</td>
<td>.09</td>
<td>-.02</td>
</tr>
<tr>
<td>Years of Education</td>
<td>-.17***</td>
<td>-.18*</td>
<td>.11*</td>
</tr>
<tr>
<td>Number of Cases</td>
<td>586</td>
<td>192</td>
<td>386</td>
</tr>
</tbody>
</table>

Note 1: *p<.05, **p<.01, ***p<.001
Note 2: Smoked During Pregnancy: No = 0, Yes = 1, Quit Smoking: No = 0, Yes = 1
Table 3
*Pearson's Correlations of Mothers' Smoking and Socio-Demographics*

<table>
<thead>
<tr>
<th></th>
<th>Weekly Average Smoking</th>
<th>Smoked During Pregnancy</th>
<th>Quit Smoking</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
<td>r</td>
<td>r</td>
</tr>
<tr>
<td>Age</td>
<td>-.07</td>
<td>-.07</td>
<td>.05</td>
</tr>
<tr>
<td>Income Level</td>
<td>-.05</td>
<td>.06</td>
<td>.07</td>
</tr>
<tr>
<td>Years of Education</td>
<td>-.11**</td>
<td>-.05</td>
<td>.13*</td>
</tr>
<tr>
<td>Number of Cases</td>
<td>585</td>
<td>469</td>
<td>260</td>
</tr>
</tbody>
</table>

Note 1: *p < .05, **p < .01, ***p < .001
Note 2: Smoked During Pregnancy: No = 0, Yes = 1, Quit Smoking: No = 0, Yes = 1
Similarly, significant associations between smoking consumption and lower educational levels were also found for the mothers’ sample. The less education a woman had, the more likely she was to consume a higher number of cigarettes per day (see Table 3). Furthermore, the greater a woman’s education, the more likely she was to quit smoking.

*Personality Domain*

The association of personality characteristics with smokers varied significantly with respect to gender of the participant. The personality variables measured were more significantly associated with male weekly smoking behavior. For instance, the more neurotic a male, the higher his average consumption of cigarettes per day. However, the less extraverted and agreeable a male, the stronger the association was to cigarette consumption. Further, the strongest positive association between personality characteristics and male weekly smoking behavior was the APP score of the smoker (see Table 4).

Similarly, women’s smoking behaviors were strongly associated with their scores on the APP (see Table 5). Interestingly, only one other personality characteristic within the NEO-PI had a significant correlation with any of the three measures of smoking behavior. Specifically, being less agreeable was significantly associated with smoking during pregnancy.
<table>
<thead>
<tr>
<th></th>
<th>Weekly Average Smoking</th>
<th>Smoked During Pregnancy</th>
<th>Quit Smoking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addiction Prone Personality</td>
<td>.26***</td>
<td>.08</td>
<td>-.11*</td>
</tr>
<tr>
<td>Neo-Five Factor Inventory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neuroticism</td>
<td>.12***</td>
<td>.01</td>
<td>-.02</td>
</tr>
<tr>
<td>Extraversion</td>
<td>-.10*</td>
<td>.12</td>
<td>.06</td>
</tr>
<tr>
<td>Openness</td>
<td>.03</td>
<td>.07</td>
<td>-.02</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>-.18***</td>
<td>-.10</td>
<td>.12*</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>-.04</td>
<td>.12</td>
<td>.03</td>
</tr>
<tr>
<td>Number of Cases</td>
<td>586</td>
<td>192</td>
<td>386</td>
</tr>
</tbody>
</table>

Note 1: *p < .05, **p < .01, ***p < .001
Note 2: Smoked During Pregnancy: No = 0, Yes = 1, Quit Smoking: No = 0, Yes = 1
Table 5

*Pearson’s Correlations of Mothers’ Personality Characteristics and Smoking*

<table>
<thead>
<tr>
<th></th>
<th>Weekly Average Smoking</th>
<th>Smoked During Pregnancy</th>
<th>Quit Smoking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addiction Prone Personality</td>
<td>.14**</td>
<td>.24***</td>
<td>-.12</td>
</tr>
<tr>
<td>Neo-Five Factor Inventory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neuroticism</td>
<td>.00</td>
<td>.04</td>
<td>-.07</td>
</tr>
<tr>
<td>Extraversion</td>
<td>-.01</td>
<td>-.02</td>
<td>.02</td>
</tr>
<tr>
<td>Openness</td>
<td>-.01</td>
<td>-.02</td>
<td>.06</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>-.04</td>
<td>-.11*</td>
<td>.07</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>-.04</td>
<td>-.09</td>
<td>.05</td>
</tr>
<tr>
<td>Number of Cases</td>
<td>585</td>
<td>469</td>
<td>260</td>
</tr>
</tbody>
</table>

Note 1: *p<.05, **p<.01, ***p<.001
Note 2: Smoked During Pregnancy: No = 0, Yes = 1, Quit Smoking: No = 0, Yes = 1
Family Environment Domain

The overall number of family environment factors that were significantly correlated with smoking behavior varied for each gender with respect to the specific family environment categories. For men, fewer resources and increased stress were significantly associated with increased tobacco consumption. In addition, the greater the level of partner conflict a man reported in his marriage, the more likely he was to consume more tobacco (see Table 6). For women, less family cohesion and increased stress were significantly associated with increased tobacco consumption (see Table 7).
Table 6
*Pearson’s Correlations of Fathers’ Smoking and Family Environment*

<table>
<thead>
<tr>
<th></th>
<th>Weekly Average Smoking</th>
<th>Smoked During Pregnancy</th>
<th>Quit Smoking</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$r$</td>
<td>$r$</td>
<td>$r$</td>
</tr>
<tr>
<td>Family Cohesion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fathers’ Cohesion</td>
<td>-.08</td>
<td>-.06</td>
<td>.10*</td>
</tr>
<tr>
<td>Mothers’ Cohesion</td>
<td>-.10*</td>
<td>.00</td>
<td>.01</td>
</tr>
<tr>
<td>Family Stress</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fathers’ Stress (FILE)</td>
<td>.14**</td>
<td>.06</td>
<td>-.11*</td>
</tr>
<tr>
<td>Mothers’ Stress (FILE)</td>
<td>.18***</td>
<td>.13</td>
<td>-.11*</td>
</tr>
<tr>
<td>Family Resources</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fathers’ Resources (FIRM)</td>
<td>-.20***</td>
<td>-.02</td>
<td>.15**</td>
</tr>
<tr>
<td>Mothers’ Resources (FIRM)</td>
<td>-.17***</td>
<td>-.14*</td>
<td>.08</td>
</tr>
<tr>
<td>Partner Conflict</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fathers’ Conflict (PVS)</td>
<td>.10*</td>
<td>.04</td>
<td>-.15**</td>
</tr>
<tr>
<td>Marital Satisfaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fathers’ Satisfaction (DAS)</td>
<td>-.16***</td>
<td>-.11</td>
<td>.09</td>
</tr>
<tr>
<td>Number of Cases</td>
<td>586</td>
<td>192</td>
<td>386</td>
</tr>
</tbody>
</table>

