

Asthma prevalence and control levels among Special Olympics athletes, and asthma-related knowledge of their coaches

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Abstract

Background The prevalence of asthma among athletes with intellectual disabilities, and the asthma knowledge levels of their coaches, is unknown.

Methods Special Olympics Canada athletes completed a demographic questionnaire ($n = 208$). Athletes who identified as having *ever* or *current* asthma completed the Asthma Control Questionnaire and the Mini Asthma Quality of Life Questionnaire and were measured for height, weight and lung function ($n = 73$). National level coaches ($n = 27$) completed a questionnaire pertaining to asthma knowledge.

Results The prevalence of *ever* and *current* asthma were 35.5% ($n = 73$) and 21.1% ($n = 44$), respectively. Athletes with asthma reported that they had inadequately controlled asthma, but good quality of life. Coaches correctly answered 43% true/false questions on the survey, indicating suboptimal asthma knowledge.

Conclusions Athletes with intellectual disabilities appear to have a greater prevalence of asthma than the general population; however, coaches of these athletes appear to have limited knowledge pertaining to asthma and exercise-induced asthma.

Keywords asthma, intellectual disability, physical activity, Special Olympics

Background

Evidence indicates that individuals with intellectual disabilities (ID) experience significant health disparities over their lifespan (Cooper *et al.*, 2015; Krahn *et al.* 2006; Lunskey *et al.* 2013). In addition to having an increased risk of chronic conditions such as asthma, individuals with ID also participate in less physical activity and have lower levels of overall physical fitness, which contributes to poor disease control (Pitetti *et al.* 1993; Stanish *et al.* 2006; Temple *et al.* 2006). Understanding the factors that promote and inhibit regular participation in physical activity and exercise among this population is critical to ongoing health promotion initiatives, particularly among those with chronic comorbidities such as asthma.

Asthma is a respiratory condition that is characterised by chronic airway inflammation and acute airway constriction (Global Initiative for Asthma 2015); it affects approximately 8% of Canadian adults (Statistics Canada 2014). Among adults with ID, research suggests that the prevalence of asthma is between 12% and 18%, which is significantly higher than the prevalence observed in the general population (Gale *et al.* 2009; Lunskey *et al.* 2013). Importantly, according to a large case-controlled community-based study, having a learning difficulty was associated with a threefold higher risk of death related to asthma after adjusting for known risk factors (OR: 3.07, CI: 95%) (Sturdy *et al.* 2002). The

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study authors were not clear on how learning difficulty is defined but considered their health problems comparable to those with ID. The reasons for this increased risk are unclear; however, it is possible that compared to the general population, individuals with ID have worse asthma control, reduced access to asthma education and additional challenges within primary health care settings (Gale *et al.* 2009; Sullivan *et al.* 2011; Lunskey *et al.* 2013). Proper medication use and adherence may also play a role in this increased risk. In fact, research indicates that adults with ID with asthma may not be using their inhalers properly (Davis *et al.* 2015). This is further compounded by research that indicates that individuals with and without ID have difficulties with inhaler devices, a dislike of medications, fear about side effects and poor supervision and/or training or follow up with medication (Bender & Bender 2005; Wells *et al.* 2008; Global Initiative for Asthma 2015; Davis *et al.* 2016). Proper use of medication is essential for management of symptoms and for prevention of exercise-induced asthma (EIA) symptoms such as coughing, wheezing and shortness of breath.

When exercise is responsible for induced airway constriction, it is referred to as EIA; this affects up to 90% of those with asthma (Weiler *et al.* 2007). However, some athletes only experience EIA and are otherwise asthma free. According to studies on elite athletes, the prevalence of EIA ranges from 4% to 60%, depending on the sport (Wilber *et al.* 2000; Kippelen *et al.* 2012). This is not surprising given that during training, athletes are exposed to cold-dry and/or noxious environments that affect airway health (Anderson & Daviskas 2000). The prevalence of asthma or EIA among athletes with ID is unknown.

