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Smoking and cardiac rehabilitation participation: Associations with referral, attendance and adherence

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ABSTRACT

Objective: Continued smoking after a cardiac event greatly increases mortality risk. Smoking cessation and participation in cardiac rehabilitation (CR) are effective in reducing morbidity and mortality. However, these two behaviors may interact; those who smoke may be less likely to access or complete CR. This review explores the association between smoking status and CR referral, attendance, and adherence.
Methods: A systematic literature search was conducted examining associations between smoking status and CR referral, attendance and completion in peer-reviewed studies published through July 1st, 2014. For inclusion, studies had to report data on outpatient CR referral, attendance or completion rates and smoking status had to be considered as a variable associated with these outcomes.
Results: Fifty-six studies met inclusion criteria. In summary, a history of smoking was associated with an increased likelihood of referral to CR. However, smoking status also predicted not attending CR and was a strong predictor of CR dropout.
Conclusion: Continued smoking after a cardiac event predicts lack of attendance in, and completion of CR. The issue of smoking following a coronary event deserves renewed attention.

Smoking prevalence in cardiac patients

Smoking prevalence in coronary heart disease (CHD) patients is higher than in the general population (Aguëro et al., 2013; Bellow et al., 2011). Multisite studies in the US report smoking prevalence of 27 to 36% in those hospitalized for an acute cardiac condition compared to a smoking rate of about 18% in the general adult population (LaBresh et al., 2007; Leifheit-Limson et al., 2013; Agaku et al., 2014). However, while smoking rates continue to decline in the general population, a similar decline has not been observed in cardiac populations (Richardson et al., 2000). This same pattern is also seen in Europe where smoking rates overall are slowly decreasing while smoking prevalence among cardiac patients remained at 20% over a 20 year period (Kotseva et al., 2009).

During hospitalization almost all cardiac patients in developed countries are required to abstain from smoking, with a preponderance receiving their care in smoke-free hospitals. Most of these hospitals offer cessation programs (e.g. Smith and Taylor, 2013), and self-reported smoking status does decline after a hospitalization for heart disease. Generally, cessation support services during hospitalization are strong but there is little systematic sustained support following discharge (Boggon et al., 2014). Not surprisingly, relapse following discharge is a problem. Rates of longer-term abstinence vary, but generally half or fewer of smokers who quit following their cardiac event are still abstinent at 6 to 12 months later (Berndt et al., 2013; Newsom et al., 2012; Larsen et al., 2011; Attebring et al., 2004). When smoking status is biochemically verified, allowing for an objective, rigorous measurement of smoking status, quit rates are even lower (e.g. 30%, Chouinard and Robichaud-Ekstrand, 2007; 22%, Johnston et al., 2004).

Smoking after an acute cardiovascular event

Smoking status following an acute cardiac event is a powerful predictor of future morbidity and mortality. Among smokers hospitalized for acute coronary syndrome, those who quit have markedly lower rates of major adverse cardiac events (RR 0.61) and mortality (RR 0.49) compared to those who continue smoking (Boggon et al., 2014). In a large, multi-country study, quitting smoking was associated with a markedly reduced incidence of myocardial infarction (OR 0.57) over a 6-month period (Chow et al., 2010). In another rigorous study where smoking status was biochemically verified, the risk of recurrent cardiovascular disease events was reduced by 40% within one year of smoking cessation (Twardella et al., 2004). Meta-analyses show that in patients with CHD, smoking cessation is associated with significant

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decreases in mortality and recurrent myocardial infarction (OR 0.54; Wilson et al., 2000); those who quit benefit from a 36% reduction in crude relative risk of mortality regardless of age, sex, index cardiac event, country, or year of study (Critchley and Capewell, 2003). Quitting smoking is considered the single most effective way to decrease risk of future morbidity and mortality following an acute cardiac event (Perk et al., 2012).

Benefits of cardiac rehabilitation

Cardiac rehabilitation (CR) is a treatment model designed specifically for individuals who have had a major cardiac event or have an established history of chronic heart disease. It includes a structured exercise program, usually lasting several months, and is combined with educational and behavior-modifying interventions focused on improving dietary and lifestyle habits (Ades, 2001; Hamm et al., 2011). The American Heart Association and the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) recognize that CR is an integral part of comprehensive care for patients with CHD (Balady et al., 2007). CR programs vary in length but generally consist of 24–36 sessions held 2–3 times weekly over 3–4 months (Wenger, 2008). Perhaps the most important element of CR is an individualized, structured, progressive exercise program (preferably initially supervised) that needs to be continued long-term (Ades, 2001). Additional elements include counseling to help improve adherence to diet and medication recommendations while minimizing the psychological effects of coronary illness. Only occasionally do CR programs offer specific behavioral and pharmacological interventions for smoking cessation (Balady et al., 2007).