Note 1: *p < .05, **p < .01, ***p < .001
Note 2: Smoked During Pregnancy: No = 0, Yes = 1, Quit Smoking: No = 0, Yes = 1
### Table 7
**Pearson's Correlations of Mothers' Smoking and Family Environment**

<table>
<thead>
<tr>
<th></th>
<th>Weekly Average Smoking</th>
<th>Smoked During Pregnancy</th>
<th>Quit Smoking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Family Cohesion</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fathers' Cohesion</td>
<td>-.07</td>
<td>-.10*</td>
<td>.13*</td>
</tr>
<tr>
<td>Mothers' Cohesion</td>
<td>-.12**</td>
<td>-.14**</td>
<td>.15*</td>
</tr>
<tr>
<td><strong>Family Stress</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fathers' Stress (FILE)</td>
<td>.12**</td>
<td>.11*</td>
<td>-.17**</td>
</tr>
<tr>
<td>Mothers' Stress (FILE)</td>
<td>.15***</td>
<td>.10*</td>
<td>-.17**</td>
</tr>
<tr>
<td><strong>Family Resources</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fathers' Resources (FIRM)</td>
<td>-.09*</td>
<td>-.12*</td>
<td>.13*</td>
</tr>
<tr>
<td>Mothers' Resources (FIRM)</td>
<td>-.10*</td>
<td>-.12**</td>
<td>.13*</td>
</tr>
<tr>
<td><strong>Partner Conflict</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mothers' Conflict (PVS)</td>
<td>.02</td>
<td>.09</td>
<td>.04</td>
</tr>
<tr>
<td><strong>Marital Satisfaction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mothers' Satisfaction (DAS)</td>
<td>-.06</td>
<td>-.12*</td>
<td>.02</td>
</tr>
<tr>
<td><strong>Number of Cases</strong></td>
<td>585</td>
<td>469</td>
<td>260</td>
</tr>
</tbody>
</table>

**Note 1:** *p < .05, **p < .01, ***p < .001
**Note 2:** Smoked During Pregnancy: No = 0, Yes = 1, Quit Smoking: No = 0, Yes = 1
Regression Results

Multiple regression analysis was performed separately for the men and women in the VFS sample. Separate predictor variables from demographic, personality, family environment, and partner smoking domains were utilized in the regression analyses. The selection of these variables was based on significant correlation results for each gender. First, the variable chosen to be included in the demographic domain for each gender was years of education due to noted significant associations with smoking measures, as shown in Tables 2 and 3.

Second, the Addiction Prone Personality was chosen from the personality domain due to significant correlations with smoking measures for each gender. Further, the APP was selected to alleviate multicollinearity problems with overlapping items within the NEO-FFI (see Tables 4 & 5). Multicollinearity refers to high intercorrelations between variables which contain redundant information (Tabachnick & Fidell, 2001). However, the NEO-FFI Agreeableness personality trait was allowed to enter the composite variable in order to predict fathers’ weekly smoking, due to low levels of multicollinearity.

Third, within the family domain comparable correlational magnitudes were found between partners’ reports of the marital environment and smoking measures (see Tables 6 & 7). Bradbury, Fincham, and Beach (2000) state that inflated scores on measures of marital quality occur when employing self-evaluation methods. Therefore, partner’s reports of the marital cohesion and stress were selected to alleviate self-report biases. Additionally, the fathers’ scores of partner conflict, PVS, were allowed to enter the model with other family predictors in order to predict fathers’ quitting smoking due to low
levels of multicollinearity. Finally, partner smoking variables were entered into the final regression equation in order to predict the smoking behavior of their spouse.

Hierarchical Regression Model: Socio-Demographics, Personality, Family Domain, and Weekly Smoking

In order to create a linear model of the weekly tobacco consumption behavior in the VFS sample, predictor variables from four domains, demographics, personality, family, and partner, were sequentially added to the composite equation.

Step One: Demographic Domain: The only predictor variable included from this domain, for each gender, was education. In the first step of the regression model for men, significant results were obtained ($F(1, 541)= 16.98, p<.001$). Education level explained 3% of the variance in male smoking behaviour. Table 8 illustrates a negative relationship between years of education and weekly smoking behavior in male participants ($\beta = -.18, p<.001$).

Similarly, in the first step of the regression model for women significant results were obtained ($F(1, 545)= 6.91, p<.01$). Education level explained 1% of the variance in female smoking behaviour. Table 9 indicates a significant negative relationship between years of education and weekly smoking averages ($\beta = -.11, p<.01$).

Step Two: Personality Domain: At the second stage of the fathers analyses, personality predictors contributed significantly to the model ($F_{change}(3, 541)= 19.10, p < .001$). An additional 7% of the variance was explained by the APP and NEO-FI Agreeableness. Regression analyses revealed a positive association between weekly average smoking and APP scores for male smokers ($\beta = .20 p<.001$). In addition, decreased agreeableness was inversely associated with weekly smoking in the male sample ($\beta = -.11, p<.01$).
Within the second stage of the mothers' analysis the APP contributed significantly to the model ($F_{change}(2, 545)=8.31, p < .001$). An additional 2% of the variance was explained by the inclusion of the APP. Results in Table 9 show a positive association between weekly average smoking and APP scores for female smokers ($\beta = .13, p < .01$).

**Step Three: Family Domain**

Family environmental predictors selected for both mothers and fathers were the perceived level of family stress (FILE) and family cohesion. At the third stage of the fathers' analysis the family domain predictors contributed significantly to the model ($F_{change}(5, 541)=13.86, p < .001$). An additional 2% of the variance was explained by the inclusion of family stress and cohesion. Regression analyses revealed that increased levels of family stress was a significant predictor of male weekly smoking ($\beta = .12, p < .01$).

