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Leisure and Risky Health Behaviors: A Review of Evidence about Smoking

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Abstract

The study of leisure and health has grown tremendously in the last decade. However, only limited attention has been given to the impact of leisure on participation in risky health behaviors. The purpose of this paper is to review research on the relationship between leisure and smoking. Searches of five major databases identified 105 relevant articles that dealt with smoking and physical activity (50 articles), smoking and sport participation (32), or smoking and various other aspects of leisure (23). The latter category included articles addressing the link between smoking and non-exercise leisure activities, leisure settings, and leisure identity formation. Primarily negative associations were found between smoking and both physically active leisure and sport participation. However, although some promising ideas and research on smoking and leisure settings, identity, and non-exercise activities were identified, increased conceptualization and investigation are needed. Suggestions for future research on leisure and smoking as well as on leisure's role in addressing risky health behaviors are discussed.

KEYWORDS: *Smoking, leisure identity, leisure setting, physical activity, sport, review, health*

Introduction

Growing interest in the relationship between leisure and health is evident both within and outside the field of leisure studies (Buchner, 2005; Henderson & Bialeschki, 2005; Hyyppä, Mäki, Impivaara, & Aromaa, 2006; Mannell & Loucks-Atkinson, 2005; Motl, McAuley, Birnbaum, & Lytle, 2006; Payne, 2002). Research dealing with the role of leisure in mental health including coping with stress and traumatic life events has grown tremendously in the last decade and a half (Iwasaki & Mannell, 2000; Kleiber, Hutchinson & Williams, 2002; Mannell, 2006). More recently,

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leisure researchers also have also begun to make significant contributions to research on physical activity (PA) and healthy living via organizations such as Active Living Research (e.g., Godbey, Caldwell, Floyd, & Payne, 2005; Bedimo-Rung, Mowen, & Cohen, 2005) and The Cooper Institute (e.g., Ainsworth, Mannell, Behrens & Caldwell, 2007). Similarly, these and other health-related conferences and journals often include analyses presented by scientists from outside of leisure studies that nevertheless feature leisure-related variables and contexts prominently within the research (e.g., Saelens et al., 2006; Giles-Corti et al., 2001). However, only limited attention has been given to the impact of leisure on participation in risky health behaviors such as drug and alcohol use and smoking.

The research that has been done on the relationship between leisure and health risk behavior has been facilitated by social ecological models of health promotion that have gained in prominence over the past decade (Green et al., 1996; Sallis & Owen, 2002). For example, Henderson et al. (2001) adopted the social ecological perspective in using focus groups to document the wide-ranging efforts necessary to promote PA in a community. In contrast to the once prevailing view that health risk behaviors such as physical inactivity and tobacco use are individual choices or problems, social ecological models posit that the healthfulness of a situation and the people within that context are influenced by multiple facets of the social and physical environments as well as numerous personal attributes (Stokols, 1992). Consequently, a wider range of disciplines, including leisure studies and parks and recreation management, have a role to play in addressing these significant health concerns.

More research is needed, however, that focuses on the relationships between specific leisure variables and specific positive or harmful health behaviors in order to better understand the wide-ranging links between leisure and health. For example, although population health problems such as physical inactivity and obesity are starting to be addressed more frequently by leisure researchers, there are a number of other health risk behaviors and issues (e.g., drug use, alcohol use, unsafe sex practices, etc.) that may be highly related to leisure participation, experiences and settings that remain relatively unexamined within the field of leisure studies (Darling, Caldwell & Smith, 2005).

One area that has received little attention from leisure researchers is the relationship between leisure and smoking in spite of the prevalence of tobacco as a global health concern (Rojek, 2006). Recent estimates have stated that 1.3 billion individuals worldwide currently smoke (Shafey, Dolwick, & Guindon, 2003). The proportion of smokers varies according to country, with estimates ranging around 20% in the United States and Canada (Centers for Disease Control and Prevention, 2006; Health Canada, 2006). Similarly, youth rates of smoking have been found to range from 22% in the United States (Centers for Disease Control and Prevention, 2004) to 12% in Canada (Manske, Diener, & Morin, 2005), and it has consistently been found that smoking initiation at an earlier age is a strong predictor of smoking behavior later in life and continuation of smoking for a longer period of time (Khuder, Dayal, & Mutgi, 1999). Estimates suggest that more than half of all smokers will succumb to death or disability as a result of their smoking behaviors (Centers for Disease Control and Prevention, 2005), as smoking is associated with increased incidences of various forms of cancer, coronary heart disease, and stroke, and is the leading cause of chronic obstruc-

tive pulmonary disease (U.S. Office on Smoking and Health, 2004). The economic costs of smoking are also significant. Between 1995 and 1999, the US experienced $150 billion in health-related economic loses due to smoking, which included $75.5 billion in excess medical expenditures in the year 1998 (Centers for Disease Control and Prevention, 2002).

Despite its magnitude as an economic and social malady, leisure researchers have shown relatively little interest in issues related to smoking and tobacco use behavior. Outley, Forster, Meyer, Weinreis, and Klein (2005) found considerable support among Minnesota residents for tobacco free policies in outdoor park and recreation areas. Wearing and Wearing (2000) looked at the role smoking can play in identity formation among adolescent girls, especially in the absence of other leisure alternatives by which they might define themselves. Caldwell and Smith (1995) found that leisure alienation as captured by boredom during leisure and the use of free time to reject adult structure was significantly related to being a regular smoker among students in four southeastern U.S. high schools. Though certainly not exhaustive, research such as this demonstrates the diverse ways that smoking and leisure may be associated.

However, these types of studies represent only a smattering of the research that has linked leisure, broadly defined, with smoking. Given that smoking is one of the most important modifiable determinants of health, it is valuable to better understand the positive and negative contributions of leisure and recreation to smoking behavior. Therefore, the purpose of this study was to systematically review and critique the extant literature relating leisure and smoking. Specifically, driven by the literature uncovered, our review addresses the following questions: (1) what is the nature of relationships between physical activity and smoking?, (2) what is the nature of relationships between sport and smoking?, and (3) how are non-exercise leisure activities, settings, and identities associated with smoking? Our goal was to synthesize research findings on the broad relationships between leisure and smoking with an eye to highlighting gaps in knowledge and areas for future inquiry.

Method

In June 2005, with the assistance of a library technician, searches were conducted within five literature databases. For the first four—PsycInfo, PubMed, LeisureTourism Abstracts, and Web of Science—we used search terms tailored to each database to identify peer-reviewed literature relating leisure and smoking*. Only articles printed in English were requested, but no date range parameters were included in the search terms and the resulting articles date back to as early as 1970. These searches returned a total of 2159 articles (after merging the results of the four searches and removing all duplicate records). The SportDiscus database was searched separately*, primarily

* **PsycInfo:** AB=(leisure OR recreation OR "free time" OR "physical activity" OR sports) AND AB=(smoking OR "tobacco use" OR "tobacco control" OR "smoking cessation").
PubMed: Search ("Recreation"[MeSH] OR "Leisure Activities"[MeSH] OR "Sports"[MeSH]) AND ("Smoking"[MeSH] OR "Smoking Cessation"[MeSH] OR "Tobacco Use Disorder"[MeSH])
LeisureTourism Abstracts: (((leisure) in ABSTRACT OR (recreation) in ABSTRACT OR (sport) in ABSTRACT OR (physical activity) in ABSTRACT) AND (("English") in LANGUAGE)) AND (((smoking) in ABSTRACT OR (tobacco control) in ABSTRACT OR (tobacco use) in ABSTRACT)
Web of Science: TS=(leisure OR recreation OR free time OR physical activity OR sports) AND TS=(smoking OR tobacco use OR tobacco control OR smoking cessation)
SportDiscus: (leisure or recreation or free time or physical activity or sport) and (smoking or tobacco)

to uncover useful grey literature on smoking and leisure that might not be indexed in the other four databases. This search produced an additional 447 hits, although, in addition to grey literature (e.g., government reports), approximately half of these documents were duplicates of journal articles found via the four main databases. Consequently, when scanning the abstracts (as described below) of documents found in SportDiscus, all journal articles were ignored.

Following a training period after which ratings by two reviewers achieved 96% agreement, the primary author scanned article abstracts to determine each paper's relevance to the current study's objectives. Articles were excluded from further analysis if they met any of the following criteria:

- articles that mentioned smoking and PA or leisure concurrently, but only as these two behaviors related to a third variable or condition (e.g., osteoporosis);
- studies that simply controlled for smoking and PA or leisure participation in examining the relationship among two other variables;
- articles that focused exclusively on substances other than cigarettes (e.g., chewing or other smokeless tobacco, cannabis, alcohol, etc.). However, articles that related smoking and drug/alcohol use were retained when the latter variable was framed as a leisure pursuit;
- studies that described associations between smoking and body mass index (BMI), as the latter variable was considered to be influenced by leisure participation but not a direct manifestation of a leisure-related concept;.
- studies that were purely methodological in purpose (e.g., validating self-report measures of smoking or leisure time use); and
- articles discussing the sponsorship of leisure or sporting events by tobacco companies were considered peripheral to the present study's objectives.

Additionally, when scanning the abstracts of articles found in SportDiscus, all papers printed in journals were ignored since these were located in the searches of the other four databases.