CR is highly effective at reducing morbidity and mortality rates following a myocardial infarction (MI) or coronary revascularization, while also reducing disability and promoting a healthy, active lifestyle (Clark et al., 2004; Taylor et al., 2004; Wenger, 2008). Participation in CR results in a 31% reduction in cardiac re-hospitalizations over a 12-month horizon and a 26% decrease in cardiac mortality over 3 years (Taylor et al., 2004; Heran et al., 2011). Thus benefits of participation accrue rapidly and limit re-hospitalization costs (Heran et al., 2011). These effects of CR are also dose dependent, with reductions in mortality increasing with the number of sessions attended and with adherence to risk factor reduction strategies (Suaya et al., 2009; Hammill et al., 2010).

The benefits of CR reach beyond reduced risks for morbidity and mortality with measures of anxiety, depression, self-confidence, and patient-reported quality of life all improve after CR (Ades, 2001). Other benefits of CR with strong empirical support include improvements in symptoms, tolerance for exercise, psycho-social well-being and stress reduction (Wenger, 2008), all of which facilitate returning to work as well as resumption of active recreational activities (Dugmore et al., 1999).

Smoking status and cardiac rehabilitation participation

Given that smoking cessation and CR attendance are both effective at reducing morbidity and mortality, interactions between these types of behavior change are of great interest. Ideally patients would both attend CR and stop smoking. However, continued smoking following a cardiac event tends to co-exist with failure to change other unhealthy behavior patterns such as improving diet or exercise habits (Chow et al., 2010; Hahn et al., 2014; Kuhl et al., 2009). These same negative relationships between smoking and participating in healthy behavior change could also be present in how patients access CR.

Of interest is how smoking status affects the likelihood of accessing cardiac rehabilitation. The process of patient involvement in CR can be broken into three parts: 1. Referral: was the patient referred to CR by the health care-provider following their cardiac event? 2. Attendance: did the patient attend even one session of CR? 3. Adherence: did the patient complete their recommended course of CR? A systematic literature search was conducted to examine associations between smoking status and these three aspects of CR.

Methods

The online databases PubMed, PsychINFO and Web of Knowledge were systematically searched using the search terms smoking and cardiac rehabilitation. Additional potential reports were identified by using Google Scholar where the search terms were combined with terms indicative of participation in CR (referral, attendance, participation, adherence, and dropout). Publications were restricted to what is commonly known as "Phase 2" CR. These programs are distinct from "Phase 1" rehabilitation, which takes place in the hospital and "Phase 3 CR" which is a long-term maintenance program. Phase 2 CR begins shortly after hospital discharge and generally lasts 3 to 4 months. All publications prior to July 1st, 2014 were considered. Full texts of these articles were independently reviewed for inclusion by two authors (DEG, AYC) and any discrepancies resolved. Additionally, reference sections of relevant articles were reviewed for other relevant citations that were evaluated for possible inclusion. In total, 701 articles were identified as potentially relevant. Studies were included if the following criteria were met: results were published in a peer-reviewed journal in English, data were reported on CR referral, attendance or completion rates, smoking was included as a possible variable associated with these outcomes, the statistical significance of the effect of smoking status was reported, and the program being studied was "Phase 2" CR. With these criteria, 56 studies were rated eligible for inclusion. The significance of associations between smoking status and CR referral, attendance, or adherence was defined as the original author's determination of statistical significance. A criterion of $p < .05$ was used across most studies; the few exceptions are noted in the tables.

Results

Effects of current smoking status on referral to CR

Ideally individuals who have experienced a qualifying cardiac event would be referred to CR while in the hospital. Referral rates are not optimal, however, and one quality improvement project increased referral rates from 16.9% to 41.7% (Zhang et al., 2005). While not all patients are appropriate for CR, these referral rates still leave room for improvement. Referrals that are not made systematically leave room for bias and those who get referred may differ significantly from those who do not. We assessed whether smoking status was associated with differences in CR referral rates.

Six studies were identified that provided data on smoking status and referral rates (Table 1). Three (50%) reported that current or recent smoking significantly increased a patient's chance of being referred to CR (Aragam et al., 2011; Brady et al., 2013; Brown et al., 2009). Two studies (33%) found no significant association between smoking status and referral (Bittner et al., 1999; Kotseva et al., 2013). Additionally, one study (17%) found a significant negative relationship between smoking status and referral (Barber et al., 2001). While more data on this issue are clearly needed, it appears that reporting current smoking may increase a patient's probability of CR referral. This is in contrast to other risk factors such as obesity and diabetes that generally reduce the likelihood of a patient receiving all available therapies, including referral to CR (Motivala et al., 2011).

Effect of smoking on CR participation/attendance

After a patient has been referred to CR, he or she must decide whether to attend. This is a potential point of self-selection as not all referred patients attend CR. One common metric for reporting attendance is determining whether a patient attends at least one CR session. Thirty-three studies provided data about the characteristics for those who did versus did not attend at least one CR session (see Table 2).

Thirteen studies (39%) provided evidence that smokers were significantly less likely to attend even one session (Ades, Huang et al., 1992; Deskur-Smielecka et al., 2009; Fontana et al., 1986; Goel et al., 2011;