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The effect of age on perceived benefits and constraints to participation in masters cycling—Literature review

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Abstract: The purpose of this literature review is to examine and explore the research literature related to masters cycling from a social ecology framework. An exploration of health promotion research, leisure research and physical activity research supports the validity of the social ecology framework with respect to perceived benefits and constraints. Three key constraints were identified as explaining the most variance in participation in masters sport. The Cyclist Motivation Instrument provided five detailed cycling-specific factors in motivation. However, no research to date has examined the effects of age on perceived benefits and constraints to participation in masters cycling.

Subjects: Sport and Exercise Science; Sport and Leisure Studies; Cycling; Health & Society

Keywords: social ecology framework; masters cyclist; benefits and constraints; health psychology; sports psychology

1. Introduction

Cycling is widely acknowledged as a physical activity with numerous physical, social and psychological benefits (Titze, Merom, Rissel, & Bauman, 2014). Studies examining the effect of cycling on population health consistently demonstrate strong fitness benefits and reduction in cardiovascular risk

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Professor P.R. Reaburn has had over 15 years looking at master's athletes and recently our group of researchers has looked at masters athletes as models of successful ageing. Furthermore, we have looked at the physiological changes in the ageing athlete including bone health with Bone Mineral density and scaropenia. An important concept is the understanding of the perceived benefits and constraints to participate in competitive sport as we age, and this has been a focus of a recent study, identify key factors by a self reflective questionnaire. Currently, we are developing bone and muscle profiles of the ageing athlete specifically male masters athletes.

PUBLIC INTEREST STATEMENT

Cycling is widely acknowledged as a physical activity with numerous physical, social and psychological benefits. Cycling is a competitive sport, transport and also a family past time. People that undertake cycling as a competitive sport especially later in life, should provide us with insight into perceived benefits and constraints of cycling, to why individuals that undertake recreational- and transport-based cycling. Masters athletes as a group and their collective perceived benefits and constraints have shown significant differences of the effect of age on participation between younger adults (45–54 years), middle-aged adults (55–64 years) and older adults (65–74 years). Furthermore researchers have observed significant differences in participation within the same age groups as well as significant interactions between age and physical activity levels. Cycling provides key health benefits specifically in cardiovascular fitness, therefore, it is important to understand what effect these may have to either increase or decrease activity levels.

factors (Oja et al., 2011). Health benefits for masters athletes reflect an overall healthy lifestyle (Shephard, Kavanagh, Mertens, Qureshi, & Clark, 1995). Masters cyclists have a lower than average BMI compared to the general population of the same age (Macgregor, 2014).

Masters' athletes systematically train to compete in organised sports for individuals aged 35–44 years, with 'middle aged masters' 45–54 years of age and 'seniors' falling into the over 55 years of age category (Reaburn & Dascombe, 2008). Participation of masters athletes in organised sports such as cycling has steadily increased in last 20 years (Stiefel, Knechtle, & Lepers, 2014). This increase in participation has led to the identification of a new cohort of masters athletes with unique physical, social and psychological traits (Dionigi, Horton, & Baker, 2013; Young & Medic, 2012).

Age-related declines that occur physiologically in normal healthy aging individuals have been well documented (Reaburn, 2009). Similarly, the ageing process and the above physiological decline also is associated with decreases in physical performance in masters athletes across a range of sports (Medic, Young, & Medic, 2011). Peiffer, Abbiss, Chapman, Laursen, and Parker (2008) examined the physiological characteristics of masters cyclists aged 35–44, 45–55 and 55 years of age and over. Key performance tests such as 15-min time trial and a graded exercise text were conducted. Time trial performance, maximal oxygen uptake and maximal heart rate significantly decreased as age increased. However, while the age-related declines in performance of masters cyclists have been well documented, the social and psychological determinants of participation in cycling have yet to be examined in detail. Specifically, there is a paucity of research investigating the psychological and social influences on participation and performance in masters cyclists and masters athletes in general.

Historically, psychological and social influences on participation have been viewed through a number of theoretical constructs (Deci & Ryan, 1985, 2000; Duda, 1989; Pelletier, Rocchi, Vallerand, Deci, & Ryan, 2013). Researchers have attempted to adapt many psychological theories into models which may be useful in explaining variation amongst differing levels of motivation, commitment and self-efficacy. However, no theory has been widely accepted as the best practice in motivational research within the masters athlete cohort. As with most psychological research, one parsimonious explanation will often fall short of explaining exactly what is occurring in one person's mind, body, environment, and social network. This literature review will use validated research methods and theory to help explain differences in perceived benefits and constraints, and the age effects of participation in masters cyclists. Specifically, this literature review will draw on research conducted within a social ecology framework. Thus, the following section of the literature review will discuss the development of a social ecology framework and how that is related to the study of effects of age on perceived benefits and constraints in masters cyclists.

2. Development of a social ecology framework

The social ecology framework has emerged through a sequential development of basic and fundamental principles that attempt to explain the interconnection between nature and nurture. Specifically, that humans are not static and isolated but dynamic and ever changing and adapting (Bronfenbrenner, 1977). Fundamental principles presented by Urie Bronfenbrenner, the famous Russian-born American psychologist, form the basis for social-ecological health promotion and sports systems motivation models.

In the late 1970's, Bronfenbrenner (1977) designed a four-part model including micro-, meso-, exo- and macro-systems to explain reciprocal causation between lifespan development and the environment. Bronfenbrenner (1977) used four concentric circles to explain the complexity of internal and external factors that led to a simple explanation of a complex issue: lifespan development. Firstly, the most inner concentric circle represents the micro-system which is the physical and social environment in which the person interacts with the immediate environment and family. This circle forms the core of who individuals are and it stands to reason that these most frequent interactions develop inner complexities such as our personality and temperament. Secondly, the meso-system

consists of the interrelationships between two or more microsystems. An example of a meso-system interaction is between peers and cultural groups. Thirdly, the exo-system consists of linkages involving social settings that individuals do not experience daily but still influence lifespan development. An example of exo-system interaction is employment or involvement in a sporting club. Finally, the macro-system is the larger cultural context. A person may not be able to interact individually with the macro-system but decisions made at this level do affect an individual's development. No single person is static in life with all stressors resolved and tensions released. Bronfenbrenner (1977) posed that reciprocal causation meant that a person would be an agent on the external world and in turn the external world would be an agent on the internal person. Nature and nurture are inseparable and in terms of lifespan development and are therefore reciprocal.