At the third stage of the mothers' analysis, the family domain predictors contributed significantly to the model ($F_{change}(4, 545)=5.87, p < .001$). An additional 1% of the variance was explained by the inclusion of family stress and cohesion. Specifically, fathers' perceptions of increased stress were positively related to female smoking behavior ($\beta = .10, p < .05$).

**Final regression for Fathers' Weekly Smoking**

In the final stage of the fathers' analysis, partner smoking contributed significantly to the model ($F_{change}(6, 541)=26.37, p < .001$). An additional 11% of the variance was explained by the inclusion of partner smoking. The results of the final regression model for males with respect to smoking behavior are shown in Table 8.
Education remained a significant predictor ($\beta = -.09$, $p < .05$). Furthermore, a positive association remained between the APP and male smoking behaviour ($\beta = .14$, $p < .01$). Additionally, the negative association between agreeableness ($\beta = -.10$, $p < .05$) and weekly tobacco consumption also remained significant. When partner smoking was entered into the regression equation, the addition of this factor doubled the ability of the model to predict males’ smoking behavior. Mothers’ smoking was the strongest predictor of male smoking, accounting for 11% of the variance within the VFS sample.
<table>
<thead>
<tr>
<th>Step Predictors</th>
<th>Demographics (Beta)</th>
<th>Personality (Beta)</th>
<th>Family (Beta)</th>
<th>Partner (Beta)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Step 1</td>
<td>Step 2</td>
<td>Step 3</td>
<td>Step 4</td>
</tr>
<tr>
<td>Education</td>
<td>-.18***</td>
<td>-.13**</td>
<td>-.13**</td>
<td>-.09*</td>
</tr>
<tr>
<td>APP Score</td>
<td>.20***</td>
<td>.18***</td>
<td>.14**</td>
<td></td>
</tr>
<tr>
<td>NEO Agreeableness</td>
<td>-.11**</td>
<td>-.10*</td>
<td>-.10*</td>
<td></td>
</tr>
<tr>
<td>Mothers’ Stress (FILE)</td>
<td></td>
<td>.12**</td>
<td>.09*</td>
<td></td>
</tr>
<tr>
<td>Mothers’ Cohesion</td>
<td></td>
<td>-.05</td>
<td>-.02</td>
<td></td>
</tr>
<tr>
<td>Mothers’ Smoking</td>
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<td></td>
<td></td>
<td>.35***</td>
</tr>
<tr>
<td>R²</td>
<td>.03</td>
<td>.10</td>
<td>.11</td>
<td>.23</td>
</tr>
<tr>
<td>R² Change</td>
<td>.03***</td>
<td>.07**</td>
<td>.02**</td>
<td>.11**</td>
</tr>
</tbody>
</table>

Note: *p<.05, **p<.01, ***p<.001
Table 9
Final Regression of Mothers' Weekly Smoking

<table>
<thead>
<tr>
<th>Step Predictors</th>
<th>Demographics Step 1 (Beta)</th>
<th>Personality Step 2 (Beta)</th>
<th>Family Step 3 (Beta)</th>
<th>Partner's Smoking Step 4 (Beta)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>-.11**</td>
<td>-.09*</td>
<td>-.10*</td>
<td>-.06</td>
</tr>
<tr>
<td>APP Score</td>
<td></td>
<td>.13**</td>
<td>.12**</td>
<td>.07</td>
</tr>
<tr>
<td>Fathers' Stress (FILE)</td>
<td></td>
<td></td>
<td>.10*</td>
<td>.07</td>
</tr>
<tr>
<td>Fathers' Cohesion</td>
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<td>-.02</td>
<td>-.01</td>
</tr>
<tr>
<td>Fathers' Smoking</td>
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<td></td>
<td></td>
<td>.36***</td>
</tr>
<tr>
<td>R²</td>
<td>.01</td>
<td>.03</td>
<td>.04</td>
<td>.16</td>
</tr>
<tr>
<td>R² Change</td>
<td>.01**</td>
<td>.02**</td>
<td>.01*</td>
<td>.13***</td>
</tr>
</tbody>
</table>

Note: *p<.05, **p<.01, ***p<.001
Final Regression for Mothers' Weekly Smoking

The final stage of the analysis for mothers weekly smoking was significant ($F_{change}(5, 545)= 21.57, p < .001$). An additional 13% of the variance was explained by the inclusion of partner smoking. Furthermore, a complete mediating effect was revealed by the addition of partner smoking to the regression equation. When partner smoking was added into the analysis, all other domain specific predictors (education, APP score, and family stress) became non-significant factors within the final equation.

Hierarchical Regression Model: Socio-Demographics, Personality, Family, and Partner Domains Predicting Quitting Behaviour

Participants that had ever smoked over 100 cigarettes and quit smoking within the VFS sample were included within the sequential binary logistic analysis of quitting smoking behaviour. In order to perform a binary logistic regression, a dichotomous variable, quit (No=0, Yes=1) was constructed.

Step One: Demographic Domain: In the first step of the fathers’ analysis, the $\chi^2$ was significant ($\chi^2(1, N=367)= 5.32, p<.05$). The Nagelkerke $R^2$ statistic indicated that 2% of the variance in quitting behavior was being explained by educational level. The Hosmer and Lemeshow Goodness of fit test indicated that the model in the first stage of the data analysis adequately fit the data ($\chi^2(3, N=367 )= 4.03, p<.26$). Table 10 illustrates that years of education was a significant predictor of quitting smoking behavior in male participants (OR = 1.10(1.01-1.20).

In contrast, the first step of the mothers’ model the $\chi^2$ was not significant ($\chi^2(1, N=247)= 3.72, p<.06$). Table 11 illustrates that years of education was not a significant predictor of quitting smoking behavior in female participants.
Step Two: Personality Domain

The predictor variable included from the personality domain for the male and female quitters was the APP score (see Table 10 & 11). In the second step of the fathers' model, non-significant results were obtained ($\chi^2(2, N=367)= 3.25, p<.07$). Specifically, regression analyses revealed the level of addiction proneness was not significantly associated with quitting smoking for men.

Similarly, in the second step of the mothers model the $\chi^2$ was non-significant ($\chi^2(2, N=247)= 2.90, p<.09$). Table 11 depicts that APP scores were not significant predictor of quitting behavior of women in the sample.