Given the higher prevalence of asthma and issues pertaining to medication use among those with ID, coaches of athletes with ID and asthma may need to assist with education and appropriate use of inhalers in order to prevent unnecessary EIA episodes. However, it is not known if coaches have the confidence or knowledge to adequately assist these athletes. There is a dearth of evidence available on asthma rates among athletes with ID and on the knowledge level of the coaches who work with these athletes with asthma. Given that regular exercise is associated with better disease control, quality of life (Dogra *et al.* 2011) and general health (Penedo & Dahn 2005) among those with asthma, this

information is essential for ensuring the safety of athletes, as well as to ensure athletes are able to enjoy their sport and perform optimally. The primary purpose of this study was to estimate the prevalence of asthma among athletes with ID and to describe asthma control levels among those athletes with asthma. A secondary purpose of this study was to better understand asthma knowledge and knowledge of EIA related symptoms among coaches working with athletes with asthma and ID. We hypothesised that the prevalence of asthma within this convenience sample of Canadian Special Olympics (SO) athletes would be similar to that observed among non-athletes with ID based on training volumes and intensities and that asthma control levels would be suboptimal based on medication use data (medication use data was not assessed due to insufficient data from the survey, described hereafter).

Methods

Study design and participants

A cross-sectional study design was used. Participants were SO athletes and coaches. SO is an international sport organisation for people with ID that organises sporting events at both the recreational and competitive level around the world (Special Olympics Canada 2007, Special Olympics International, 2012). The majority of data was collected during the National Team SO Training Camp. Additional data were collected during regional meets.

The athletes were involved in competitive events and recruited from national and provincial teams; the coaches were involved with SO athletes on the national team. There were no other inclusion or exclusion criteria. All participants provided informed consent and all procedures were approved by the Research Ethics Board of the University of Ontario Institute of Technology.

Athlete procedures

All athletes completed a demographic questionnaire. Prevalence of a previous diagnosis of asthma was determined by whether participants answered 'yes' to the following question: 'Have you *ever* been told by a doctor or health professional that you have asthma or exercise induced asthma?' Prevalence of current asthma was determined by whether participants

answered 'yes' to the following question: 'Do you currently have asthma or exercise induced asthma?' All athletes were asked if they experienced EIA related symptoms following exercise such as, coughing, wheezing or shortness of breath. Those who reported three or more symptoms after exercise were included in the ever asthma group ($n = 13$), no participants reported two symptoms and some reported only one symptom ($n = 6$). The last group was not included in the asthma group as there was not enough evidence to suggest that the individual had asthma or EIA.

There are currently no valid or reliable scales to determine asthma control or asthma quality of life among adults with ID. Athletes in the present study who reported *ever* asthma completed two additional questionnaires, which have been shown to be valid and reliable among adults with asthma: the *Asthma Control Questionnaire* (ACQ) and the *Mini Asthma Quality of Life Questionnaire* (AQLQ) (Juniper *et al.* 1999a; Juniper *et al.* 1999b). The ACQ is composed of six questions and spirometry measures. It is scored on a 7-point scale ranging from 0 (*totally controlled*) to 6 (*extremely poorly controlled*). It can also be scored without spirometry by using the mean score of questions 1–6. The ACQ has been shown to be a valid and reliable tool for assessing asthma control among adults (reliability intraclass correlation coefficient = 0.90). The mini-AQLQ uses an inverted 7-point scale where 1 indicates the greatest severity. The mini-AQLQ has also been shown to be valid and reliable tools for assessing quality of life among adults with asthma (reliability intraclass correlation coefficient = 0.83) (Juniper *et al.* 1999a; Juniper *et al.* 1999b). Athletes with difficulty reading and writing completed the questionnaires with assistance from the researchers and/or caregivers (primarily coaches) providing verbal answers when appropriate.

Athletes with *ever* asthma were also measured for *height* and *weight* using a standardised medical scale (Detecto, Webb City MO, USA) used to calculate body mass index (BMI) and were asked to complete spirometry measures using a handheld spirometer (Vitalgraph, United Kingdom) in accordance with the American Thoracic Guidelines (Parsons *et al.* 2012). Participants were given verbal instructions for spirometry and were provided with a visual demonstration of the proper manoeuvre by researchers. Additional visual demonstrations were provided on an as-needed basis for those participants

requiring additional assistance. The best trial for *forced expiratory volume in 1 s* (FEV_1) and *forced vital capacity* (FVC) was used for analysis.