In total, 108 unduplicated articles from the five databases were retained after these initial criteria were applied. Among these 108 articles, five journals were represented by more than five papers: *Addictive Behaviors*, *Canadian Journal of Public Health*, *Journal of Adolescent Health*, *Preventive Medicine*, and *Tobacco Control*. Subsequently, a total of 263 issues for these five journals from the start of 2000 to mid-2005 were handsearched to identify any relevant articles that may have been missed by the database searches described above. This process revealed only four additional studies. Seven of the 112 articles identified to that point could not be located despite extensive searches by institutional librarians.

In the end, a total of 105 articles were reviewed that describe various facets of the relationship between smoking and leisure. In the following Review section, the three major themes that were distilled from the articles are discussed. Numerous studies conducted primarily in heath-related fields have examined the associations between smoking and PA and between smoking and sport participation. Studies falling into these two categories are reviewed in the first two sections. The empirical and conceptual literature describing relationships between smoking and non-exercise activities, as well as smoking and leisure settings and leisure identities is discussed in the final section.

Review

Smoking and Physical Activity

Smoking and physical inactivity are two of the leading preventable risk factors for some of today's most common chronic diseases (Colditz et al., 2000; Fagerstrom, 2002; Friedenreich, 2001; Newcomb & Carbone, 1992; Paffenbarger & Hale, 1975). Consequently, these two behaviors have been the focus of much investigation, including their relationship to one another. The searches identified 50 studies that reported an empirical relationship between smoking and PA[1]. This extensive body of literature is reviewed separately elsewhere (Kaczynski, Manske, Mannell & Grewal, 2008) and is only summarized here. For each of the 50 studies, the empirical associations reported between smoking and PA were dichotomized as either i) negative or ii) mixed, non-significant, or positive. Mixed associations occurred when different relationships were observed for different gender or age sub-groups, or when substituting different smoking or PA variables produced contrasting relationships. Table 1 shows the number of studies of both adults and youth which reported each type of association. In the vast majority of the articles, the PA variable(s) analyzed in relation to smoking habits were related specifically to participation in PA during leisure time, as indicated by the specific questions asked of survey respondents or inferred based on the descriptions provided by the original authors.

Thirty-three of the 50 studies involved adult populations (all or vast majority of the sample over 18 years). In 20 (61%) of these studies, the association between smoking and PA was negative[2]. For example, in a study of 82,918 adults conducted in several U.S. territories (Strine et al., 2005), current smokers, those who had smoked more than 100 cigarettes in their lifetime and currently smoked on at least some days, were significantly more likely than never smokers (less than 100 cigarettes lifetime) to have engaged in no leisure-time PA in the past thirty days (30.2% vs. 22.5%). Over 60% of the adult studies reporting negative relationships were based on probability samples[3], and almost half had sample sizes approaching or exceeding 10,000 participants[4]. The studies also originated from countries around the globe, including Norway (Kvaavik et al., 2004), Finland (Laaksonen et al., 2002), Sweden (Frisk et al., 1997), Greece (Pitsavos et al., 2005), The Netherlands (Schuit et al., 2002), and other European coun-

TABLE 1
Number of Articles Reporting Negative or Mixed, Positive or Non-Significant Associations between Smoking and Physical Activity

Study Population	Negative	Mixed, Positive, Non-significant	Total
Adults	20	13	33
Youth	8	9	17
Total	28	22	50

tries (Steptoe et al., 1997), as well as Japan (Takemura et al., 2000), Australia (Johnson et al., 1995; Hart, 1984), Canada (Nguyen et al., 1996; Faulkner et al., 1987), and the U.S. (Ward et al., 2003; Boutelle et al., 2000; Boyle et al., 2000; Schmitz et al., 1997; Perkins et al., 1993).

On the other hand, 13 (39%) of the studies of adult populations reported associations between smoking and PA that were either mixed, non-significant, or positive[5]. For example, a study of heavy smokers in Spain (Schroder et al., 2003) showed mixed findings in that heavy smoking was not associated with participation in low/moderate intensity PA, but was related to lower participation in high intensity PA. Further, amongst 20,000 participants from Denmark, there was no association between having stopped smoking in the past five or ten years and amount of leisure-time PA during that time period (Osler et al., 1999). Overall, though, fewer studies have reported a mixed, non-significant, or positive association between smoking and PA, and those that did were generally based on smaller sample sizes than the studies which reported primarily negative associations. However, the studies in this group still comprised populations from a wide range of countries, including The Netherlands (van Oort et al., 2004), Belgium (de Bourdeau-dhuij & van Oost, 1999), Australia (Burke et al., 1997) and the United States (Boudreaux et al., 2003; Johnson et al., 1998)

Only 17 of the 50 articles explored the relationship of smoking and PA in youth (less than 18 years). In eight of these studies[6], primarily negative associations between the smoking and PA variables were reported, while in nine studies[7], mixed, non-significant, or positive associations were found. Therefore, while many studies of adolescents and young adults have provided support for the inverse relationship that was observed more frequently in the adult studies, a surprisingly similar proportion of analyses have shown no association or more mixed evidence among younger populations.

There was also some weak evidence of differential gender effects for the relationship between smoking and PA. In the 15 studies in which the results were disaggregated by gender, similar smoking-PA associations were reported for both males and females in eight articles[8], six studies found differences between the genders[9], and in the other study (Winnail et al., 1995), interpretation of the gender effects was confounded by the additional grouping of participants by racial categories. For the six studies in which the relationships were found to differ for males and females, five reported that the relationship between smoking and physical inactivity is less predictable in males[10]. For example, in a sample of 18 year old Australians (Burke et al., 1997), a similar proportion ($p=.12$) of male smokers (14%) and non-smokers (20%) were classified as inactive, as indicated by fewer than three 30-minute sessions of PA per week. However, there was a much larger difference in the percentage of female smokers (54%) and non-smokers (35%) who were inactive ($p=.006$). Overall, the few studies like this which reported gender differences indicated that the negative relationship between smoking and PA may be less pronounced among males than females.

Within the literature reviewed, a variety of different hypotheses were offered by the original authors to explain the generally negative relationship between smoking and PA. These are explored in greater depth elsewhere (Kaczynski, Manske, Mannell, & Grewal, 2008). The most common explanation is that positive and negative health behaviors simply cluster together. Problem Behavior Theory (Jessor, 1991), tested mainly in reference to adolescents, suggests that health risk behaviors group together

as a result of an individual's overall tendency toward unconventionality (Donovan & Jessor, 1985; Jessor & Jessor, 1977) and that involvement in one negative behavior increases the likelihood of involvement in other health-risk behaviors (Donovan, Jessor, & Costa, 1991). Other authors have suggested that low education level is a key socioeconomic variable which moderates the relationship between PA and smoking (Schnohr et al., 2004). Certain physiological and psychological explanations have also been offered for the negative relationship between smoking and PA. For example, smoking may impair lung function to the point where it impedes PA (Gold et al., 1996; Higgins et al., 1993; Louie, 2001). As well, given the inverse relationships between PA and depression (Field, Diego, & Sanders, 2001; Norris, Carroll & Cochrane, 1992; Pate et al., 1996) and the positive association between depression and smoking (Covey & Tam, 1990; Fergusson, Lynskey, & Horwood, 1996), lower levels of PA may lead to increased levels of depression and, consequently, smoking (Audrain-McGovern et al., 2003). Finally, high levels of PA may be related to lower levels of smoking in so far as the two behaviors provide similar rewards or serve redundant purposes for certain individuals, such as reduction of stress (Byrne & Byrne, 1993; Fisher, Lichtenstein, & Haire-Joshu, 1993) or as weight loss strategies (Bish et al., 2005; Jeffery, Hennrikus, Lando, Murray, & Liu, 2000; Klesges & Klesges, 1988; Filozof, Fernandez Pinilla, & Fernandez-Cruz, 2004).

Smoking and Sport

A large number of studies we reviewed analyzed associations between smoking and sport participation. In contrast to PA which is often defined as "any bodily movement produced by skeletal muscles that results in energy expenditure" (Caspersen, Powell & Christenson, 1985, p. 126), sports are often conceptualized as being socially constructed and institutionalized activities characterized by their social dynamics (e.g., competitive vs. cooperative) and that nevertheless usually involve some amount of PA (Coakley, 2001). Therefore, some overlap may exist in the two categories in so much as measurements of sport participation may include PA participation and vice versa. In this article, we differentiate sport and PA based on the terms and definitions used by the original authors of the articles we reviewed.

Thirty-two primary studies were found that reported direct empirical relationships between smoking and sport participation. These are summarized in Table 2 and listed in reverse chronological order. The first three columns describe the age, location, and size of the study sample, and whether it was drawn in a fashion so as to be representative of the larger population. Brief descriptions of the smoking and sport participation variables are then provided, along with the associations among them that were reported by the original authors. Only three of the studies involved exclusively adult populations (Emmons, Wechsler, Dowdall, & Abraham, 1998; Ferrante, Muzzolon, Fuso, & Pistelli, 1993; Schuit et al., 2002), and thus the table is not disaggregated by age.