In the late 1980's, McLeroy, Bibeau, Steckler, and Glanz (1988) reworked the social ecology framework concepts presented by Bronfenbrenner. McLeroy and colleagues identified interpersonal, intrapersonal, institutional, community and public policy as the necessary five factors or levels of systems that interact with the individual on a psychological and behavioural level. McLeroy and colleagues' modification of Bronfenbrenner's theory allowed for Bronfenbrenner's theory to be used in a health promotion model. McLeroy et al.'s (1988) interpersonal factors closely align with the micro-system and include such factors as knowledge of the individual, personality and developmental history. McLeroy et al. (1988) refers to interpersonal processes that relate to Bronfenbrenner's meso-system where family, workgroup, and friendship networks are accounted for. Institutional factors, community, and public policy all relate to the macro and exo-systems within Bronfenbrenner's social ecology framework. However, McLeroy et al.'s (1988) public policy most likely equates to Bronfenbrenner's construct of the exo-system, as generally public policy is outside of a single person's circle of influence. McLeroy et al. (1988) has been highly influential in shaping the way researchers think about an individual's interaction with health promotion programs. According to Google Scholar (2014), their article has been cited in over 2500 scholarly articles and has shaped many other streams of research in health promotion and health psychology.

In the late 1990's, Sallis, Bauman, and Pratt (1998) produced an influential review of environmental and policy interventions that then informed health promotion. The review developed into a model describing the development of policy and environmental interventions designed to influence population health. The major finding suggested that more research and conceptual models were needed in the health promotion arena. Sallis et al. (1998) also cited the need for a widespread collaborative approach with other researchers in the field.

Another influential proponent of the social ecology framework was Dan Stokols (1992, 1994). Stokols questioned assumptions underlying existing health promotion theory. Firstly, Stokols (1992) tried to explicitly define the dynamic interactions between individuals that affect health promotion. Later, Stokols (1994) further explained the idea of integration between biopsychobehavioural factors and sociophysical environmental factors. He determined that each human context was individual and, as Bronfenbrenner (1977) conceptualised, complex interactions occur between individual humans, other humans, and the environment. Stokols (1994) continued to lay the theoretical foundation and emphasis of the social ecology framework for research including physical activity. His profound impact on health promotion is felt today through the introduction of key health resources and perceived constraints that exist in specific environmental settings.

In summary, the basic principles of Bronfenbrenner (1977) still apply today. That is, nature and nurture are not independent and a dynamic and ever changing relationship occurs on several levels of theoretical conceptualisation in lifespan development. The names of certain factors have been altered in a progressive development of a social ecology framework for use in health promotion and public policy interventions. The remainder of research reviewed in this paper ascribes to the general theoretical underpinning of Bronfenbrenner's social ecology framework. The following section reviews physical activity, health promotion and Seniors' Games events research in relation to perceived constraints.

3. Perceived constraints

Perceived constraints are the limiting factors which prevent someone from participating in physical activity (Cardenas, Henderson, & Wilson, 2009). Barriers can be real or perceived and can impinge on a person's psychological, social and physical state (Booth, Bauman, & Owen, 2002). Those who perceive constraints may still participate in physical activity, however, they may feel some internal or external limitation.

3.1. General perceived constraint studies

Booth, Bauman, Owen, and Gore (1997) conducted an Australian pilot study examining benefits and barriers. Booth et al. (1997) randomly sampled 2,298 adults aged between 18 and 78. Booth and colleagues administered survey research in relation to physical activity preferences, preferred sources of assistance, and perceived barriers to increased activity among physically inactive Australians. The main barriers to undertaking physical activity were insufficient time, lack of motivation and child-care responsibilities. Among the 60–78 years of age cohort, injury and poor health were most frequently cited as barriers to physical activity. The key finding of this study was that health promotion programs with a "one-size-fits-all" approach were likely to miss many people in the process, given the many barriers to physical activity faced by Australian adults.

Dergance et al. (2003) used foundations of the social ecology framework to explore benefits and constraints of leisure time physical activity (LTPA) in the elderly, and cross-cultural differences in these benefits and constraints. The two cohorts examined were Mexican Americans (MA) and European Americans (EA). Dergance et al. (2003) compared LTPA in 210 sedentary and active participants in both cultural groups. In total, 98 MA's (39 female, 24 male) and 112 EAs (29 female, 8 male) participated in the study. The modified version of the *Minnesota Leisure Time Physical Activity Questionnaire* (MLTPA) was used to measure self-reported physical activity barriers to LTPA. Researchers identified barriers in line with attributed cultural expectations and norms. Barriers perceived by sedentary participants included a lack of interest (MA = 19%, EA = 45.9%), lack of self-discipline (MA = 11.1%, EA = 45.9%), self-consciousness (MA = 0%, EA = 18.9%), lack of company (MA = 6.3%, EA = 21.6%), lack of enjoyment (MA = 9.5%, EA = 29.7%) and lack of knowledge (MA = 1.6%, EA = 16.2%). Sedentary Mexican Americans perceived less barriers to physical activity than European Americans.

Similarly, Booth et al. (2002) conducted cross-sectional research with 402 participants (221 females, 181 males) 60 years and older. Instead of using a questionnaire, the seniors were asked an open-ended question about their three main barriers to physical activity in relation to their current physical activity. Booth and colleagues developed the list of barriers as presented by participants to analyse with a physical activity participation measure. The comparison between sedentary and active participants was tenuous with only marginal statistical significance being reported. Lack of time was a frequently reported constraint in active adults (Booth et al., 1997). A consistent finding was that insufficient time was cited less as age increased. Booth et al. (2002) hypothesised that retirement changes lifestyle as age increases and therefore reduces time constraints. Booth et al. (2002) recommends further research into priorities of LTPA as age increases.