Coach procedures

Coaches completed a questionnaire anonymously. The questionnaire for coaches was created by the researchers as no validated questionnaires exist to assess asthma knowledge levels of coaches on concepts such as asthma/EIA related confidence, asthma/EIA training and preparedness for asthma/EIA exacerbations. The questionnaire included 11 true/false questions to test knowledge pertaining to symptoms and triggers of asthma, as well as steps that could be taken to prevent EIA, and seven yes or no questions dealing with confidence, training and preparedness surrounding EIA.

Statistical analysis

Data collected on athletes without asthma were used to determine prevalence of asthma. Data are presented as means, standard deviations and percentages of the sample.

Results

Athlete results

The average age of the total sample was 43 ± 9.8 years (18–65 years, $n = 208$). Additional sample characteristics are presented in Table 1.

Self-reported *ever* asthma was reported in 35.5% ($n = 73$) of the total sample ($n = 208$), while self-reported *current* asthma was reported in 21.1% ($n = 44$) of the total sample ($n = 208$). The average BMI among those with asthma was 27.7 ± 6.6 kg/m². Among those with *ever* asthma, 52% ($n = 38$) reported current use of asthma medications, while 17% were not using medication, and the remaining 31% did not know or did not respond. The most common symptoms experienced by athletes with *ever* asthma during and/or after exercise were coughing (21%), sore throat (18%), wheezing (17%) and chest tightness (17%).

The average FEV_1 for those with *ever* asthma was 2.9 ± 0.6 L for male athletes and 2.3 ± 1.1 L for female athletes, corresponding to 59.5% and 62.7% of predicted values for male and female participants,

Table 1 Participant characteristics

Participant characteristics	No asthma (<i>n</i> = 164)	Current asthma (<i>n</i> = 44)
Male/female	127/37	35/9
Age in years ($\bar{x} \pm SD$)	31.3 $\pm$ 10.5	31.5 $\pm$ 9.6
Years playing with Special Olympics ($\bar{x} \pm SD$)	9.4 $\pm$ 6.7	9.2 $\pm$ 8.5
Types of sport (%)		
Indoor aerobic	100.0	100.0
Summer outdoor	35.3	9.0
Cold indoor aerobic	6.8	9.0
Indoor resistance	4.2	2.2
training		
Swimming	13.4	9.0
Winter aerobic	23.7	15.9

Indoor aerobic: floor hockey and basketball; summer outdoor: track and field, tennis, bocci ball, soccer, baseball, and golf; cold indoor aerobic: hockey and skating; indoor resistance training: gymnastics and power lifting; winter aerobic: skiing and snowshoeing.

respectively. The average FVC was 3.7 ± 0.8 L for male athletes and 2.9 ± 1.0 L for female athletes, corresponding to 68.9% and 68.8% of predicted values for males and females participants, respectively.

The ACQ score with spirometry was 5.0 ± 0.3 , and the score without spirometry was 3.6 ± 0.2 indicating inadequately controlled asthma. The average overall score for the mini-AQLQ was 5.7 ± 0.6 indicating good asthma related quality of life. The average scores for each of the four domains within the mini-AQLQ were as follows: *symptoms* 5.6 ± 0.4 , *activity limitation* 6.2 ± 0.4 , *emotional function* 5.9 ± 0.2 and *environmental stimuli* 5.1 ± 0.9 . According to the mini-AQLQ results, the factor contributing to the greatest severity of asthma related quality of life was exposure to cigarette smoke.

Coach results

The coaches identified 43% of the true/false statement correctly. Responses to the true/false statements are displayed in Table 2a, and yes/no questions are displayed in Table 2b.