Almost all of the empirical associations reported in Table 2 describe a negative relationship between smoking and sport participation. For example, in their study of over a thousand high school students in Spain, Pastor, Balaguer, Pons, and Garcia-Merita (2003) observed a correlation of -0.16 ($p<.0001$) between a composite smoking rating and how frequently the students participated in sports outside of school. As

TABLE 2
Articles Reporting Empirical Associations between Smoking and Sport Participation

Authors and Date	**Population Age**[a]	**N**[b]	**Smoking Variable**[c]	**Sport Variable**[c]	**Association**
Aleixandre et al. (2005)	13-19 year olds in Spain	1378	Not described	Sports participant vs. non-participant	Sports participants consume significantly less tobacco than subjects who do not participate in sports. 59% difference said to translate into 20 fewer cigarettes/week.
Fergus et al. (2005)	African American high school students in Midwest U.S.	566*	Smoking trajectory over high school (five groups) based on smoking frequency in past 30 days collected in each of four years	Participation in sports (index of attendance, leadership roles, and length of involvement) in each of four years	Experimenters/consistent light smokers (less than 1 cigarette/day in two to three years of the four years data were collected) reported significantly higher sports participation than consistent regular smokers (1+ cigarettes/day in all four years). Consistent abstainers (no smoking in all 4 years) and experimenters/consistent light smokers had higher sports participation than quitters (those who smoked in first three years, but not year four).
Moore & Werch (2005)	Grade 8 students in Florida	891	Smoked 1+ days in past 30 days	Participation in particular school sports and non-school sports/activities	Females: Skateboarding the only school or non-school sport associated with significantly increased odds of cigarette use (OR=3.12). Males: School wrestling and non-school tennis the only activities associated with significantly increased odds of cigarette use (OR=3.21 and 3.33, respectively).
Audrain-McGovern et al. (2004)	High school students in northern Virginia	968*	Never smoker Early/fast adopter of smoking (grade 9) Late/slow adopter of smoking (grade 12)	# of school or community teams played on in past 12 months	Team sport participation consistently discriminated between being a never smoker or late adopter of smoking and being an early adopter of smoking.

[a] Even when the exact survey (e.g. Youth Risk Behavior Survey) was mentioned in the original article, only the sample age and location (where available) are reported here.
[b] An asterisk adjacent to the sample size indicates that it was discernable that the sample was drawn in a manner so as to be representative of the study population.
[c] Although other variables related to smoking or sport participation may have been collected or analyzed (or other values of the variables that are presented), only the smoking or sport variables/values that were related directly and empirically are reported in these columns.

TABLE 2 (CONTINUED)

Castrucci et al. (2004)	Grade 9-12 students in U.S.	17,287*	Ever smoked a cigarette Current smoker (smoked in last 30 days) # of days smoked in past 30 days # of cigarettes smoked per day on days smoked	Participation in organized sports or organized team physical activities in past year (yes/no)	Higher percentage of non-participants than sports participants had ever tried smoking (69.6% and 66.4%, respectively; p<.01) and had smoked in past 30 days (34.2% and 27.7, respectively; p<.001). Sports participants more likely to smoke on fewer days of the month (p<.001) and to smoke fewer cigarettes in past month than non-participants (p<.001). When adjusting for age, race, gender and school performance, sports participants less likely to be current smokers than non-participants (OR=.78) but no difference between participants and non-participants in having ever smoked a cigarette.
Rodriguez & Audrain-McGovern (2004)	Grade 9 students in northern Virginia (followed through high school)	1098*	Current smoker (>100 cigarettes lifetime and/or 20+ days in last month)	Number of school and community sport teams participated on (1=none, 4=3+)	Higher (vs. lower) baseline smoking associated with being less likely to have consistently high (vs. consistently low) team participation (OR=.70) and more likely to have decreasing team participation over high school (OR=1.81). Students with decreasing participation in team sports over time more likely to be current smokers in later high school than students with consistently low team sports participation (OR=1.90) and even more probable compared to those with consistently high team sport participation (OR=2.95). Adolescents with erratic team sport participation more likely than those with consistently high participation to be smokers in eleventh grade (OR=2.87).
Coetzee & Spamer (2003)	13-18 year olds in South Africa	323*	Regular smoking (not defined)	Sport Participants/ Non Participants	Regular smoking not significantly associated (P=.07) with being a sport participant (17%) or non-participant (9%). Regular smoking not significantly different (p=.46) between male (33%) and female (37%) sport participants or between different ethnicities (p=.16).
Pastor et al. (2003)	15-18 year old high school students in Spain	1038*	Composite tobacco consumption rating (1-6 score)	Non-school sports participation (1-6 frequency score)	Sport participation negatively correlated (-0.16) with tobacco consumption (p<.0001).

TABLE 2 (CONTINUED)

Peretti-Watel et al. (2003)	16-24 year old elite student athletes in Southeastern France	458	Current smoker (smoke cigarettes from at least time to time as of study date)	Type of sport Weekly duration of sporting activity Average duration Competitive level	Type of sport (individual, sliding – e.g. snowboarding – or team) not significantly associated with being a smoker. For females, lower odds of smoking with >15 hours/week of sporting activity (OR=0.3) but higher odds with higher competition level (international or Olympic; OR=6.1). For males, higher odds of smoking when average training session is >2 hours (OR=2.2) when compared against subjects with average session <2 hours.
Sasco et al. (2003)	10-18 year old students in France	3650*	Regular smoker (weekly)	Participation in sports (yes/no)	In highest/last grade, playing sports associated with somewhat lower odds (OR=0.7, 95% CI = 0.4-1.0) of regular (weekly) smoking .
Choquet & Arvers (2002)	16-18 year olds in France	5983*	Tobacco use (smoke 10+ cigarettes/day)	Length of sport practice Level of competition	For both males and females, lower odds of tobacco use for subjects practicing sports 1-8 hrs/week (OR=.54 and .60, respectively) but not for 8+ hrs/week. For females only, lower competition level (local/regional vs. national/inter-national) associated with higher risk of smoking (OR=1.59).
Peretti-Watel et al. (2002)	14-19 year old students in France	10,807*	Daily smoking (1+ cigarettes/day during last 30 days) Heavy smoking (10+ cigarettes/day)	# of hours of non-compulsory sport per week (4 categories) "Regular" participation in team sports, athletic sports, and individual sports Registration in a club (>1 year)	For both males and females, higher percentage of heavy smokers among non-athletes (0 hrs/week) and intense sports participants (8+ hrs/week), whereas percentage of daily smokers declined steadily with increasing sports participation. For males only, odds of daily smoking significantly reduced with 8 or more hours/week of sporting activity outside school (OR=.79), registration in a club (OR=.77), and regular practice of athletic sports (OR=.64), but increased with participation in other individual sports (OR=1.37), while heavy smoking decreased with 1-7 hrs/week of non-school sporting activity (OR=.54) and regular practice of athletic sports (OR=.50). For females, smoking increased with participation in strength or combat sports (OR=2.4).

TABLE 2 (CONTINUED)

Videmsck et al. (2002)	13 year olds in Slovenia	163*	Amount of cigarette smoking	Hours per week of sport participation	No association between amount of cigarettes smoked and sport activity participation.
Bonard et al. (2001)	15-20 year olds in Switzerland	9268*	Never smoke Former smoker Regular smoker	Practice sports Belong to sports club	When adjusted for age and sex, former smokers significantly more likely to belong to a sports club (OR=1.38) and to practice sports at least once/week (OR=1.87) than regular smokers but less likely than never smokers to belong to a sports club (OR=.79).
Melnick et al. (2001)	High school students in U.S.	16,262*	Regular smoker (every day for a 30 day period) Smoked in past 30 days	# of sports teams participated on at and outside of school	Moderately involved (1-2 teams) male and female athletes less likely to be regular smokers than non-athletes (OR=..68 and .75, respectively), while highly involved (3+ teams) male and female athletes even less likely to be regular smokers (OR=.58 and .61, respectively).
Challier et al. (2000)	9-25 year old students in France	2396*	Smoker Non-smoker	Participation in 24 club sports and 24 sports with friends	In both boys and girls, group of club sports activities that had higher individual associations with smoking (many different activities) showed significantly higher odds (OR=1.41 for boys and 1.45 for girls) for predicting smoking, when other socio-demographic, family, and substance use variables included in model.
Pate et al. (2000)	Grade 9-12 students in U.S.	14,221*	# of days in past 30 days smoked a cigarette	Participation on 1+ school or community sports teams in past 12 months	Males: Smoking significantly less likely (OR=.66) among sports participants (34.8%) than non-sports participants (44.6%) – true for all ethnic groups studied. Females: Smoking significantly less likely (OR=.73) among sports participants (32.1%) than non-sports participants (39.3%) – true for white females, but not African Americans or Hispanics, when sample divided by ethnicity.
Emmons et al. (1998)	College students in U.S.	17,592*	Smoker (smoked in last 30 days) Former smoker (abstinent for 1+ months) Never Smoker	Participation in intercollegiate athletics Athletics not important Leisure Activities	Nonparticipation in intercollegiate athletics (men only), considering athletics to be not very important, and level of participation in leisure activities all significantly predicted being a smoker.