In summary, Dergance et al. (2003) and Booth et al. (2002) examined constraints to physical activity within an elderly population and contrasted the factors between sedentary and active seniors. They found that defining, educating and communicating what constitutes physical activity is difficult. Dergance et al. (2003) and Booth et al. (2002) confirmed the initial findings of Booth et al. (1997), that both sedentary and active participants experience perceived constraints in varied ways.

3.2. Recent perceived constraint studies

More Recently, Patel, Schofield, Kolt, and Keogh (2013) studied perceived barriers, benefits and motives for physical activity in two primary-care physical activity programs involving 80 participants (48 females, 32 males) from the "Healthy Steps Study" (Kolt et al., 2009). Participants were 65 years and older. The Healthy Steps Study was a 12-month randomised trial in which participants were assigned

to 1 of 2 intervention programs. The 2 groups had 40 participants in each; 80 participants in total. The two physical activity programs were pedometer-based (where participants accumulated a certain number of steps) and time-based (where participants engaged in physical activity for a set period of time). All 80 participants were included in the self-report questionnaire. Principal-components analysis identified three factors as constraints of physical activity participation. Factor 1 (personal barriers) were related to perceived personal barriers (e.g. "I don't feel motivated"). Factor 1 accounted for 16% of the total variance in physical activity participation. Factor 1 reported a Cronbach's $\alpha = 0.73$. Factor 2 (perceptual barriers) related to perceived barriers of physical activity participation (e.g. "I feel too old to be physically active"). Factor 2 accounted for 16% of the total variance in physical activity participation. Factor 2 reported a Cronbach's $\alpha = 0.53$. Factor 3 (time constraints) related to how much time was needed to act on physical activity engagement (e.g. "I had no time due to family responsibilities"). Factor 3 accounted for 13% of the total variance in physical activity participation. Factor 3 reported a Cronbach's $\alpha = 0.73$. Significant differences for perceived constraints were found in relation to Factor 1 (personal barriers) and the number of chronic health conditions reported and weight status. Compared with normal-weight participants, obese participants perceived more personal barriers for physical activity. Participants with three or more chronic health conditions perceived more personal barriers than those who reported no chronic health conditions. In summary, Patel et al. (2013) was able to identify three factors that explained a combined 45% of the variance in self-reported constraints to participation in physical activity. The above shows statistically significant results that perceived barriers may increase as a function of chronic health conditions and weight status.

Cardenas et al. (2009) specifically targeted perceived benefits and constraints to sports participation in older individuals. Participants were gathered from the 2006 North Carolina Senior Games (NCSG). Thus, the 440 participants were 55 years or older. Near equal numbers of male and female respondents (231 females, 213 males) participated in self-developed benefits and constraints scale. Utilising the conceptual underpinning of a social-ecological framework, they compared three levels of perceived constraints. Cardenas and colleagues concluded that the major constraints to sports participation in an older cohort may be intrapersonal (time, self-consciousness, physical abilities or disabilities), social (companionship and exercise partners) or community (facilities, lack of information). Cardenas et al. (2009) found that constraints yielded a three-factor solution with each constraint moderately correlated with one another. Firstly, community-linked and social influences were significantly correlated ($r = 0.61$); secondly, community-linked were significantly correlated with intrapersonal ($r = 0.56$); and thirdly, social influences were significantly correlated with intrapersonal ($r = 0.69$). Cardenas et al. (2009) found that NCSG participants reported minimal perceived constraints as reported "almost never". Consistent with other research, Cardenas and colleagues did find that self-consciousness, lack of time, companionship and facilities were the major constraints. One important finding was that younger old people (55–64 years) had more community constraints and social constraints than older (65+ years) people. The framework presented by Cardenas and colleagues will provide the basis for the remainder of the constraints literature.

3.2.1. Intrapersonal constraints

The following section will review the literature with regard to intrapersonal constraints. Intrapersonal constraints are typified by an ongoing internal negotiation with one's self (Hinch, Jackson, Hudson, & Walker, 2005). In terms of a leisure behaviour framework, intrapersonal constraints were originally defined by Crawford and Godbey (1987) as individual psychological states and attributes which interact with leisure preferences rather than intervening between preferences and participation. More recently, Godbey, Crawford, and Xiangyou Sharon (2010) assessed their previous definition of intrapersonal constraints as subjective perceptions or assessments of appropriateness and relevance of participation in a given leisure activity by the individual in question. Crawford and Godbey (1987) reiterated the negotiation process that occurs with constraints. Intrapersonal constraints, and all constraints for that matter, are dependent not on the absence of constraints but on the negotiation through them.

Older adults have been the focus of intrapersonal constraint research within the context of participation in LTPA (Carey, 2011). The factors that deal with the individual differences in participation are directly related to perceived intrapersonal constraints. For example, one older athlete may deal with the constraint of lack of time completely differently to another older athlete. The first athlete may make time by getting up earlier to train and cope better with being tired, whereas the second athlete may avoid training and use the lack of time as an excuse not to train.

Intrapersonal constraints can be the most prominent constraint compared to other constraints. The importance of intrapersonal constraints was examined by Giles-Corti and Donovan (2002) in a study of 1,773 healthy workers and homemakers (1,206 females, 564 males) aged 18–59 living in Western Australia. The researchers' aims were two fold. Firstly, to measure individual, social and physical environmental factors of participation in planned recreational physical activity. Secondly, to examine the interaction between environmental and individual factors that influence exercising as recommended. They found that 59% of respondents exercised as recommended. Individual factors were analysed using the Theory of Planned Behaviour (Ajzen, 1991). This model of behaviour includes perceived behavioural control and therefore increases the model's predictive ability. Researchers used a series of logistical regressions to determine that individual factors rather than environmental or physical factors were more influential in determining participation in regular physical activity. In fact, participants who rated in the highest individual factor score category were 8.14 times more likely to exercise as recommended. The individual factor category was two times higher than the equivalent social environmental score and five times higher than the physical environment score. In summary, positive individual factors are the most influential in increasing participation followed by positive social factors.