Step Three: Family Domain

After consideration was given to possible multicollinerarity problems the family environmental predictors selected were: Partner’s reports of perceived level of family stress (FILE), family cohesion, and Partner Conflict Scores (PVS). Spouses’ reports of the marital environment were selected due to correlation magnitude, and to alleviate self-report biases (see Tables 6 & 7). In the third step of the fathers’ analysis, the $\chi^2$ was not significant ($\chi^2(3, N=367)= 7.50, p<.06$). Interestingly, the binary logistic regression analyses revealed that there was a trend towards decreased levels of partner conflict and was a significant predictor of males quitting smoking (OR = .87(.75-1.00), p<.051).

Similarly, in the third step of the mothers’ model, non-significant results were obtained ($\chi^2(4, N=247)= 5.96, p<.06$). Table 11 reveals that fathers’ reports of family stress and cohesiveness were not significant contributors to predicting female quitting behavior.

Final regression for Fathers’ Quitting Smoking
The final model of fathers quitting behavior was significant ($\chi^2(6, N=367)= 6.90, p<.01$). The Nagelkerke $R^2$ statistic indicated that 9% of the variance in quitting behavior was being explained by the composite variable. The Hosmer and Lemeshow Goodness of fit test indicated that the model in the final stage of the data analysis adequately fit the data ($\chi^2(6, N=367)= 5.15, p<.74$). Increased levels of females' quitting behavior was a significant predictor of male quitting status (OR = 1.88(1.17-3.04)). In other words, males with in the sample became 1.88 times more likely to quit smoking when their partner was also engaging in cessation behavior (see Table 10).

In this analysis, there was only one indication of a possible mediating effect. Males' years of education was reduced to a non-significant level when family environment factor indicators were allowed to enter into the model. To determine possible reason for the mediation effect, the correlations between years of education and the family environment variables were assessed. However, explanation of the specific path model was not possible as no significant correlations occurred between years of education and the individual family factors.

*Final Regression for Mothers' Quitting Smoking*

The final model for mothers' quitting behavior was significant ($\chi^2(5, N=247)= 8.30, p<.01$). The Nagelkerke $R^2$ statistic indicated that 8% of the variance in quitting behavior was being explained the composite variable. The Hosmer and Lemeshow Goodness of fit test indicated that the model in the final stage of the data analysis adequately fit the data ($\chi^2(8, N=247)= 4.28, p<.83$). Increased levels of partner quitting smoking was a significant predictor of mothers' quitting behavior in the sample (OR = 2.24(1.29-3.90).
### Table 10

**Binary Regression of Fathers’ Quitting Smoking**

<table>
<thead>
<tr>
<th>Step Predictors</th>
<th>Demographic Step 1 OR (CI=95%)</th>
<th>Personality Step 2 OR (CI=95%)</th>
<th>Family Step 3 OR (CI=95%)</th>
<th>Partner Step 4 OR (CI=95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>1.10*(1.01-1.20)</td>
<td>1.09*(1.00-1.20)</td>
<td>1.08(1.00-1.18)</td>
<td>1.09(1.00-1.18)</td>
</tr>
<tr>
<td>APP Score</td>
<td>.94(.88-1.01)</td>
<td>.96(.89-1.03)</td>
<td>.95(.89-1.02)</td>
<td></td>
</tr>
<tr>
<td>Mothers’ Stress (FILE)</td>
<td></td>
<td>1.00(.99-1.00)</td>
<td>.96(.83-1.13)</td>
<td></td>
</tr>
<tr>
<td>Mothers’ Cohesion</td>
<td></td>
<td>.96(.83-1.12)</td>
<td>.96(.83-1.13)</td>
<td></td>
</tr>
<tr>
<td>Fathers’ Conflict (PVS)</td>
<td></td>
<td>.87(.75-1.00)</td>
<td>.87(.75-1.01)</td>
<td></td>
</tr>
<tr>
<td>Mother Quit Smoking</td>
<td></td>
<td></td>
<td></td>
<td>1.88*(1.17-3.04)</td>
</tr>
<tr>
<td>Nagelkerke R Squared</td>
<td>.02</td>
<td>.03</td>
<td>.06</td>
<td>.09</td>
</tr>
</tbody>
</table>

Note: *p<.05, **p<.01, ***p<.001
Table 11  
*Binary Regression of Mothers' Quitting Smoking*

<table>
<thead>
<tr>
<th>Step Predictors</th>
<th>Demographic Step 1 OR (CI=95%)</th>
<th>Personality Step 2 OR (CI=95%)</th>
<th>Family Step 3 OR (CI=95%)</th>
<th>Partner Step 4 OR (CI=95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>1.16 (.99-1.35)</td>
<td>1.14 (.97-1.32)</td>
<td>1.13 (.97-1.33)</td>
<td>1.14 (.97-1.34)</td>
</tr>
<tr>
<td>APP Score</td>
<td></td>
<td>.92 (.84-1.01)</td>
<td>.93 (.85-1.03)</td>
<td>.94 (.85-1.03)</td>
</tr>
<tr>
<td>Fathers' Stress (FILE)</td>
<td></td>
<td>1.00 (.99-1.00)</td>
<td></td>
<td>1.00 (.99-1.00)</td>
</tr>
<tr>
<td>Fathers' Cohesion</td>
<td></td>
<td>1.09 (.91-1.31)</td>
<td></td>
<td>1.09 (.90-1.31)</td>
</tr>
<tr>
<td>Father Quit Smoking</td>
<td></td>
<td></td>
<td></td>
<td>2.24*** (.129-3.90)</td>
</tr>
<tr>
<td>Nagelkerke R Squared</td>
<td>.02</td>
<td>.04</td>
<td>.07</td>
<td>.08</td>
</tr>
</tbody>
</table>

Note: *p<.05, **p<.01, ***p<.001*
Hierarchical Regression Model: Socio-Demographics, Personality, Family, and Partner Domains Predicting Smoking During Pregnancy

Male smokers that smoked through the duration of their partners' pregnancy and women who smoked during pregnancy were included within the sequential binary logistic analysis of smoking behaviour. In order to perform a binary logistic regression, a dichotomous variable, smoked during pregnancy (No=0, Yes=1), was constructed.