TABLE 2 (CONTINUED)

Page et al. (1998)	Grade 9-12 students in U.S.	12,272*	Ever tried smoking; ever smoked regularly; smoked cigarettes in past 30 days	Number of school sports teams played on in past 12 months	Participants on one or more school sports teams significantly more likely to have not ever tried cigarette smoking, not ever smoked cigarettes regularly, and not smoked cigarettes in past 30 days.
Davis et al. (1997)	Male high school students in Louisiana	1200	Heavy smoker (> 0.5 packs/day)	Highest sport intensity played: Low (e.g. golf), Medium (e.g. baseball), High (e.g. swimming)	Medium and high-intensity athletes significantly less likely to be heavy smokers than non- or low intensity athletes ($p<.01$). However, no difference found when controlling for race and GPA.
Donato et al. (1997)	Male high school students in Italy	1462*	Never smoked Ex-smoker (tried smoking in past) Current smoker (at least one cigarette per week)	No sports activity Occasional sports activity Regular sports activity (not explicitly defined)	Grades 9-11: Students with regular (highest category) sports participation exhibited significantly higher odds of being a current smoker (OR=1.8) than those with no/occasional activity (when controlling for parents' education and smoking status and peers' and siblings' smoking status). Grades 12-13: Students with regular (highest category) sports participation exhibited significantly lower odds of being a current smoker (OR=0.6) than those with no/occasional activity (when controlling for above variables).
Rainey et al. (1996)	High school students in South Carolina	7846*	Ever smoked regularly (1 cigarette/day for 30+ days)	Athlete (1+ sports teams at or outside school) Non-athlete (0 teams)	Non-athletes significantly more likely to be smokers than athletes ($p<.0001$). Highest physical activity category of non-athletes (5-7 days of physical activity in past week) most likely to be smokers (26% of group) compared to other non-athlete groups.
Escobedo et al. (1993)	Grade 9-12 students in U.S., Puerto Rico and Virgin Islands	11,248*	Regular smoker (smoked on at least 5 days in past 30 days) Heavy regular smoker (5+ cigarettes/ day	Number of inter-scholastic sports played	Participation in interscholastic sports significantly associated with decreased likelihood of being a regular ($p<.0001$) or heavy ($p<.0001$) smoker.

TABLE 2 (CONTINUED)

Ferrante et al. (1993)	20 year old males in Italy	1153	Smoker (1+ cigarettes/ day)	Sportsmen (1+ sessions/week)	Non-sportsmen significantly more likely to be smokers (56%) than sportsmen (49%), significantly more likely (68% vs. 55%, p<.001) to be a heavy smoker (10+ cigarettes/day), and started smoking at a significantly younger age (15.4 vs. 15.8 years, p=.02) .
Rinchuse et al. (1992)	Grade 1-12 students in Pennsylvania	2189*	Smoker	Regular participant in some sport	Significantly (p<.001) higher percentage of smokers among non-sport participants (31.9%) than among sport participants (11.0%).
Vilhjalmsson & Thorlind-sson (1992)	15-16 year old Grade 9 students in Iceland	1131*	Weekly smoking frequency (0=never, 6=every day)	Club sport, group (non-club or school) sport and individual sport participation (0=never, 6=almost every day) Strenuous exercise (2-item summary score)	Smoking negatively and significantly (p<.01) correlated with club (-.19) and group (-.16) sport participation and with strenuous exercise (.26). Small but significant negative correlation (-.06) between smoking and individual sport participation (p<.05).
Assanelli et al. (1991)	17-19 year old males in Italy	696*	Current smoker (1+ cigarettes/week)	Members of amateur sports teams	Athletes exhibited significantly (p=.003) lower odds (OR=0.5) of being a current smoker than non-athlete students of similar age and geographical area.
Thorlindsson et al. (1990)	15-16 year old students in Iceland	1131*	Weekly smoking frequency (0=never, 6=every day)	Weekly school sport frequency (0=none, 6=6+ times/week) Hours per week in non-school sports (0=none, 5=10+ hours/week)	Smoking negatively correlated to both weekly school sport frequency (-.242, p<.001) and hours per week of non-school sports (-.219, p<,.001).

TABLE 2 (CONTINUED)

Thorlindsson (1989)	12-15 year olds in Iceland	814*	# of packs of cigarettes smoker per week (0-6+)	# of times per week trained with sport club (0-6) or in sports in general (0-6)	Significant ($p<.001$) negative correlation between smoking and sport club participation (-.21 and -.23 for two similar samples) and general sport participation (-.24 and -.28).
Rantakallio (1983)	14 year olds in Finland	10,937*	Smoker (1+ cigarettes/ day)	Participation in sports Ability in sports	Males: Participation in sports ($p=.000$) and ability in sports ($p=.032$) both significant, negative predictors of smoking (24 variables in model). Females: Participation in sports ($p=.000$) a significant, negative predictor of smoking (24 variables in model), but no association for ability in sports ($p=.121$).
Malkin & Allen (1980)	Grade 8 and 11 students in rural Pennsylvania	229*	Smoker (daily or occasional) Non-Smoker	Self perception of being "athletic" (true/false)	No significant difference between percentage of smokers (60%) and non-smokers (64%) who reported a positive athletic self-perception.
Newman et al. (1970)	High school students in New Zealand	2024	Smoker (smoke regularly or more often)	Member of school sports team	Males: Non-smokers more likely to be members of school sports teams than smokers in all forms (grades) except 5th form. Females: Smokers more likely to be members of school sports teams than non-smokers in all forms.

well, Thorlindsson (Thorlindsson, 1989; Thorlindsson, Vilhjalmssonm, & Valgeirsson, 1990; Vilhjalmsson & Thorlindsson, 1992) has conducted several earlier investigations of Icelandic adolescents which showed consistent, significant correlations in the range of -0.20 between various smoking and sport variables. Further, several studies have, somewhat more specifically, found that people who smoke are less likely to participate in sports (Aleixandre, Perello del Rio, & Palmer Pol, 2005; Bonard, Janin-Jacquat, & Michaud, 2001; Fergus, Zimmerman, & Caldwell, 2005). The majority of analyses reported in Table 2, however, examine the smoking habits of the participants according to their level and type of sports involvement. All but two (Coetzee & Spamer, 2003; Videmsck, Karpljuk, Resetar, Kondric, & Stihee, 2002) of these studies found that sports participants are less likely to smoke than non-participants (Assanelli et al., 1991; Audrain-McGovern, Rodriguez, Tercyak, Cuevas et al., 2004; Castrucci, Gerlach, Kaufman, & Orleans, 2004; Davis et al., 1997; Emmons et al., 1998; Escobedo, Marcus, Holtzman, & Giovino, 1993; Ferrante et al., 1993; Melnick, Miller, Sabo, Farrell, & Barnes, 2001; Page, Hammermeister, Scanlan, & Gilbert, 1998; Pate, Trost, Levin, & Dowda, 2000; Rainey, McKeown, Sargent, & Valois, 1996; Rantakallio, 1983; Rinchuse et al., 1992; Rodriguez & Audrain-McGovern, 2004; Sasco, Merrill, Benhaim-Luzon, Gerard, & Freyer, 2003).

For example, Castrucci et al. (2004) analyzed the recent smoking behaviors of a nationally representative sample of U.S. grade 9-12 students in relation to whether they had participated in organized sports or team physical activities over the past year. The authors found that, in the past 30 days, a significantly greater percentage of non-participants compared to sports participants had smoked at all (34.2% vs. 27.7%, respectively) and had smoked 5 cigarettes or less (70.0% vs. 57.8%, respectively). The odds of being a current smoker remained 22% less for sports participants, even after adjusting for age, gender, race, and school performance. In two other samples of U.S. high school students, for both males and females, participation in sports was associated with significantly lower odds of having smoked in the last 30 days (Pate et al., 2000; Melnick et al., 2001) and of having smoked every day over a 30-day period at some point in the respondents' lifetime (Melnick et al., 2001). Similarly, among students in France in their final year of high school, playing sports was marginally associated with lower odds of smoking on a weekly basis (OR=0.7, 95% CI=0.4-1.0) (Sasco et al., 2003). Several earlier studies have produced similar results regarding the propensity of sports participants to be non- or less-frequent smokers (Assanelli et al., 1991; Davis et al., 1997; Emmons et al., 1998; Escobedo et al., 1993; Ferrante et al., 1993; Page et al., 1998; Rainey et al., 1996; Rantakallio, 1983; Rinchuse et al., 1992). Potential explanations for this trend are described below.

Within this general categorization of participation, some authors have investigated the association between smoking and particular sports activities. For example, Moore and Werch (2005) found that the odds of having smoked in the past thirty days were three-times greater for males who participated in out-of-school tennis and in-school wrestling and for females who skateboarded outside of school. However, numerous other school and out-of-school sports were not associated with smoking in either males or females. In a sample of French teenagers, males' participation in 'athletic' sports (e.g., cycling) was associated with lower odds of both daily (OR=0.64) and heavy (OR=0.50) smoking, while males' participation in 'other individual' sports (e.g.,

golf) and females' participation in 'strength or combat' sports (e.g., weightlifting) were associated with increased levels of daily and heavy smoking, respectively (ORs=1.37 and 2.40, respectively) (Peretti-Watel, Beck, & Legleye, 2002). Finally, Challier, Chau, Predine, Choquet, and Legras (2000) derived a summary participation score of all the sports they investigated that had negative, individual associations with smoking for the participants in their sample. Those sports were volleyball, rugby, wrestling, orienteering, mountain biking, and roller skating, and the summary score was a significant predictor of being a smoker for both males (OR=1.41) and females (OR=1.45) even when numerous other known correlates of smoking were included as covariates. However, in the only other study that reported sport-specific associations, the type of sport participated in by elite student-athletes in France – 'individual' (e.g., judo), 'sliding' (e.g., sailing), or 'team' (e.g., volleyball) – was not significantly related to being a current smoker (Peretti-Watel et al., 2003).