3.2.2. Social constraints

The following section will review the literature in regards to social constraints. Social constraints are the perceived limitations of social supports with family and friends (Cardenas et al., 2009). The concept of social limitations on physical activity participation is well researched (Dionigi, 2006). Social constraints may take the form of perceived discouragement from friends, lack of time, lack of interest or lack of partners to train with. More recently, Dionigi, Fraser-Thomas, and Logan (2012) identified family support, absence of support, and family conflicts as key social constraints experienced by masters athletes. In this research, masters athletes aged 46–61 ($M = 50$) participated in a semi-structured interview. The sample included 14 married adults from Ontario, Canada. Their research indicates a dichotomous negative or positive relationship with aspects of family life including: spousal support, scheduling, spouse and families training together or separately, and children. Social constraints are not only limited to family commitments and the associated time pressures. Social constraints can also include the pressure from both training friends and non-training friends.

The concept that social factors can either be perceived as constraints or benefits is illustrated by recent qualitative research conducted by Bethancourt, Rosenberg, Beatty, and Arterburn (2014). These researchers conducted focus groups with four participant groups to determine barriers and facilitators of physical activity programs used by older adults. Participants were selected from Group Health Medicare in King County, Washington and were 66–78 years old. At a social level, barriers included the presence of others being perceived as intimidating, yet some participants perceived the presence of others as a facilitator of physical activity. Some participants expressed a fear or lack of discipline to do physical activity (intrapersonal constraint) but were motivated to by having a group with which to be active (social benefit). Conversely unsolicited advice from others could serve as a barrier to participation. Interestingly, lack of guidance was a prominent barrier for many participants. Specifically, participants perceived a barrier of not knowing how much to exert oneself.

In summary, perceived social constraints focuses on the interpersonal interactions that limit participation in sports. Qualitative research has highlighted commonly experienced perceived social constraints in a masters athlete context and physical activity context (Bethancourt et al., 2014; Dionigi et al., 2012).

3.2.3. Community constraints

The following section will review the literature in regards to community constraints. Community constraints are the ongoing negotiations with supportive environments (Sallis et al., 1998). This may include community facilities, information, program time and any consideration that can be changed by community involvement. The focus of most health promotion research has been targeted towards improving existing community structures and removing community constraints to increase participation and commitment to sports (McLeroy et al., 1988; Sallis et al., 1998).

An institutional factor may be related to the location of the fitness centre to the individual. Bethancourt et al. (2014) focus group study identified the proximity of the preferred fitness centre as being a barrier to physical activity. Participants reported the importance of having clean, convenient and close fitness facilities. Similarly, another reported community constraint was participants whose health care cover did not allow them to participate in certain activities such as *Silver Sneakers* or *EnhanceFitness* (two programs designed to enhance fitness for older populations). Furthermore, focus group participants most commonly perceived the weather as an important constraint. Additionally, not having safe, aesthetically pleasing and interesting places to walk with flat, even surfaces and resting spots was a reported barrier. Perceived community constraints are somewhat easier to target in prevention and intervention strategies as they can be meet with tangible results; for example, building new fitness centres, increasing walking tracks and providing better health cover (Sallis et al., 1998). Furthermore, research presented in the intrapersonal constraints section of this review gives a good example of how a community intervention may occur. Giles-Corti and Donovan (2002) found that due to the popularity of walking in the community, it was recommended that the creation of streetscapes would enhance walking for recreation and transport. This recommendation is consistent with social ecology recommendations (Sallis et al., 1998).

4. Perceived benefits

Benefits are the perceived rewards or gains made from participation in physical activity (Dergance et al., 2003). When the reward of perceived benefits outweighs the negotiation of perceived constraints, involvement in physical activity can commence (Cardenas et al., 2009). The following sections will review literature that focuses on perceived benefits and discuss how varied measures for assessing sports participation have been developed.

4.1. Benefits amongst older populations

Not one benefits scale has been used in perceived benefits research of physical activity participation in seniors. Therefore, it is important to consider the reliability implications of developing a new scale for new research and how that impacts convergent evidence. In other words, each piece of literature takes a slightly different approach, yet benefits measures narrow in on the same construct (Kaplan & Saccuzzo, 2010). Thus, emphasis will be placed on the psychometric properties of the following benefits literature and the perceived benefits that result.

In a random sample of 449 (248 females, 201 males) Australian adults aged 60 and older, Booth, Owen, Bauman, Clavisi, and Leslie (2000) assessed self-reported physical activity and a range of social-cognitive and perceived environmental factors. Booth and Colleagues conducted factor loading to determine how two factors were involved in perceived benefits. Based on the Rotated Principal Component Analysis they found health benefits and enjoyment loaded on separate factors. Factor 1 (Health Benefits) were related to health benefits associated with physical activity involvement and reported a Cronbach's $\alpha = 0.74$. Factor 2 (Enjoyment) was defined as the pleasures involved with being active and reported a Cronbach's $\alpha = 0.71$. Factor 1 (Health Benefits) was significantly associated with physical activity participation, with a larger proportion of active people expressing a positive attitude to the health benefits of physical activity than a low or negative attitude to physical activity. Enjoyment showed expected associations with physical activity participation, however this association was not statistically significant. In summary, Booth and colleagues showed that Factor 1 (Health Benefits) was a significant factor in determining whether someone would participate in physical activity.