Step One: Demographic Domain

Table 12 presents a binary logistic regression analysis. In the first step of the analysis in the fathers’ model the $\chi^2$ was significant ($\chi^2(1, N=179)= 5.61, p<.05$). The Nagelkerke $R^2$ statistic indicated that 4% of the variance in smoking during pregnancy was being explained by education level. The Hosmer and Lemeshow Goodness of fit test indicated that the model in the first stage of the data analysis adequately fit the data ($\chi^2(4, N=179)= 2.34, p<.67$). Results in Table 12 show that attending less years of school was a significant contributor to smoking during their partners’ pregnancy for men (OR = .88(.80-.98).

In contrast, the $\chi^2$ in the first step of the mothers model was non-significant ($\chi^2(1, N=183)= .64, p<.43$). Specifically, education was not a significant predictor of smoking during pregnancy for women (see Table 13).

Step Two: Personality Domain

In the second step of the father’s analysis, the $\chi^2$ was not a significant ($\chi^2(1, N=179)= .42, p<.52$). Table 12 illustrates that APP scores were not significantly associated with male smoking during his partner’s pregnancy.
In contrast, in the second stage of the mothers’ analysis, significant results were obtained ($\chi^2(2, N=183)=14.73, p<.001$). The Nagelkerke $R^2$ statistic indicated that 12% of the variance in smoking during pregnancy was being explained by APP scores. The Hosmer and Lemeshow Goodness of fit test indicated that the model in the second stage of the data analysis adequately fit the data ($\chi^2(8, N=183)= 9.30, p<.32$). Specifically, binary logistic regression analyses revealed that higher APP scores were a significant predictor of mothers smoking during pregnancy (OR = 1.26(1.11-1.43).

*Step Three: Family Domain*

In the third step of the father’s analysis, non-significant results were obtained ($\chi^2(4, N=179)= 3.96, p<.14$). Table 12 reveals that neither levels of family cohesion or stress were significant predictors of men smoking during their partners’ pregnancy.

In the third step of the mothers’ analysis non-significant results were obtained ($\chi^2(4, N=183)= 2.90, p<.24$). Table 13 illustrates that fathers’ reports of family stress and cohesiveness were not significant predictors of mothers’ smoking during pregnancy. However, increased APP scores remained a significant predictor of female smoking behavior (OR = 1.25(1.10-1.41).

*Final regression for Fathers Smoking During Pregnancy*

In the final step of the analysis of the fathers’ model, significant results were obtained ($\chi^2(5, N=179)= 9.79, p<.01$). The Nagelkerke $R^2$ statistic indicated that 14% of the variance was being explained by the composite variable. The Hosmer and Lemeshow Goodness of fit test indicated that the model in the final stage of the data analysis adequately fit the data ($\chi^2(8, N=179)= 4.20, p<.84$). Males years of education
remained an independent predictor of smoking behavior during their partners’ pregnancy (OR = .89(.79-.99). Mothers’ smoking during pregnancy was a significant predictor of males smoking throughout their partners’ pregnancy (OR = 3.51(1.53-8.03). In other words, males became 3.51 times more likely to smoke during their partners’ pregnancy when their partner was also engaging in tobacco use throughout pregnancy (see Table 12).

Final Regression for Mothers Smoking During Pregnancy

In the final step of the mothers’ analysis, the model was significant ($\chi^2(5, N=183)= 7.43, p<.01$). The Nagelkerke $R^2$ statistic indicated that 19% of the variance in smoking during pregnancy was being explained by the composite variable. The Hosmer and Lemeshow Goodness of fit test indicated that the model in the final stage of the data analysis adequately fit the data ($\chi^2(8, N=183)= 10.22, p<.25$). Table 13 illustrates that increased APP scores remained a significant contributor to predicting female smoking during pregnancy (OR = 1.22(1.08-1.39). In other words, mothers with higher APP scores were more likely to continue smoking throughout pregnancy. The addition of partners’ smoking behavior to the regression analysis increased the likelihood by almost three times (OR = 2.85(1.30-6.23) that women would continue to smoke during pregnancy (see Table 13).
Table 12  
*Binary Regression of Fathers’ Smoking During Pregnancy*

<table>
<thead>
<tr>
<th>Predictor Step</th>
<th>Demographic Step 1 OR (CI=95%)</th>
<th>Personality Step 2 OR (CI=95%)</th>
<th>Family Step 3 OR (CI=95%)</th>
<th>Partner Step 4 OR (CI=95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>.88*(.80-.98)</td>
<td>.89*(.80-.99)</td>
<td>.88*(.79-.98)</td>
<td>.89*(.79-.99)</td>
</tr>
<tr>
<td>APP Score</td>
<td></td>
<td>1.03(.94-1.14)</td>
<td>1.02(.93-1.13)</td>
<td>.99(.90-1.10)</td>
</tr>
<tr>
<td>Mothers’ Stress (FILE)</td>
<td></td>
<td>1.00(1.00-1.00)</td>
<td>1.00(1.00-1.00)</td>
<td></td>
</tr>
<tr>
<td>Mothers’ Cohesion</td>
<td></td>
<td>1.08(.88-1.32)</td>
<td>1.18(.95-1.47)</td>
<td></td>
</tr>
<tr>
<td>Mother Smoked During Pregnancy</td>
<td></td>
<td></td>
<td></td>
<td>3.51**(1.53-8.03)</td>
</tr>
<tr>
<td>Nagelkerke R Squared</td>
<td>.04</td>
<td>.05</td>
<td>.07</td>
<td>.14</td>
</tr>
</tbody>
</table>

Note: *p< .05, **p< .01, ***p< .001
## Table 13

*Binary Regression of Mothers’ Smoking During Pregnancy*

<table>
<thead>
<tr>
<th>Predictor Step</th>
<th>Demographic OR (CI=95%)</th>
<th>Personality OR (CI=95%)</th>
<th>Family OR (CI=95%)</th>
<th>Partner OR (CI=95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>.93 (.80-1.11)</td>
<td>1.00 (.83-1.20)</td>
<td>1.01 (.84-1.22)</td>
<td>1.04 (.86-1.26)</td>
</tr>
<tr>
<td>APP Score</td>
<td></td>
<td>1.26*** (.11-1.43)</td>
<td>1.25** (.10-1.41)</td>
<td>1.22** (.08-1.39)</td>
</tr>
<tr>
<td>Fathers’ Stress (FILE)</td>
<td></td>
<td></td>
<td>1.00 (.09-1.00)</td>
<td>1.00 (.09-1.00)</td>
</tr>
<tr>
<td>Fathers’ Cohesion Score</td>
<td></td>
<td></td>
<td>.83 (.66-1.05)</td>
<td>.83 (.66-1.06)</td>
</tr>
<tr>
<td>Father Smoked During Pregnancy</td>
<td></td>
<td></td>
<td></td>
<td>2.85** (.30-6.23)</td>
</tr>
<tr>
<td>Nagelkerke R Squared</td>
<td>.01</td>
<td>.12</td>
<td>.14</td>
<td>.19</td>
</tr>
</tbody>
</table>

**Note:** *p < .05, **p < .01, ***p < .001*
DISCUSSION

Prevalence

The purpose of this study was to analyze the prevalence and predictors of smoking in a sample of Vancouver couples. The overall frequency of females who had smoked at least 100 cigarettes was 260, or 43.3%, while the prevalence rates of males who had smoked at least 100 cigarettes within the sample was 386, or 64.2%.