Other studies have examined the prevalence of smoking according to either the competition level or the intensity of the respondents' sports participation. For example, Choquet and Arvers (2002) reported that competing at lower levels (local or regional as opposed to national or international) was associated with higher odds of smoking more than ten cigarettes per day (OR=1.59) among the females in their sample of 16-18 year olds from France. In contrast, also in France and again for only females but for 16-24 year old elite student athletes, Peretti-Watel et al. (2003) found that those who competed at the highest levels (international or Olympic) were much more likely to be current smokers (OR=6.1). In the same sample, however, females with the greatest duration of sports participation (15 or more hours per week) were less likely to be current smokers (OR=0.3), but males in the higher category of training session duration (greater than 2 hours per session) were more likely to be current smokers (OR=2.2). In an earlier national school sample, Peretti-Watel et al. (2002) reported that participating in 8 or more hours per week of sports outside of school reduced the odds of daily smoking (1 or more cigarettes each day) in boys (OR=0.79), but not heavy smoking (10 or more cigarettes per day). Heavy smoking was lower, however, among boys who played sports with less intensity (OR=0.54 for 1-7 hours per week). The authors found no relationships between smoking and sport duration or frequency for girls in the sample. Choquet and Arvers (2002) observed a somewhat similar pattern in that both boys and girls who practiced sports 1-8 hours per week were less likely (ORs=0.54 and 0.60) to be heavy smokers (greater than 10 cigarettes per day), but no significant difference in the smoking measure was observed for either boys or girls who practiced sports more than eight hours per week. Finally, in a sample of males in Italy, grade 12-13 students with the highest frequency of sports participation (at least twice per week) were less likely to be current smokers (OR=0.60), but students in grades 9-11 with the same sporting frequency exhibited higher odds for smoking (OR=1.8) (Donato et al., 1997).

In summary, mixed results were observed for the two studies that examined competition level and smoking, but some evidence exists to suggest that heavier smoking is potentially more prevalent among students, especially males, with a greater intensity of sports participation. While a pair of studies reported that increasing sporting intensity reduces smoking linearly (Peretti-Watel et al., 2003; Melnick et al., 2001), the relationship between smoking and sport intensity may instead be U-shaped and is definitely

in need of further investigation (Peretti-Watel et al., 2002). One reason suggested for this is that high-level competitors, who are most likely to practice their sport with the strongest intensities, may use tobacco to alleviate stress associated with the pressures of participation and competition (Choquet, Shelly, Guilbert, & Arvers, 2001). Such a U-shaped relationship for smoking and sport would be consistent with studies that have found that both non-participants and intense sports participants have higher levels of alcohol and cannabis use than moderate intensity participants (Choquet & Hasler, 1997; Aquatias, Desrues, Leroux, Stettinger, & Valette-Viallard, 1999).

Overall, however, with only two studies in our search reporting entirely contradictory results (Coetzee & Spamer, 2003; Videmsck et al., 2002), the negative association between smoking and sports participation, especially for moderate levels of the latter, appears to be even more robust than that which was found between smoking and PA. Based largely on discussion by Melnick et al. (2001), there are several explanations that may account for this relationship.

As might be expected, some of these explanations are similar to those that have been advanced to explain the negative relationship between smoking and PA. For example, participation in sport can be a source of stress relief and mood elevation (Centers for Disease Control and Prevention, 1994), thereby negating the need for athletes to seek out these positive effects through smoking. As well, as with the discussion of lung capacity above, athletes may perceive that smoking will impair their performance (Fergus et al., 2005; Pate et al., 2000). Avoiding this negative consequence may be even more imperative in sport contexts than in less structured PA given the widespread emphasis on winning and the motivation to not let teammates down (Melnick et al., 2001).

Certain psychological arguments have also been presented to explain the negative sport-smoking relationship. Above it was suggested that depression provided a link between PA and smoking, in so much as it is negatively correlated with the former behavior and positively associated with the latter. Similarly, athletes generally have higher self-esteem and self-confidence (Kamal, Kelly, & Ekstrand, 1995), while smoking is associated with lower levels of these traits in adolescents (McDermott et al., 1992). As well, it has been suggested that sports also reduce social insecurity and social isolation (Novak, 1976), two situations which are associated with increased smoking initiation and cigarette consumption (Evans, 1998). Therefore, sports may be a protective factor for smoking to the extent that they ward off psychological symptoms associated with higher levels of smoking.

Both smoking and sport participation can also serve as means to develop a sense of identity in adolescence (Melnick et al., 2001). This is similar to the way smoking and PA can potentially provide comparable rewards, as described above. For adolescents involved in competitive sports, smoking may be antithetical to their desired self-image, whether this image is intrinsically or extrinsically motivated (Escobedo et al., 1993; Fergus et al., 2005). Likewise, adolescents engaged in a culture associated with smoking may eschew sports as incompatible with the alternative lifestyle with which they identify. Consequently, the identity formation process which is a critical part of the teenage years may dictate which behaviors are consistent with the desired persona, and which incompatible actions are to be consciously avoided (Eccles & Barber, 1999).

Finally, several aspects of the sport subculture help to explain the negative rela-

tionship between smoking and sport. Role modeling is important in a youth's decision to initiate or abstain from cigarette smoking. Though other positive role models may exist for non-athletes, sport participants are regularly exposed to and influenced by coaches and other adults who are likely to be disproportionately non-smokers (Melnick et al., 2001). As a result, athletes may be exposed to less negative modeling and more positive modeling than non-athletes (Fergus et al., 2005). In the same way, athletes may be more knowledgeable of the negative health consequences of smoking through their frequent exposure to health professionals and to advice surrounding fitness training and other related topics (Melnick et al., 2001). Further, related to Jessor's Problem Behavior Theory described above, sports may cultivate basic values, such as fair play and achievement, which foster the sense of conventionality that underlies a tendency toward non-destructive behaviors (Pate et al., 2000). As well, the team mentality inherent in team sport contexts may foster an inclination towards conformity and this may be reinforced by the teamwork necessary to achieve success in many organized sports. Lastly, more explicit rules may be present in some sport contexts (e.g., forbidding smoking) that may serve to influence the relationship between smoking and sport participation.

Of course, the majority of these explanations are simply hypotheses at this point. Whether sports deter smoking by increasing self-esteem, through their potential to impair performance, or by exposing athletes to positive role models (and so on) are all empirical questions that have received only minimal examination and substantiation. Moreover, it is difficult to say, for example, whether sports increase self-esteem and thereby deter smoking, or if adolescents already high in self-esteem self-select themselves into sports participation (Melnick et al., 2001). This is because, as was the case for the majority of the PA articles described above, causality cannot be inferred in the studies of smoking and sport because of their cross-sectional research designs. Two recent and notable methodological exceptions, however, are longitudinal studies by Audrain-McGovern and colleagues (Audrain-McGovern, Rodriguez, Tercyak, Cuevas et al., 2004; Rodriguez & Audrain-McGovern, 2004) and Fergus et al. (2005). In one study (Audrain-McGovern, Rodriguez, Tercyak, Cuevas et al., 2004), students were resurveyed periodically over grades 9-12 and were classified into a particular smoking progression trajectory based on whether and how quickly they adopted smoking behaviors over their high school years. The authors reported that students with higher in-school or out-of-school team sport participation in ninth grade were significantly more likely to be late adopters than early adopters of smoking (OR=0.63), but more likely to be a late adopter than to have never smoked (OR=1.31) or to have experimented (OR=1.38) with smoking. However, students with higher team sport participation in the twelfth grade were more likely to be a late adopter, experimenter, or never smoker than to be an early adopter of smoking.

In another longitudinal study (Rodriguez & Audrain-McGovern, 2004), each student's sport participation (number of school or community teams) over the course of high school was classified as consistently high, consistently low, decreasing, or erratic. Students with higher grade nine smoking status were significantly more likely to have consistently low sport participation (OR=1.30) or decreasing sport participation (OR=1.81) than consistently high participation. When smoking was assessed in grade eleven, students with decreasing sport participation were almost twice as likely as stu-

dents with consistently low participation (OR=1.90) and nearly three times more likely than students with consistently high participation (OR=2.95) to be current smokers. As well, erratic team sport participation over the course of high school was significantly more associated with being a current smoker in grade eleven than with having consistently high sport participation (OR=2.87).

Finally, Fergus et al. (2005) used data collected in each year of high school to classify the African American high school students in their sample into one of five smoking behavior trajectories: consistent abstainers, consistently light smokers, consistently regular smokers, accelerators (increasing cigarette consumption over the four years) and quitters (those who smoked in the first three years of data collection but had quit in year four). Their repeated measures analyses suggested that consistently light smokers exhibited significantly higher overall sports participation than consistently regular smokers, and that at year four, consistent abstainers and consistent light smokers reported greater sport participation than quitters. In conclusion, these longitudinal studies of sport trajectories generally suggest that smoking is associated with consistently low or declining athletic involvement.

Before concluding however, it should be noted that little is known about the nature of the relationship between smoking and sport participation in adults. All of the analyses described in Table 2 were conducted on data collected from subjects ranging in age from 9 to 25, with most using high school students as the study population. The adolescent and young adult years are a formative time for both leisure and smoking habits, and for this demographic at least, smoking and sport participation appear to be relatively incongruent behaviors.