More recently, Patel et al. (2013) studied perceived barriers, benefits and motives for physical activity in two primary-care physical activity programs involving 80 participants (48 females, 32 males) from the "Healthy Steps Study" (Kolt et al., 2009). Participants were 65 years and older. The Healthy Steps study was a 12-month randomised trial in which participants were assigned to one of two intervention programs. The two groups had 40 participants in each; 80 participants in total. The two physical activity programs were pedometer-based (where participants accumulated a certain number of steps) and time-based (where participants engaged in physical activity for a set period of time). All 80 participants were included in the self-report questionnaire. Factor scores were used to explore differences between groups for perceived barriers, benefits and motives. Principal-components analysis identified two factors for benefits of physical activity participation. Factor 1 (Personal Benefits) was related to perceived personal benefits of physical activity participation and accounted for 32% of the total variance. Factor 1 reported a Cronbach's $\alpha = 0.85$. Factor 2 (Physical Benefits) related to perceived physical benefits of physical activity participation and accounted for 19% of the total variance. Factor 2 reported a Cronbach's $\alpha = 0.70$. Significant differences for perceived benefits as a function of age were discovered. Participants aged 76 years and older perceived more personal benefits (Factor 1) as a result of engaging in physical activity than did participants in the 65–75 year age group. Also older participants (76 years and older) reported more physical benefits (Factor 2) as a result of being physically active than did younger participants (65–75 years old). In summary, Patel et al. (2013) were able to identify two factors that explained a combined 51% of the variance in self-reported benefits to participation in physical activity. Overall findings suggest that perceived benefits may increase as a function of age in both Factor 1 and Factor 2.

The above three studies used different measurement tools to measure the same construct of perceived benefits to older adults being engaged in physical activity. Differences existed in the contexts of each of the studies. Booth et al. (2000) measured participants in a non-competitive LTPA. Cardenas et al. (2009) was interested in a specific competitive event; the NCSG. Patel et al. (2013) measured older participants in an ongoing primary care physical activity program. Benefits were explained and labelled as health benefits, enjoyment (non-significant) (Booth et al., 2000), benefits (Cardenas et al., 2009), personal benefits and physical benefits (Patel et al., 2013). Similar responses for all three contexts converge to provide a consistent level of reliability amongst perceived benefits to participation in physical activity. A large proportion of physically active older adults were able to identify the health benefits and report perceived benefits to participation. Seniors Games participation indicated a high reporting of perceived benefits with some suggested differences between genders. The effect of age is present in Patel and colleagues' study reporting higher levels of benefits in older participants. Perceived benefits have not only been studied amongst older populations but also been studied amongst younger populations in regard to physical activity. The next section will examine literature in an adolescent context.

4.2. Benefits amongst younger populations

Younger populations have been researched to determine perceived benefits in sports participation. King, Vidourek, English, and Merianos (2014) conducted a recent study of college students to examine the perceived benefits, barriers, cues to action, and extent of involvement in Vigorous Physical Activity (VPA). Researchers sampled 480 participants (318 females, 162 males) in a Midwestern American university. A 21-item survey was created to fit the desired model of the health belief model. They used a panel of five experts to establish both face validity and content validity. The survey was determined by the panel to be reliable with test-retest reliability based on Kendall's tau-b Correlation Coefficient. They yielded the following results: perceived benefits, 0.861; perceived barriers, 0.884; and perceived cues, 0.792. Reliability was found to be adequate. Some of the items on perceived benefits section of the survey included: "Improving health", "Improving appearance", "Maintaining a healthy weight" and "Reducing stress". The researchers reported a significant difference in the number of perceived benefits based on gender $p < 0.05$. Males tended to perceive more benefits than females. The researchers suggested that those who vigorously exercise in college were more likely to participate in vigorous exercise throughout their lifespan. King and colleagues identified that perceived benefits of parent and peer encouragement were associated with higher levels

of VPA in the college students. Furthermore, those who had such encouragement perceived significantly more benefits to engaging in physical activity.

Another study of university students examined the potential benefits from physical activity participation. Dhurup (2012) examined 256 South African students (130 female, 126 male) to examine gender differences in benefits of engagement in physical activity. Factor analysis revealed four benefits. Factor 1 (health benefits) reported a Cronbach's α = 0.90. Factor 2 (coping with stress) reported a Cronbach's α = 0.91. Factor 3 (physical appearance) reported a Cronbach's α = 0.84. Factor 4 (stress management) reported a Cronbach's α = 0. The themes outlined by Dhurup are consistent with previous literature, in particular the college research of King et al. (2014) aforementioned. However, unlike King et al. (2014), Dhurup (2012) found no gender effect and cited a small sample size as a limitation of the research.

In summary of the perceived benefits section, research with both older and younger populations has been explored. Firstly, research amongst older adults revealed expected results that physical health benefits were perceived by most physical activity participants (Booth et al., 2000; Cardenas et al., 2009; Patel et al., 2013). Surprisingly, older adults perceived more benefits to participation in physical activity than younger older adults (Patel et al., 2013). As age populations focused on college students a greater emphasis was placed on researchers identifying relevant perceived benefits. Thus, self-esteem, appearance and stress management were identified as important themes (Dhurup, 2012; King et al., 2014). These benefits research studies have occurred in the context of general physical activity, vigorous physical activity and specific event activity. The specific context of cycling research will now become the focus of this literature review in an attempt to converge on the effects of age on perceived benefits and constraints to participation in masters cycling.

5. Cycling specific research

The most current and relevant cycling literature is the implementation strategy recently released by the Australian Bicycling Council (ABC), named the National Cycling Strategy 2011–2016 (NCS) (Australian Bicycle Council, 2014). The following explanation of the NSC (Australian Bicycle Council, 2014) is provided in this literature review to give background and understanding on the state of Australian cycling. It will also demonstrate the social ecology emphasis placed on current research with cycling.

5.1. National cycling strategy

The recent NCS (Australian Bicycle Council, 2014) aims to double the number of people cycling in Australia by 2016. The NCS (Australian Bicycle Council, 2014) proposes six key priorities and objectives: cycling promotion, infrastructure and facilities, integrated planning, safety, monitoring and evaluation, and guidance with best practice. The NCS (Australian Bicycle Council, 2014) aligns well with a social ecology framework and is focused on creating lifelong cyclists in order to combat obesity-related illness.

The NCS (Australian Bicycle Council, 2014) indicates a slight decrease in overall cycling participation from 2013 compared with figures in 2011. However, other research indicates a general increase in competitive cycling (LaChausse, 2006). The NSC (Australian Bicycle Council, 2014) states the obvious benefits of cycling as convenience, safety and efficient transport but the *perception* of these benefits by the general population are the keys to increasing participation. The NCS is supported by theory suggesting changes in environmental contexts to make healthy options the default choice, regardless of education levels, income, service provision or other societal factors (Frieden, 2010).