Approximately two-thirds of the males surveyed in the VFS reported life-time daily smoking. In other words, at one point during their life, two-thirds of the men were identified as daily smokers. The inflated rate of tobacco consumption may reflect the propensity of men in earlier generations to smoke. Researchers have found that being male is an independent risk factor for tobacco use, and this increased susceptibility could be due to a combination of social and biological influences (Menzes, Gocalves, & Anschmi, 2006).

With regard to current daily smoking, 22.6% of the males reported daily smoking, while 15.3% of the female sample reported daily smoking. Both of these percentages are within range of the national average consumption rates of approximately 20% (Health Canada, 2003). Furthermore, 15.8% of the women surveyed in the VFS reported smoking throughout their pregnancy, and this prevalence is comparable to the national prevalence of 15% (Health Canada, 2003).

Socio-demographics and Smoking Status Measures

Earlier studies have found a significant relationship between increased tobacco consumption in younger, lower income, and less educated individuals (DiClemente, et al., 2000; Pollak & Dolan-Mullen, 1997; Severson, et al., 1995). Within the female sample,
significant correlations were found between female smoking behaviour and sociodemographic variables. Specifically, lower education levels were associated with increased weekly consumption, while quitting smoking was positively associated with increased education levels. Similar results with respect to educational attainment occurred within the male sample of smokers. Specifically, a significant negative correlation between weekly amount of smoking and education level (r = -.17, p<.001) was found in the sample of Vancouver male smokers.

Our findings are consistent with current research indicating that low educational levels are important in predicting current smoking behaviour. McGee and Williams (2006) examined the cessation rates in a sub-sample of women in the Dunedin Multidisciplinary Health and Development Study (DMHDS) over a period of thirteen years. The researchers found that low educational attainment, less than high school, was a significant predictor of continued smoking in the sample of 575 women. Furthermore, Finklestein, Kubzansky, & Goodman, (2006) found through a series of logistic regressions that current adolescent smoking was predicted by parental education levels.

**Personality Domain and Smoking Status Measures**

Within the personality domain it was hypothesized that significant positive correlations would occur between personality measures and smoking status indicators. This hypothesis was confirmed for males within the VFS sample because significant positive correlations occurred between smoking status variables and APP scores (see Figure 3). Similar results, high APP scores and increased smoking behaviour, have been reported by Barnes and colleagues (Anderson, et al., 1999; Barnes, et al., 2000).
Furthermore, significant associations occurred between increased smoking and three of the personality domains of the NEO-FI for the male sample. For instance, the negative correlation found between agreeableness and increased smoking is consistent with current research findings (Anderson, et al., 1999; Barnes, et al., 2000; Terraccino & Costa, 2003). The significant negative correlation between the NEO-FI Extraversion and weekly smoking consumption in males is contradictory to previous research findings. Rocca, et al., (2006), found that introversion scores increased with age, therefore, the higher mean age of the fathers with the VFS sample could explain the anomaly.

Within the female sample, similar results were revealed when women's smoking behavior in the VFS was correlated with APP scores (see Figure 4). Significant positive correlations were also found between high APP scores and smoking behaviors, and weekly smoking, and smoking during pregnancy for the female sub-sample of the VFS. These results replicate the work of Barnes and colleagues (Anderson, et al., 1999).
Family Domain and Smoking Status Measures

In the present study, it was postulated that increased smoking would occur in high stress family environments and this hypothesis was confirmed by correlational analysis. As predicted, a significant negative correlation occurred between male's perception of marital satisfaction and weekly smoking behavior ($r = -.16 p < .001$). That is, the less satisfied a male was with his marriage, the more tobacco he consumed each week. Additionally, significant relationships were found between mothers' reports of decreased family cohesion and increased smoking behavior in each gender. Zucker (2005) found that family cohesion was not predictive of long-term recovery from alcoholism. The current results, which are tobacco specific, contradict the findings of Zucker (2005). However, Homish & Lenoard (2005) state that differential substance use patterns occur in couples. Therefore, effects of decreased marital cohesion could be specific to
increased tobacco consumption in couples. Further research is needed to replicate these findings and delineate the role of family cohesion in substance use.

**Moderating**

The interaction between family cohesion and partners' smoking was tested for each gender. The moderating effects of these variables were not found to be statistically significant for the smoking behavior of either males or females. McClelland & Judd (1993) postulated difficulty in obtaining interaction effects could be due to the fact that errors in measuring each contributing variable are exacerbated when multiplication occurs to form the cross product and relative statistical power decreases.

**Meditation**

**Weekly Smoking Behavior**

Based on previous research by Barnes and colleagues (Anderson, et al., 1999; Barnes, et al., 2000), it was postulated that higher rates of partner smoking and family stress would mediate the relationship between partner's APP scores and the amount of individual tobacco consumption. Correlational analysis revealed a significant association between smoking status measures, personality traits, and measures of family stress, (FILE), for both genders. Furthermore, increased weekly smoking behavior was associated with higher APP scores and increased family stress for both genders (see Tables 5 & 6). Although significant correlations between increased family stress and smoking measures were obtained for males in the sample, the hypothesized mediating role of the APP and family stress on partner smoking was not supported in the VFS sample. A linear regression of the male smokers revealed that lower number of years of
education, high APP scores, high FILE scores, and high amounts of partner smoking were all independent predictors of male weekly smoking behavior (see Figure 5).