Smoking and Other Aspects of Leisure

The previous sections reviewed a large number of articles related to PA and sport, two leisure activities which have obviously been of great interest to health researchers. A much smaller set of articles has described other aspects of leisure and the association with various smoking indicators and behaviors. The following sub-sections address the relationship of smoking with non-exercise leisure activities, leisure settings, and leisure identities.

Leisure activity participation and smoking or non-smoking behavior. In addition to PA and sport, a number of studies have looked at the relationship of smoking with a variety of other leisure activities. Gidwani, Sobol, DeJong, Perrin, and Gortmaker (2002) examined the association of television viewing in 1990 with smoking initiation between 1990 and 1992 using data from 592 respondents in the National Longitudinal Survey of Youth. Compared to youth who watched television 0-2 hours/day, those who watched more than five hours or 4-5 hours were 5.99 and 5.24 times more likely to have initiated smoking respectively. Other articles report investigations of the association of smoking with a group of leisure activities. For example, Audrain-McGovern, Rodriguez, Tercyak, Epstein et al. (2004) followed 983 high school students in Virginia from grade nine to eleven and tracked their degree of progression through five stages ranging from being a never smoker to a frequent smoker. They also investigated the students' participation in "substitutable reinforcers" at each time point – including school-related teams, clubs, and activity groups, along with PA and academic

performance—and found that "involvement in substitutable reinforcers is associated with a two-fold reduced likelihood of smoking progression" (p. 70). However, Blackford, Bailey, and Coutuwakulczyk's (1994) study of a smaller sample of 179 teenagers from Sudbury, Ontario found no relationship between leisure activities or interests (e.g., playing pool or snooker, participation in team sports, exercising, interest in famous sport or music stars) and cigarette use. McGraw, Smith, Schensul, and Carrillo's (1991) study of Puerto Rican adolescents showed significantly increased odds of having smoked in the past month for females (but not males) who reported participating in recreational activities and sports. Accompanying interview data indicated that the sports and recreational activities reported generally were unstructured games at the corner basketball court rather than formally organized sports supervised by adults. Finally, Sweeting and West (2003) examined data from two cohorts of 15 year olds in Glasgow, Scotland that were separated by 12 years, with 1009 respondents in 1987 and 2196 respondents in 1999. The 13 activities in their study were categorized into four types of leisure activities: (1) street-based leisure (e.g., hanging out), (2) commercialized leisure (e.g., going to cinema), (3) conventional/safe activities (e.g., reading), and (4) sports and games (e.g., playing computer games). Participation in the street and commercial activity types were related to significantly higher odds of ever smoking, while the sports/computer factor was related to lower odds of ever smoking at both time points. Participation in conventional/safe activities was related to lower odds of ever smoking in 1999, but not in 1987.

Two other studies reported by Caldwell and Smith (Caldwell & Smith, 1995; Smith & Caldwell, 1989) examined the subjective experience of leisure in relation to smoking. In the first study of 1407 adolescents from 66 schools in Ontario (Smith & Caldwell, 1989), the 25% of the sample who always or sometimes smoked during their most common leisure activity were more likely to express feelings of lower competence and challenge and greater boredom during the activity. These and other findings led the authors to conclude: "that nonsmokers are less bored, perceive themselves as being more competent, and feel more challenged than do smokers [and this] seems to indicate that the subjective leisure experience of nonsmokers is more fulfilling than that of smokers" (p. 159). In the second study, Caldwell and Smith (1995) examined the leisure alienation of 2756 students from four high schools in the Southeastern U.S. Leisure alienation, conceptualized as high leisure boredom and the use of free time to reject adult structure, was associated with being a regular smoker for both males and females in their sample.

Three other articles that were reviewed described research in which the associations between smoking and different measures of community involvement were examined. Broman (1993) examined data from the 1979 and 1980 National Study of Personal Health Practices and found that being a member of a voluntary organization (including a church) was significantly related to lower levels of moderate and heavy smoking in both surveys. Lindstrom, Isacsson, and Elmstahl (2003) reported similar findings in their study of participation in 13 formal and informal group activities (e.g., church, demonstration, organization meeting, etc.) for almost three thousand smokers in Malmo, Sweden. They found that daily smokers who had remained daily smokers when surveyed a second time one year later reported participating in significantly fewer group activities over the past year than the daily smokers who had quit or reduced

their smoking frequency. Finally, Griener, Li, Kawachi, Hunt, and Ahluwalia (2004) found that being a current smoker was negatively associated with individuals' ratings of their community being a good place to live and with their reports of being involved in a civic group in the past five years. However, in multivariate analyses, only the community rating variable, and not the community involvement variable, was related to current smoking.

Finally, research by Nellis, Emurian, Brady and Ray (1985) compared smoking behavior during work with that during leisure time. In their study, eight research participants lived in a residential laboratory for an average of 8.3 days and engaged daily in alternating one-hour periods of work and recreation. Observation of these work and non-work activities, as well as measurements made with personal, portable 'puff-detecting' devices, showed a higher rate of smoking during recreational tasks than work tasks and that the first cigarette occurred much later during the work hours than during the non-work hours.

Although too little research has been reported to draw firm conclusions, there is some preliminary evidence, especially for adolescents, that greater involvement in organizations that provide structured leisure opportunities and feeling positive about leisure involvements may be associated with lower levels of smoking.

Leisure as a context for smoking or non-smoking behavior. In addition to its association with various recreation and leisure-related activities, smoking may be influenced by contextual variables in leisure settings. Three articles in our review examined the role of smoking cues in leisure-related settings in impacting tobacco use behavior. In two of these articles, the authors discussed how social smoking—a person increasing their usual cigarette consumption when in social contexts—is prevalent in leisure settings (Biener & Albers, 2004; Trotter, Wakefield, & Borland, 2002). For example, Biener and Albers analyzed data from 12,447 adults who participated in the Massachussetts Adult Tobacco Survey. They found that younger (18-30 years) smokers and nonsmokers were more than twice as likely as older smokers (31-65 years) to be frequent patrons of bars and clubs and younger (18-30) White (but not Black) smokers were significantly more likely to be social smokers than White older (31-65) smokers. Similarly, Trotter et al. (2002) also reported that socially cued smokers were substantially more likely to be under the age of 30. In their sample of 517 smokers from Victoria, Australia, 70.1% of the respondents who visited bars, nightclubs, or gaming venues at least monthly smoked more when they were in these social venues. Thus, the authors of both of these studies suggested that those who smoke more in these settings would be more likely to reduce their consumption overall and/or quit if smoking bans were introduced in social venues.

In another study of smoking in social contexts, Alesci, Forster, and Blaine (2003) asked 9762 adolescents and 1586 of their parents if they had seen smoking in seven different public places and the extent to which they felt smoking was acceptable in those settings. The seven locations included: (1) on school property, (2) near school property, (3) shopping center, (4) fast food restaurant, (5) other type of restaurant, (6) recreation centre, video arcade, bowling hall, etc., and (7) outdoor gathering places. Both smoking and non-smoking youth perceived adult smoking to be acceptable in restaurants, recreation venues, and outdoor gathering places, but they were less tolerant of teen smoking in the same venues. Parents were also quite tolerant of adult smoking

in these venues, but found it less acceptable for adults to smoke indoors or at outdoor school events. It is not surprising that in comparison to youth or adults who smoked, nonsmoking youth and parents found smoking to be less socially acceptable for both adults and teens in all locations. Finally, the more that adults were observed smoking in a location, the more likely it was that teens were observed smoking there as well. As above, the authors argued that smoking bans could reduce youth smoking through four mechanisms: (1) decreased opportunities to smoke, (2) having fewer role models of tobacco use available, (3) reduced opportunities for social exchange of tobacco and (4) a change in community attitudes towards the social acceptability of tobacco use.

Indeed, a small number of studies examined the establishment of smoke-free policies in leisure and recreation settings. A case study by Henriques, Newton and Marshak (2003) chronicled how a 12-year old from Grand Terrace, California initiated a successful campaign to have all city parks designated as smoke-free zones. By collecting petition signatures and tobacco-related trash from parks, the boy, whose grandfather had died of lung cancer, received strong support from residents and eventually the city council. Other studies also have shown similar evidence for the support of such smoke-free initiatives. Howell (2005) chronicled how Ireland's legislation to ban smoking in enclosed workplaces, including bars and restaurants, was successful in many regards. The law—enacted in 2004 as the first national policy of its kind anywhere in the world—was well-received with over 70% of bar and restaurant patrons saying it improved their experience in those settings. Pikora et al. (1999) conducted an entrance survey and an observational study at two sports stadia in Perth, Australia to examine spectator compliance with non-smoking regulations. They found that there was a high level of compliance (8 smoking incidences total across the two venues), despite the fact that over 1500 smokers were in attendance at the two events and that only 40% of smokers agreed with the policy compared with 86% of non-smokers. Finally, Giles-Corti et al. (2001) evaluated the impact of Healthway, an organization established by the government of Western Australia in 1992 that uses health sponsorship to promote healthy behaviors and to compensate for tobacco sponsorship dollars lost by sport, arts, and racing organizations as a result of restrictive legislation. Sport and recreation settings, in particular, were seen by Healthway as particularly effective places to communicate with hard-to-reach groups in the community and those with elevated risk for tobacco and alcohol use. Using a variety of data, the authors found that awareness and compliance with smoke-free policies at Healthway-sponsored leisure venues was high, and that the number of venues sponsored by Healthway that went smoke-free increased significantly throughout the seven years after the sponsorship program was established. In summary, based on the limited research reported, it seems clear that social recreation contexts that allow smoking increase the prevalence of smoking behavior and that restrictions and bans in public recreation spaces are effective in curtailing and inhibiting smoking.