The NCS (Australian Bicycle Council, 2014) intends to promote cycling in three different areas -promotion of cycling for short trips, promotion of recreational cycling, and encouraging cycling-friendly workplaces. These initiatives have been trialled in a range of states with varied success. From a social ecology perspective, the NCS (Australian Bicycle Council, 2014) is looking to develop a safe, attractive cycling network to key destinations and to provide associated facilities.

The NCS (Australian Bicycle Council, 2014) conceptually aligns with McLeroy et al.'s (1988) institutional, community and public policy factors. These are represented in the NCS (Australian Bicycle Council, 2014) as the integrated planning aspect of governmental policy, infrastructure needs and inter-community club relations. The aim of this approach is to improve efficiency, accessibility and choice as well as promoting healthy living and sustainable communities. Most of the major capital cities have integrated planning for roadways, bike paths and cycling facilities.

The NCS (Australian Bicycle Council, 2014) also targets safety as a major concern and implementation need. According to social ecology research, one perceived interpersonal constraint is fear of injury (Cardenas et al., 2009). The NCS (Australian Bicycle Council, 2014) has identified that cyclists are "vulnerable road users". According to the Australian Automobile Association (Australian Automobile Association, 2012) 50 cyclists died on Australian roads in 2013, accounting for four percent of total road fatalities. Aggregate annual numbers exceeding 50 have not been experienced since 1997. The NCS (Australian Bicycle Council, 2014) aims to provide an environment that "feels" safe to ride in. This notion of "feeling" safe is confirmatory to the *perception* of interpersonal constraints. In summary, the NCS (Australian Bicycle Council, 2014) is a document and implementation strategy that confirms the importance of research, prevention and intervention from an ecology framework in a cycling specific context.

5.2. Further trends to participation in Australian cycling

Prior to the NCS (Australian Bicycle Council, 2014) being released, Titze et al. (2014) explored the trends for recreational cycling amongst Australian adults. In a cross sectional population survey, data from the Exercise, Recreational and Sports Survey (ERASS) for 2001–2009 were analysed. Over 13,000 Australia adults, (15 years of age +) were interviewed each year across all years. The researchers categorised cyclists into three groups based on their average cycling per week. The activity level groups were grounded in recommendations from the Physical Activity Guidelines for Americans (2008) and included achieving >150 min, >300 min, and five sessions of 30 min of cycling per week. Cycling prevalence was reported at 10%. Titze et al. (2014) also explored age differences in cycling habits. Whilst cycling participation decreased amongst 15–34 years, prevalence increased in all activity levels in all age groups 35 and over. Employed middle-aged men with tertiary education were reported as having the highest prevalence of recreational cycling. Only a third of cyclists met the physical activity guidelines of 150 min/week and even fewer met the guidelines for 300 min/week or five sessions of 30 min/week. Non-organised riding was by far the most popular amongst cyclists, with low percentages (1%) of cyclists participating in organised only events. Titze et al. (2014) aligned with the findings of the NCS (Australian Bicycle Council, 2014) and recommended the improvement of cycling environments, integration and communication about best practice across jurisdictions. Titze and colleagues recommended the removal of community constraints. In summary, Australian cycling trends highlight the need for future research and implementation processes to increase participation in cycling, as cycling is a plausible way to meet health-enhancing physical activity.

5.3. Constraints to participation in cycling

Constraints to involvement in cycling have received limited attention in current social ecology research. The following section will present what limited current literature is available in relation to constraints to participation in cycling. In a Commonwealth government-commissioned report, Bauman et al. (2008) identified cycling-specific constraints for Australians. The constraints that were identified included: individual factors, social and cultural factors, built environment factors, safety factors and policy and regulation factors. These factors correlate closely with the social ecology framework. However, as indicated by the NCS (Australian Bicycle Council, 2014), cyclists may be unique due to the lack of safe places to ride. This is in contrast to runners who have paths more suited to running. Early social ecology reports such as McLeroy et al. (1988) and Sallis et al. (1998) failed to mention constraints that are social and specific to cyclists. Nevertheless, Bauman et al. (2008) gives the example that cyclists in lower socio-economic areas had reduced access to supportive environments for physical activity. Cyclists may also perceive particular intrapersonal constraints due to the most regular times for training being in the early morning when fewer cars are on

the road and work and family commitments are reduced. Bauman et al. (2008) did not conduct research into constraints in this instance but compiled a report based on existing research making recommendations for the Commonwealth government.

5.4. Benefits to participation in cycling

Benefits in leisure time activity, masters sport participation and vigorous physical activity have been well documented (Booth et al., 2000; Cardenas et al., 2009; King et al., 2014; Patel et al., 2013) and previously reported in this literature review. However, there may also be unique benefits specifically for cyclists. A potential cycling-specific benefit may be to 'meet more people' because of the social nature of cycling and the typical lower heart rate of cyclists compared with runners (Reaburn, 2009). The following section will examine two cycling specific research papers that highlight these unique properties and explore the potential to enhance benefits for cyclists to increase participation in cycling.

Motivations to participation in cycling have been researched through a competitive and non-competitive perspective. LaChausse (2006) conducted a study focusing on the motivational differences between competitive and non-competitive cyclists. A large sample of 1,239 cyclists (295 females, 944 males) living in the United States completed a modified online version of the *Motivation of Marathoners Scale* (MOMS). The instrument is a 56-item tool divided into nine variables under four broad categories. The MOMS measures psychological motives, physical motives, social motives and achievement motives. Generally, cyclists reported goal achievement and health concerns as the major reasons for cycling. Male cyclists were also more likely to prefer competition, with non-competitive cyclists more likely to cycle due to weight concerns and affiliation motives. LaChausse (2006) cannot be categorised as strictly social ecology research. However, this research gives an indication of the motives and perceived benefits experienced by cyclists. LaChausse (2006) is frequently cited in Brown, O'Connor, and Barkatsas (2009) and provides a sound basis for Brown and colleagues to develop a cycling specific motivation tool.