Recently, Urban, Kulger, and Olah (2006) investigated the interaction of education, depressive symptoms, trait anxiety, coping traits and smoking behaviour in a sample of 574 adult males. The researchers hypothesized that trait anxiety and coping skills would mediate the relationship between education and smoking. However, through multivariate analysis, the researchers found that education was independently related to smoking behaviour within the men. Homish and Lenoard (2005) also found that husbands’ smoking was not influenced by the consumption behaviours of their spouse. Through multivariate models, the researchers found that men who married smokers were not likely to begin or relapse into smoking behavior (Homish & Leonard, 2005). In sum, the current findings support the growing body of literature in which husbands’ smoking behavior seems to be independently associated with multiple domain predictors.
Within the sample of female smokers, complete mediation occurred between partner smoking and all other predictor variables entered into multivariate logistic regression analysis (see Figure 6). These results partially confirmed the hypothesis that the relationship between addiction prone personality and smoking is mediated by other predictor variables, specifically partner smoking. However, structural equation modeling is necessary to examine the relationship in more detail. Our results replicate the findings of other tobacco research (Franks, et al., 2002; Homish & Leonard, 2005; Mudar, et al., 2002; Olser, 1998) that also found that spouses play an important role in regulating health-related behaviors of women, such as drinking, exercising, and smoking.
Stimpson and colleagues (2006) found significant associations between couples smoking concordance rates and health lifestyle variables through a series of binomial regression analyses. Similar to the present study, Stimpson, et al., (2006) found that husbands exert a greater influence over their partner's smoking behavior. Specifically, the women's risk of smoking was 73% higher than that of her husband's if she was married to a man who smoked. In sum, the present study suggests that shared lifestyle patterns for wives are not universally a protective factor. Even for women who do not smoke, having a smoking partner exposes them to second-hand smoke and the risk of incorporating smoking into their lifestyle (Daly, Lund, Harty, & Ersted, 1993; Homish & Leonard, 2005).

**Quitting Smoking**

Disparate results occurred between men and women in the current study with respect to smoking cessation behavior. For the males, the role of years of education was mediated by the family environment domain, confirming the hypothesis that family
variables play an important role in tobacco cessation. However, non-significant correlations between years of education and family factors produced difficulty in delineating the relationship to a specific family environment variable. In addition, mothers’ quitting behavior was an independent factor in predicting fathers’ quitting behavior (see Figure 7).

Figure 7

Fathers’ Quitting Smoking

Note: *p<.05, **p<.01, ***p<.001

Interestingly, decreases in fathers’ partner violence scores were significantly correlated with increased cessation behavior (r = -.15, p<.01). Within the regression analysis, fathers’ PVS scores trended towards being a statistically significant predictor, (β= -.14 p=.051). Unger, Sussman, & Dent (2003), studied the relationship of the Conflict Tactic Scale, the unabridged version of the PVS, and substance use in a sample of 681 adolescents. The researchers employed logistic regression to examine the association between interpersonal conflict and substance use. The researchers found that increased levels of physical and non-physical aggression put the youth at significantly higher risks for cigarette smoking. Unfortunately, Unger, et al. (2003) did not stratify the sample based on gender and other tobacco researchers have neglected to study the role of interpersonal conflict in smoking cessation. The trend of the present study is similar to the general conclusion of Unger et al. (2003), which concludes that lower levels of interpersonal conflict predicts decreased smoking, however, this trend is specific to males.
within the VFS. Future research detailing the role of non-aggressive conflict resolution techniques in cessation efforts of men is needed to understand and prevent substance use.

Similarly, one independent factor predicted the cessation efforts of women within the VFS. Specifically, increased levels of partner’s quitting made it more than twice as likely that women would quit smoking (OR=2.24(1.28-3.90). Similarly, McGee and Williams (2006) investigated the predictors of persistent smoking and smoking cessation in a sample of 575 women. The researchers found that having a partner that smoked significantly increased the odds that the women would become a persistent smoker. In sum, women who have partners that quit smoking seem to have better odds at cessation attempts.

*Smoking During Pregnancy*

Expectant fathers that smoked throughout their wives’ pregnancies were found within the VFS sample to have fewer years of education. The hypothesis that family environmental conditions, such as stress or cohesion, would mediate or moderate fathers’ smoking was not confirmed in the present study. These findings are similar to recent work by Stimpson, et al. (2006) who found that education was an independent predictor of male smoking behavior during general co-habitation. In addition, Everett, et al. (2005) interviewed 138 low income fathers residing with their pregnant partners about their substance abuse behavior. Comparable to the present study’s results, the researchers found that expectant fathers who smoked throughout their partners’ pregnancies had decreased levels of education. Furthermore, Everett, et al. found that expectant fathers were significantly more likely to smoke if their spouse maintained their addiction throughout pregnancy. These findings indicate that inclusion of men in smoking cessation
during pregnancy is an important window of opportunity to prevent chronic tobacco addiction in fathers.

Finally, the pregnant smoking behavior of female participants in the VFS survey was predicted by two variables, high APP scores and continued smoking by the father throughout the pregnancy (see Figure 8). That is, women with greater susceptibility to addiction who have a smoking partner will have a greater likelihood of smoking throughout pregnancy. The current results replicate the work of previous tobacco researchers (DiClemente, et al., 2000; Frank, et al., 2002; McBride, et al., 2004; Pollak & Dolan-Mullen, 1997).

Figure 8
*Mothers' Smoking during Pregnancy*

![Diagram showing the relationship between mothers' APP score, fathers' smoking, and mothers' smoking during pregnancy. OR = 1.22** for mothers' APP score, OR = 2.85** for fathers' smoking.]

Importantly, the current paper highlights the significance of addiction proneness in smoking throughout women's pregnancies. In the future, incorporating refined measures of personality constructs, such as the APP, will aid in identifying resistant smokers and aid in preventing expectant mothers from smoking during pregnancy.

*Methodological & Design Limitations*
Limitations in the current research are mainly due to the confines of secondary data analysis. For instance, more elaborate prediction models could have been constructed by the researcher if more detailed questions about dyadic smoking were complied during the initial survey. These included potential questions, such as, “How many cigarettes did you smoke with your spouse today?” Additionally, the research design could be have been strengthened by integrating open-ended questions about tobacco use. The incorporating of qualitative data would have provided the researcher with the means to complete a mixed method study of tobacco use. Finally, due to the truncated age range of the original sample, the potency of the effect of partner smoking may be diminished. In other words, because younger, low income couples did not complete the VFS, the results obtained capture the general interaction of couple smoking, however, the true magnitude of the problem might not be revealed by the present study.