Leisure identity and smoking or non-smoking behavior. Leisure behavior can be the basis for identity formation and affirmation. These processes require self-expression and interaction with other people. In leisure, these opportunities are available and people feel free to try out new possibilities (Mannell & Kleiber, 1997). In a pair of related commentaries, Wearing, Wearing and Kelly (1994) and Wearing and Wearing (2000) discuss the competing and concurrent roles for leisure and smoking in identity forma-

tion among adolescent girls in particular. "Leisure spaces", they argue, "at school, at home, and in the local community are areas where identities are tried out and developed" (Wearing et al., 1994, p. 629). However, while gender status for boys is attached to physically active and aggressive activities, adolescent girls' identities are commonly wrapped up in feminine stereotypes of passive activities and docile supportiveness (cf. Green, Hebron & Woodward, 1990). For some young women, then, smoking symbolizes resistance to traditional female personas and is also leisure-related in so much as it provides significant pleasure and escape (Wearing et al., 1994). Given the dual meanings of smoking as resistance and pleasure, the authors then ask "what … are some specific ways in which adolescent girls can pursue pleasurable leisure activities which assist them in constructing feminine identities which resist submissiveness and passivity and increase their autonomy and sense of self-worth?" (Wearing et al., 1994, p. 636). In response top their own question, they suggest that sports, for their physical outlet and social component, outdoor recreation, for its mixed sensations of elation, adventure, and relaxation, and dance, for its expressiveness and sexuality, may serve as plausible alternatives for this purpose.

In a more recent, but related paper, Wearing and Wearing (2000) describe cigarette use as a fashion accessory and draw comparisons to Veblen's (1899) idea of conspicuous consumption as part of the explanation for the role smoking can play in identity formation among adolescent girls. Citing tobacco-toting, female role models from film and other fashionable influences (e.g., advertising and imagery from the tobacco industry), the authors argue that "smoking can impart a sense of self-confidence, sexuality and autonomy which defies authority and traditional images of femininity at a formative stage in the life-course" (Wearing & Wearing, 2000, p. 55). Again, they discuss sports and outdoor recreation as more positive outlets for achieving such goals of resistance and identity expression. Finally, according to Rojek (1997, 2006), deviant leisure requires greater empirical and theoretical attention, especially when, as is the case with smoking, short-term gains in fashion and identity formation are so drastically outweighed by the potential for long-term health concerns.

In an empirical study reported by Wearing et al. (1994), boys were found more readily than girls to construct identities independent of smoking through active pursuits. Using focus groups with 42 thirteen and fourteen year-olds in New Zealand, Plumridge, Fitzgerald, and Abel (2002) found that smoking was associated with being at both the upper and lower ends of the adolescent social hierarchy, while non-smokers were commonly relegated to being in the middle of the social status range. As the authors put it, "Boys and girls solved this problem differently. Boys were able to not only deconstruct smoking as a sign of prestige, they were able to build on notions of physicality to develop alternative, and arguably as credible, self identities" (p. 173). Whereas the middle-status boys in their study frequently described their participation in sports and other active pursuits, girls depicted their leisure as more passive involving frequent sitting and talking. Therefore, lacking an alternative identity to which they could lay claim, the non-smoking girls were more inclined to accept their subordinate status in the social hierarchy. Given these results, the authors argue that the issue of smoking uptake/refusal cannot be fully comprehended independent of the power structure of social relations among adolescents. However, they suggest that providing

desirable alternatives to smoking is likely to be a more plausible solution to this power- and gender-related problem than trying to alter either adolescent social structures or the meanings associated with smoking manufactured by tobacco companies.

In a study examining associations between numerous health-compromising behaviors, Hazard and Lee (1999) suggested that social context may again play a key role in adolescent risk-taking, including smoking. Their study of 12-16 year olds in Germany examined not only prevalence of risk-taking behaviors, but also other variables such as participants' perceptions of smoking as appealing, their exposure to peers who smoke, and their self-rated competence in dealing with social situations when offered cigarettes by others. The findings suggest that adolescents with friends who smoke tend to smoke and drink more, to rate these behaviors as social appealing, and to be less concerned with their health. Additionally, competence in dealing with health-comprising situations was, surprisingly, positively related to smoking. The authors concluded that "cigarette smoking and alcohol consumption are perceived by German youth not so much as health-threatening behaviors but as social behaviors" (p. 361) and that "risky behavior may be socially valued as a basis for prestige and social identity" (p. 362).

The final study to be discussed explored how tobacco companies explicitly research and target women's psychosocial needs in order to develop advertising materials that will appeal to different market segments of female smokers. Based on reviewing 704 documents related to tobacco industry advertising campaigns, Anderson, Glantz and Ling (2005) identified five salient positioning strategies and provided examples from specific campaigns. One tobacco company focus group report stated that associating smoking with attractive lifestyle behaviors is an effective strategy to encourage smoking. For example, the 'Spoil Yourself with Satin' campaign prompted responses from women such as "deserving time for themselves … she is totally relaxed, taking a break – dinner is done, kids are asleep – this is her time" (as quoted in Anderson et al., 2005, p. 128). In addition to this 'private time' theme, other needs reflected in ads targeted at women included social acceptability, escape, peer group belonging, and female camaraderie, most of which reflected aspects of leisure and lifestyle dimensions. The authors suggest two potential solutions to counteract the subtle influences of advertising aimed at psychosocial need satisfaction. The first was the need for comprehensive tobacco advertising bans, given that advertisements do not need to show people actually smoking in order to draw effective associations between cigarettes and particular lifestyles. The second suggestion was to increase use of counter-advertising that (1) undermines and refutes the need-satisfaction messages in tobacco campaigns, or (2) "provides alternatives to pro-smoking associations formed by tobacco advertising that resonate with the psychosocial needs of each target audience" (p. 132). As an example, the authors cite the widely-known Truth campaign directed by youths which plays on youths' need for independence and individuality.

In summary, a small number of papers were found in which personal identities and smoking behavior among adolescents were hypothesized to be strongly tied to leisure lifestyle behaviors. The preliminary evidence reported suggests support for these links.

Conclusion

Over 100 articles were reviewed for this paper in an attempt to synthesize knowledge about the relationships between smoking and leisure. A substantial amount of empirical research has addressed the association between smoking and PA (50 articles in our review) and between smoking and sport (32 articles). The third category of articles in our review, which was significantly smaller and covered a wide range of topics, described smoking in relation to non-exercise leisure activities, leisure settings, and leisure identities. This latter category was comprised of only 23 articles.

Smoking and PA were found to be negatively related in the majority of articles reviewed, although the link was less predictable in males and younger populations. Unfortunately, few articles reporting studies of smoking-PA associations were guided by a theoretical framework and only a few hypotheses were advanced to help explain the observed associations. Several authors suggested mechanisms by which the two behaviors might be related, but the cross-sectional nature of the studies precluded any causal inferences. In the future, greater use of interventions, experiments, and longitudinal research designs could more effectively document and describe the nature of these associations and the underlying mechanisms. For example, although a little research on the use of PA as a smoking cessation aid has been undertaken, the results have been mixed (deRuiter & Faulkner, 2006; Marcus et al., 1999, 2003).

The relationship observed between sport participation and smoking was found to be more consistently negative though almost all the studies reported investigations of youth populations. It should be noted, however, that our review dealt solely with cigarette use, whereas sport participation has been associated more commonly with use of smokeless tobacco (i.e., chewing tobacco) and other substances open to misuse such as alcohol (Garry & Morrisey, 2000; Hildebrand, Johnson, & Bogle, 2001; Rainey et al., 1996). Again, few authors tested a specific theoretical framework or hypothesis in examining the sport and smoking relationship. Consequently, numerous questions require further exploration, including the role of teammates and coaches in smoking prevention, the potential substitutability of smoking and sport in adolescent identity development, and the optimal amount and intensity of sport participation to curb cigarette use, to name but a few areas for inquiry.

With respect to non-exercise leisure participation and settings, a wide variety of associations with smoking were described. The articles that addressed leisure alienation and quality (Caldwell & Smith, 1995; Smith & Caldwell, 1989) and social participation (Broman, 1993; Griener et al., 2004; Lindstrom et al., 2003) would suggest that individuals who have more fulfilling leisure lifestyles tend to smoke less. Audrain-McGovern, Rodriguez, Tercyak, Epstein et al. (2004) argued that "adolescent smoking prevention programs may improve outcomes through incorporating awareness, availability, and accessibility to alternatives that compete with smoking" (p. 70). The research also suggests that adolescents may substitute smoking as a means of identity development in the absence of other leisure-related alternatives by which to differentiate themselves. These findings highlight at least two potential hypotheses that merit further exploration: Do adolescents (and perhaps adults as well) engage in smoking because of a lack of other leisure alternatives, or does smoking provide similar rewards and fulfillment and therefore is simply a chosen leisure preference?