According to Brown et al. (2009) cyclists do possess unique motivational attributes. Five hundred and twenty-two "serious leisure" cyclists (51 females, 371 males) completed a 51-item survey. All participants were registered with a state competitive cycling body. Brown et al. (2009) utilised social ecology theory to construct a cyclist motivation instrument (CMI). Their intention was to investigate key cycling-specific motivational attributes and pilot the CMI with "serious leisure" cyclists.

The development of this new scale included five principal component loadings with Varimax rotation. These factors were: Factor 1 (social), Factor 2 (embodiment), Factor 3 (self-presentation), Factor 4 (exploring environments) and Factor 5 (physical health outcomes). The factor categorisations do not contradict earlier studies examining both competitive and non-competitive cyclists but added to the unique properties experienced by cyclists (LaChausse, 2006). Psychometric properties were excellent with reliability was recorded at Cronbach's $\alpha = 0.92$. Four out of the five sub-scales demonstrating moderate–to-high reliability. Factor 1 (social) focused on key items such as social activity, spending time with other cyclists with similar interests, wearing identifying cycling clothes. LaChausse (2006) and Brown et al. (2009) agree that "serious leisure" cycling is an individual and team sport by riding solo or in groups, adding to the associated social factors. Factor 2 (embodiment) is a physical and psychological sense of being. Brown et al. argues that this catharsis associated with cycling is like no other sport and specific to cycling. Factor 3 (self-presentation) conceptually identifies with the idea that cyclists can omit aspects of one's self in order to optimise a favourable social impression. In terms of cyclists this may result in being competitive and competition, use of technology and positively enjoying the notion that others think they are cyclists. Factor 4 (exploring the environment) identifies outdoor environments and mobility are factors associated with cycling. Finally, Factor 5 (physical health outcomes) includes items such as: weight control and eating, staying free from injury and disease and preventing certain types of injuries.

The CMI is an important instrument combining the knowledge and findings of a number of previous research studies to produce a reliable and valid cycling-specific benefits motivation scale. The

exploratory and developmental nature of the instrument attempted to explain motivational variance between sub-groups of cyclists. The five-factor solution explained 47.2% of variance in motivation with the social factor explaining the greatest amount of variance in their sample. In summary, both LaChausse (2006) and Brown et al. (2009) have increased the awareness of cycling-specific perceived benefits to participation. A lack of research is obvious in identifying and developing cycling specific tools that explain perceived benefits and constraints in cyclists. The remainder of this literature review will focus on general masters-sports participation and age effect and gender effects associated with participation.

6. Masters sport participation

There has been a significant increase in the number of older athletes competing at high performance levels in individual and multisport events designed for masters athletes in the last 20 years (Baker, Horton, & Weir, 2009). This is evident from the increase in participants in the World Masters Games held every four years since the inception of these games in Toronto, Canada in 1985. In 2009, in Sydney Australia, there was an almost fourfold increase in the number of participants compared with the original games (Heazlewood et al., 2011). The recent 2013 World Masters Games held in Torino, Italy, had more participants, more countries represented and an increase in the number of events offered, compared with the previous event (Dionigi et al., 2013).

6.1. Effect of age on participation in masters athletes

This section of the literature review will examine the effect of age on participation in masters athletes. Medic et al. (2011) studied participation-related age effects in masters swimming in a six-year longitudinal analysis. They found that younger cohorts of masters athletes participated more frequently and achieved higher performances than older cohorts of masters athletes. Using archived data from the 2003 to 2009 US Masters Short Course National Championships, swimmers' attendance was analysed over a period of six years in the retrospective study. The results showed that the likelihood of participating in that particular event decreased as individual's age relative to their peers in the same category increased. The results also showed that the probability of a masters swimmer participating in the championship during the first year of any five-year age category was higher than the probability of that athlete participating in the championship during any other year in that same age group. These findings are similar to other master athlete research that has examined the effect of age in masters sport (Medic, Starkes, Weir, & Young, 2007; Medic, Starkes, & Young, 2007). The results of this study confirms that masters swimmers tend to attend competitions most often when they are relatively young and least often when they are relatively oldest compared to their peers within the same age group cohort.

Carey (2011) completed one of the few studies examining lifespan development in relation to masters athletes and perceived constraints. The cohort consisted of 180 participants (99 female, 81 male) all aged 45 and older. The cohort was divided into three age groups (45–54, 55–64 and 65–74) who varied in their physical activity levels from sedentary to very active. Carey (2011) used a number of measures including the *Godin Leisure Time Exercise Questionnaire* (GLTEQ) taken from Godin and Shephard (1985) and the *Open-ended Barrier Questionnaire* modelled after Gyurcsik, Spink, Bray, Chad, and Kwan (2006). Both instruments were reported as having high inter-rater reliability through correlation between coders. Carey (2011) reported that younger adults (45–54 years) had more barriers than the middle-aged and older adults, suggesting that younger adults are more busy at this life-stage (i.e. working and taking care of children), whereas older adults may be retired and their children no longer living at home. Carey (2011) also examined the interaction between the age and level of physical activity and observed that an inactive younger population may be experiencing specific difficulties with barriers and specific intervention efforts may need to be made to increasing physical activity levels within this younger age group.

In summary, Medic et al. (2011) studied the effect of age in performing masters athletes. Carey (2011) studied the effect of age with varied levels of physical activity. Medic et al. (2011) found that, in general, participation decreased as age increased. On the other hand, Carey (2011) found the

opposite; that as age increased, physical participation activity levels increased, with a higher level of perceived constraints experienced by younger adults. Another area related to differences in master athlete participation is gender differences.

6.2. Gender differences in participation in masters athletes

Gender differences may be seen in the way individuals negotiate perceived constraints and encourage perceived benefits to engage in masters sport. Dionigi (2010) recognised the potential for gender differences in masters sport participation. She included cyclists in a qualitative study of personal and cultural meanings for 70 older sportswomen who competed in the 2001 Australian Masters Games and 23 who competed in the 2009 World Masters Games in Sydney. The analyses of in-depth interviews and observations from the two sets of data demonstrated that these older female athletes resisted traditional stereotypes of ageing and gender and experienced a sense of personal empowerment through involvement in masters sport. Qualitative findings such as Dioinigi's have resulted in a recent report released by the Confederation of Australian Sport (Confederation of Australian Sport, 2013) that highlights the importance of retaining the membership of women in sport.