Implications for Practice, Policy, Theory and Future Research

Practice

The results of the current study suggest that it is imperative to construct smoking interventions that encompass couple dynamics. Dyadic level smoking interventions may decrease the number of current smokers and the amount that individuals smoke each week. Findings from the current paper imply that couple interdependence is a necessary component of continued tobacco use. Novel smoking intervention programs, such as the family consultation model (FAMCON), are based on the social context of tobacco use in couples (Shoham, Rohrbaugh, Trost, & Muramoto, 2006). The family consultation model assumes that smoking is woven into the family structure, that salient, close relationships are integral in maintaining change-resistant smoking, and that partners and
family members need to be involved in treatment efforts (Shoham, Rohrbaugh, Trost & Muramoto, 2006). Incorporating measures of addiction proneness, such as the APP, will provide clinicians with valuable information about hardened smoking subpopulations. Providing clinicians with training in innovative cessation techniques, such as the FAMCON methods, is fundamental in producing lasting change in tobacco consumption in couples.

Additionally, findings from the present study highlight the influence of paternal smoking on expectant mothers. These findings replicate the work of previous researchers (McBride, et al., 2004; Homish & Leonard, 2005; Daly, Lund, Harty, & Ersted, 1993) and illustrate the significant role that partner smoking has on smoking during pregnancy. Trends within prenatal health, such as the first ever randomized clinical trial of dyadic smoking interventions, underscore the influence of paternal behavior on mothers’ smoking throughout pregnancy (McBride, et al., 2004). As clinical cessation tools continue to be developed a more detailed understanding of the predictive factors in continued smoking during pregnancy can be garnered by researchers. Men’s smoking during pregnancy has been independently associated with offspring health issues such as decreased birth weight and Sudden Infant Death Syndrome (Martinez & Taussing, 1994). Therefore, by providing clinicians with tools to decrease tobacco consumption of both expectant family members will contribute to elevated levels of infant health.

Policy

Tobacco control policy includes a range of initiatives, such as including restrictions on tobacco location, sales to minors, advertising enforcement, community and public health programs (Doucet, Velcert, & Laforge, 2007). To date, comprehensive
tobacco policies poorly reflect the smoking trends within vulnerable sub-populations, such as women (Greaves, Vallone, & Velicer, 2007). Curtailing the use of tobacco in specific sub-populations requires well designed public education campaigns and prevention programs. For instance, Nofziger & Lee (2005) propose that incorporating experimental findings on same-sex role modeling of smoking may be the missing element in designing prevention programs for the fastest growing sub-population of smokers, young women. Additionally, the current paper provides evidence that the smoking behavior of expectant fathers is a salient feature in continued tobacco use by pregnant women. Public education campaigns must reflect current empirical findings, such as the significant role of the father in prenatal smoking, in order to reach vulnerable groups and hardened smokers. In sum, translating experimental findings into evidence-based tobacco control policies is a fundamental component in creating effective tobacco prevention strategies.

Theory

Current smoking interventions are based on individual cessation efforts or the health-related consequences of tobacco use (Adrian, 2003; Bottorff, et al., 2005). Bottorff, et al. (2005) report that the failure of cessation programs for pregnant smokers can be ascribed to the extensive focus on individual level change strategies. The current paper highlights the role of the micro-system in smoking during long-term partnership. Specifically, the findings emphasize the importance of partner smoking in predicting continued use of nicotine in general cohabitation and pregnancy. Bottorff, et al. (2005) state that there is a paucity of research with respect to the micro-social context of family environments and its influence on women's substance use. The current paper provides
empirical evidence for the importance of the micro-system in couples’ smoking behavior. Importantly, the ecological framework employed by the current paper facilitates a detailed understanding of the role of each contextual domain on various smoking behaviors for each gender.

Furthermore, sequential logistic regression analysis allows for researchers to explore the interaction between contextual domains. Previous researchers (Homish & Lenoard, 2005; Daly, Lund, Harty, & Ersted, 1993) established an association between spouses’ smoking, however, the direction of influence within the relationship is still not fully understood. The current paper aids in delineating the path of influence by providing evidence that mothers’ weekly smoking is mediated by one micro-system variable, the smoking behavior of her spouse. These results suggest that dyadic interactions within the micro-system have differential effects on each gender.

Additionally, results from the current paper illustrate the effects of the choronomosystem, or the sociohistorical conditions, on a cohort. Specifically, the current paper found that over two thirds of the men in the sample had smoked over a hundred cigarettes in their life-time. Wilcox (2003) states that when non-random patterns of aggregate rates exist, it is questionable if individual-level characteristics can fully account for the behavior. Future tobacco researchers must shift to employing a multi-systemic framework in order to understand the complexity of dyadic smoking.

*Future Research*

Poland and colleagues (2006) stated that understanding the social context of smoking is the next frontier for tobacco researchers. Innovative research designs must include the personality and behavioral patterns of smokers’ spouses in order to predict
and prevent chronic smoking. Inclusion of the Addiction Prone Personality into future experimental designs may facilitate the process of predicting the likelihood that couples will continue to smoke throughout their partnership and pregnancy. First, researchers could extend the level of personality analysis by including the partners’ addiction prone scores into logistical regression analysis to determine if a spouse’s susceptibility to addiction is a significant predictor of chronic smoking in individuals.

Second, detailed research on the differential effects of partner influence on substance use is paramount to decreasing addiction within couples. Employing the Vancouver Family Survey researchers can generalize the findings of Leonard and Homish (2005) to tobacco research. Specifically, researchers have the potential to construct variables of moderate and heavy tobacco use within the VFS sample and examine the role of wives’ influence in heavy and occasional tobacco use. Importantly, these finding could then be compared with the occasional and heavy alcohol use within the VFS couples sample.

Finally, a gap exists between identifying smokers who have considerable difficulty quitting smoking during pregnancy and those who do not. The Addiction Prone Personality could be included in prospective clinical trials of smoking during pregnancy to aid in recognizing hardened smokers. Furthermore, the addition of the APP measure to clinical trials would replicate and strengthen the generalizability of the current study. The APP may provide clinical researchers with a concise and cost effective measure of identifying hardened smokers. In sum, distinguishing resistant smoking couples can provide clinicians and researchers with the necessary information to aid families in successfully terminating cyclical tobacco addiction.
BIBLIOGRAPHY