Further, opportunities exist for examining specific characteristics of leisure activities for their association with smoking. For example, debates about the relative value of structured versus unstructured activities for youth and adolescent development have been renewed lately (e.g., Larson, Walker & Pearce, 2005). However, little has been specifically studied about whether structured or unstructured leisure is associated with greater levels of smoking initiation among youth and teens. Among a sample of 703 fourteen year-olds in Sweden, Mahoney and Stattin (2000) reported that participation in highly structured leisure activities with adolescents of the same age, a regular weekly meeting time, and with an adult leader was linked to low levels of antisocial behavior. However, their eight indicators of antisocial behavior did not include smoking. Studies that examine the presence of health risk behaviors according to different types of activities could help specify the ideal amount of structure for discouraging smoking.

Further, researchers could determine if solitary or social leisure pursuits have a greater association with smoking. Substantial evidence suggests that, among youth, friends have a significant impact on the decision to smoke or not smoke, usually more so than parents or siblings (West, Sweeting, & Ecob, 1999). Sasco et al. (2003) argued that reading and computer use may be protective because they do not involve socializing with friends. As we saw from the studies of smoking and leisure settings, a large proportion of young adult smokers were 'social smokers' in that they consumed more cigarettes in social settings such as bars and clubs (Bierner & Albers, 2004; Trotter et al., 2002). However, with respect to smoking and sport, the vast majority of the associations we looked at were negative and it has been suggested that certain social aspects of sport, including positive role modeling and an emphasis on the values of teamwork and achievement, help to explain this inverse relationship (Melnick et al., 2001; Fergus et al., 2005). As suggested by Jessor (1991), adolescents' involvement in risk behaviors is likely a function of the balance between exposure to risk factors and protective factors. Elucidating what these risk and protective factors are in leisure settings will help in better understanding this dynamic interaction of determinants of smoking among both youth and adults.

A greater diversity of investigative methods will also expand understanding of the leisure-smoking connection. Most of the research on PA, sport and smoking, including all of the articles reviewed here, is based on quantitative methods. These have proved useful for understanding the prevalence and correlates of smoking at the population level. However, qualitative and interpretive approaches are much less common in these areas of research and could provide additional detail about the processes by which smoking and PA or sport are linked. Moreover, even the use of quantitative methodologies could be expanded. For example, the experience sampling method that has been employed with some frequency by leisure researchers (Havitz & Mannell, 2005; Mannell, Kaczynski, & Aronson, 2006) could provide insights into the psychological experience of smoking in various social and physical leisure settings.

Social ecological models of health promotion posit that multiple sectors and disciplines can and should contribute to reducing smoking uptake and frequency. The adoption of such perspectives by public health professionals paves the way for leisure researchers and professionals to contribute to solutions to smoking issues. Social ecological models also suggest that multiple levels of behavioral influence should be targeted to have the greatest effect, including intrapersonal, interpersonal, institutional,

community, and public policy levels (McLeroy, Bibeau, Steckler & Glanz, 1988). However, the majority of research reviewed in this paper was focused at the individual level. Similarly, most of the hypotheses that were discussed as potential explanations for the smoking and PA or smoking and sport associations (e.g., lung function, education level, etc.) were individual-level explanations. Nevertheless, our review did uncover some examples of broader social, environmental, and policy factors related to leisure and sport that might influence smoking behavior. For instance, the discussion of role-modeling by coaches and the implementation of smoke-free zones in parks and stadia represent two higher-level mechanisms that may help to curtail individual smoking rates. When designing and evaluating interventions, whether they are planned or natural, leisure professionals and scholars should consider these multiple levels of influence. Analytic techniques such as multi-level modeling (Sibthorp, Witter, Wells, Ellis, & Voelkl, 2004; Leatherdale, Cameron, Brown, Jolin & Kroeker, 2006) can help to sort out the different leisure-related factors that operate at each level to enhance smoking cessation efforts.

Notes

1. Aaron, Dearwater, Anderson, & Olsen, 1995; Audrain-McGovern, Rodriguez, & Moss, 2003; Audrain-McGovern, Rodriguez, Tercyak, Cuevas, et al., 2004; Boudreaux, Francis, Taylor, Scarinci, & Brantley, 2003; Boutelle, Murray, Jeffery, Hennrikus, & Lando, 2000 ; Burke et al., 1997; Boyle, O'Connor, Pronk, & Tan, 2000; Butterfield et al., 2004; Costakis, Dunnagan, & Haynes, 1999; de Bourdeaudhuij & van Oost, 1999; Easton & Kiss, 2005; Faulkner, Bailey, & Mirwald, 1987; Frisk, Brynhildsen, Ivarsson, Persson, & Hammar, 1997; Gardner, Womack, Montgomery, Franklin, & Killewich, 1999; Garrett et al., 2004; Hart, 1984; Holmen, Barrett-Connor, Clausen, Holmen, & Bjermer, 2002; Johnson, Boyle, & Heller, 1995; Johnson, Nichols, Sallis, Calfas, & Hovell, 1998; Klesges, Stein, Hultquist, & Eck, 1992; Kvaavik, Meyer, & Tverdal, 2004; Laaksonen, Luoto, Helakorpi, & Uutela, 2002; Lewis, Harrell, Bradley, & Deng, 2001; Lockery & Stanford, 1996; Lytle, Kelder, Perry, & Klepp, 1995; Marti & Vartiainen, 1989; Nguyen, Beland, Otis, & Potvin, 1996; Osler, Clausen, Ibsen, & Jensen, 2001; Osler, Prescott, Godtfredsen, Hein, & Schnohr, 1999; Paavola, Vartiainen, & Haukkala, 2004; Papaioannou, Karastogiannidou, & Theodorakis, 2004; Pate, Heath, Dowda, & Trost, 1996; Paulus, Saint-Remy, & Jeanjean, 2000; Perkins, Rohay, Meilahn, & Wing, 1993; Pitsavos, Panagiotakos, Lentzas, & Stefanadis, 2005; Sasco, Laforest, Benhaïm-Luzon, Poncet, & Little, 2002; Savage & Holcomb, 1997; Schmitz, French, & Jeffery, 1997; Schroder, Elosua, Marrugat, & REGICOR Investigators, 2003; Schuit, van Loon, Tijhuis, & Ocké, 2002; Sherwood, Hennrikus, Jeffery, Lando, & Murray, 2000; Steptoe et al., 1997; Stones, Kozma, McNeil, & Stones, 1986; Strine et al., 2005; Sylvia, 2004; Takemura, Sakurai, Inaba, & Kugai, 2000; van Oort, van Lenthe, & Mackenbach, 2004; Ward et al., 2003; Wilson et al., 2005; Winnail, Valois, Mckeown, Saunders, & Pate, 1995

2. Boutelle et al., 2000; Boyle et al., 2000; Faulkner et al., 1987; Frisk et al., 1997; Gardner et al., 1999; Hart, 1984 ; Johnson et al., 1995; Kvaavik et al., 2004; Laaksonen et al., 2002; Nguyen et al., 1996; Paavola et al., 2004; Perkins et al., 1993; Pitsavos et al., 2005; Schmitz et al., 1997; Schuit et al., 2002; Steptoe et al., 1997; Stones et al., 1986; Strine et al., 2005; Takemura et al., 2000; Ward et al., 2003

3. Boutelle et al., 2000; Boyle et al., 2000; Frisk et al., 1997; Hart, 1984 ; Johnson et al., 1995; Laaksonen et al., 2002; Nguyen et al., 1996; Pitsavos et al., 2005; Schmitz et al., 1997; Stones et al., 1986; Strine et al., 2005; Ward et al., 2003

4. Boutelle et al., 2000; Faulkner et al., 1987; Johnson et al., 1995; Kvaavik et al., 2004; Schuit et al., 2002; Steptoe et al., 1997; Strine et al., 2005; Ward et al., 2003

5. Boudreaux et al., 2003; Burke et al., 1997; Butterfield et al., 2004; Costakis et al., 1999; de Bourdeaudhuij & van Oost, 1999; Garrett et al., 2004; Johnson et al., 1998; Klesges et al., 1992; Lockery & Stanford, 1996; Osler et al., 1999; Schroder et al., 2003; Sherwood et al., 2000; van Oort et al., 2004

6. Holmen et al., 2002; Lytle et al., 1995; Marti & Vartiainen, 1989; Osler et al., 2001; Pate et al., 1996; Savage & Holcomb, 1997; Sylvia, 2004; Wilson et al., 2005

7. Aaron et al., 1995; Audrain-McGovern et al., 2003; Audrain-McGovern, Rodriguez, Tercyak, Cuevas, et al., 2004; Easton & Kiss, 2005; Lewis et al., 2001; Papaioannou et al., 2004; Paulus et al., 2000; Sasco et al., 2002; Winnail et al., 1995

8. Boutelle et al., 2000; Faulkner et al., 1987; Holmen et al., 2002; Kvaavik et al., 2004; Lytle et al., 1995 ; Pitsavos et al., 2005; Steptoe et al., 1997; Wilson et al., 2005

9. Aaron et al., 1995; Burke et al., 1997; Lewis et al., 2001; Lockery & Stanford, 1996; Osler et al., 2001; Sherwood et al., 2000

10. Aaron et al., 1995; Burke et al., 1997; Lewis et al., 2001; Osler et al., 2001; Sherwood et al., 2000

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