The Confederation of Australian Sport (2013) reported that flexibility in work and home commitments is central to a successful sport retention strategy. Social support and networks to share child minding were considerations, while environmental factors such as additional facilities and services being provided were important. For 85% of the respondents to the Confederation of Australian Sport (2013) survey women's participation in sport is for physical factors including fitness and feeling healthy. For 71% of respondents, sports also give a sense of achievement, and being part of a team with sports clubs makes it easier to get together with friends. These findings are consistent with the social ecology framework.

The Confederation of Australian Sport (2013) report recommends six social ecology changes that would increase participation for women. First, the provision of child care facilities. Second, increasing affordability by reducing costs of participation in sporting competition and events. Third, scheduling of sporting competitions to align with important timing such as school terms. Fourth, access and availability of local sporting facilities. Fifth, access and availability of sporting officials. Finally, promotion of local sporting opportunities including improving advertising and promotion.

A number of other studies also describe gender as a variant in masters sports participation (Medic, Young, Starkes, & Weir, 2012; Wigglesworth, Young, Medic, & Grove, 2012). For example, Medic et al. (2012) surveyed 71 elite masters athletes at the Canadian and USA Masters Track and Field Competition. Medic et al. (2012) used the *Sports Motivation Scale* (Pelletier et al., 2013) and the *Task and Ego Orientation Sports Questionnaire* (Duda, 1989). Females who had a coach reported the highest levels of intrinsic motivation to accomplish goals. Females without a coach had the highest levels of amotivation. Both male and female master athletes who did not train with a coach had higher ego orientation than those who had a coach.

Wigglesworth et al. (2012) also studied gender effects and differences in the level of sports commitment in masters athletes. Although this study was not strictly examined through a social ecology framework, it highlights gender differences in motivations in masters athletes. Based on questionnaire data from male and female competitive masters swimmers, males reported significantly higher obligatory commitment, involvement alternatives, personal investment and social constraint levels. Enjoyment predicted both male and female functional commitment, yet personal investments uniquely predicted female functional commitment. These findings provide evidence that sports commitment and determinants may be affected by gender.

In summary, gender differences in participation and motivation are supported by literature. Specifically, the Confederation of Australian Sport (2013) reports fundamental Australian specific women's sport participation strategies from a social ecology framework. This report highlights the

perceived benefits and constraints that women face when engaging in physical activity. Other motivational literature (Medic et al., 2012; Wigglesworth et al., 2012) identifies that gender differences on motivation to achieve or participate may be present.

7. Conclusion

Masters cyclists have to negotiate many perceived constraints and encourage perceived benefits to maintain participation in their chosen sport. Research consistently supports physiological changes do occur as cyclists age (Oja et al., 2011). These physiological changes may also be accompanied by physical and social changes (Medic, Starkes, Weir, et al., 2007).

Theories developed from the lifespan model such as a social ecology framework have been used in previous studies related to LTPA, vigorous physical activity and health promotion (Cardenas et al., 2009; McLeroy et al., 1988; Sallis et al., 1998). A social ecology model explains human development as internal and external agents working via reciprocal causation (Bronfenbrenner, 1977). Studies in health promotion and systemic change have shown encouraging perceived benefits and negotiating perceived constraints may lead to increasing participation or cessation of an unwanted behaviour (Dergance et al., 2003).

Perceived constraints and benefits to sports participation in older adults are the measures that have been studied in social ecology research (Cardenas et al., 2009). Constraints have been described by social ecology theorists in a number of factors including perceived intrapersonal, interpersonal and social constraints (Cardenas et al., 2009; Dergance et al., 2003 McLeroy et al., 1988; Sallis et al., 1998; Sallis, Owen, & Fisher, 2008; Stokols, 1992, 1994). Dionigi et al. (2012) theorises that perceived constraints do not equate with complete withdrawal or stoppage in participating in sports, but that constraints are able to be negotiated through.

Research suggests that perceived benefits are explained by one factor encompassing physical and psychological benefits called “benefits” (Booth et al., 2000; Cardenas et al., 2009; Patel et al., 2013). However, Brown et al.’s (2009) cycling-specific research on the development of the CMI divides perceived benefits into a larger number of factors that include social, embodiment, self-presentation, exploring environments and physical health outcomes.

The NCS (Australian Bicycle Council, 2014) is a recent document released by the Australian Bicycling Council with the goal to increase participation in organised and non-organised cycling. Both the NCS (Australian Bicycle Council, 2014) and research recently published by Titze et al. (2014) highlight the importance of encouraging older and younger individuals into cycling. As participation in masters sport increases it is important to identify and remove the perceived constraints to participation by older adults. Moreover, it is also important to identify and promote the benefit of engaging in masters sport including cycling.

8. Limitations and future research

The reviewed research literature contains limitations and opportunities to explore future research areas. The major limitation in social ecology research is the inherent nature of reciprocal causation. Researchers are unable to infer causality because they are limited to date using cross-sectional data. Another limitation is that the available research literature is based on self-report data from surveys, focus groups and interviews. Ideal research methods would involve a double-blind treatment experimentation.

Another important limitation is the relative lack of qualitative studies comparing the effects of age amongst specific cohorts including masters cyclists. For example, Cardenas et al. (2009) focused on masters athletes as a group and their collective perceived benefits and constraints. Future research could examine the effects of age on these perceived benefits and constraints. This suggestion is reinforced by Carey (2011) who observed significant differences of the effect of age on participation between younger adults (45–54 years), middle aged adults (55–64 years) and older adults

(65–74 years). Carey (2011) also observed significant differences in participation within the same age groups as well as significant interactions between age and physical activity levels. This research is particularly interesting as it provides a platform to expand the existing body of research to older populations such as masters athletes. However, to date, there is a paucity of research literature examining the effect of age to participation masters cyclists using social ecology research.

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