When asked to list symptoms of an asthma exacerbation, 23/27 coaches listed at least one symptom. All symptoms listed were correct. The most common symptom listed was shortness of

breath (18/23), followed by wheezing (10/23) and chest tightness (4/23). When asked to list triggers of an asthma exacerbation, 24/27 coaches listed at least one trigger, and these were accurate. The most common trigger reported was exercise (18/24) followed by environmental conditions (11/24) and stress/anxiety (5/24). Additional triggers reported included smoking, sickness, food allergy and scents.

Discussion

The researchers sought to describe the prevalence of asthma in a sample of competitive athletes with ID and to describe asthma knowledge levels of coaches working with these athletes. The primary finding of this study is that Canadian SO athletes with ID have a greater prevalence of asthma than the general population and that their asthma control levels are suboptimal. A secondary finding is that coaches of athletes with ID appear to have limited knowledge of asthma and EIA related symptoms. These findings are the first to describe asthma among SO athletes, and asthma knowledge levels among their coaches.

The greater prevalence of asthma observed among SO athletes is in line with previous research on athletes (Kippelen *et al.* 2012). Athletes in the present study reported involvement in a variety of sports conducted in a variety of indoor and outdoor environments, thus exposing them to cold-dry, chlorinated, polluted and/or allergen containing environments. Exercise training in such environments increases the risk of developing asthma and EIA (Anderson & Daviskas 2000). The high prevalence observed in these athletes is also consistent with research from non-athletes with ID where the prevalence of asthma is higher compared to the general population (Cooper *et al.* 2015). The prevalence rate of ever asthma reported in the current study was 35.5%, much higher than the rate of current asthma of 21%. This discrepancy may be attributed to 'asthma remission' where individuals (predominately children) 'grow out' of asthma, that is, are well controlled and therefore do not require medical intervention. Epidemiological evidence has suggested that approximately two thirds of children diagnosed with asthma undergo such remission. The potential for remission is closely linked to the severity of the underlying disease, exposure to environmental

Table 2 Coach knowledge data

a. Responses to true or false statements (n = 27)		
Statement	% coaches with correct response	Correct responses
Exercise is a trigger for asthma.	96.2	True
Exercise-induced asthma is more likely to occur <i>during</i> exercise than <i>after</i> exercise.	48.1	False
Exercise-induced asthma is more likely to occur in a <i>cold dry</i> environment compared to a <i>warm humid</i> environment.	59.2	True
For up to a few hours after an asthma attack, an athlete <i>will not</i> experience another asthma attack.	0.0	True
Asthma and asthma medications <i>damage</i> the heart.	25.9	False
Antibiotics are an important part of treatment for most individuals with asthma.	40.7	False
Individuals with asthma become addicted to their asthma drugs.	18.5	False
Swimming is the only suitable exercise for asthmatics.	3.7	False
With appropriate treatment, most athletes with asthma should lead a normal life with no restrictions in activity.	100.0	True
Asthma is usually more of a problem at <i>night</i> than during the <i>day</i> .	18.5	False
Athletes with frequent asthma should have preventive drugs.	66.6	True
b. Coaches response to yes or no questions (n = 27)		
Question	% of coaches who responded yes	
Do any of your athletes have asthma?	55.5	
Do you feel confident that you can handle an asthma attack if your athlete had one while playing their sport?	51.8	
Do you know the difference between short-acting and long-acting asthma inhalers?	44.4	
Do you know what you can do to prevent an exercise-induced asthma attack?	44.4	
Have you received any training to prepare you for working with athletes with asthma?	33.3	
Do you have an emergency plan for an athlete that has a serious attack?	18.5	
Would you be interested in attending a workshop that focused on asthma in athletes?	75.0	

pollutants and familial factors (Jonsson & Boe 1992; Oswald *et al.* 1994; Burgess *et al.* 2011).

The higher prevalence of current asthma found within this sample of Canadian SO athletes warrants further investigation. It is possible that there is an additive effect of being an athlete with an ID; this should specifically be addressed in a follow up study. It is also possible that BMI contributed to the higher prevalence observed. Gale *et al.* (2009) found an overall asthma rate of 12% but noted that asthma rates were higher among participants with ID who were

obese. In the present study, athletes with asthma had an average BMI that fell into the overweight category. This may serve to further explain the higher prevalence rate of asthma reported.

Our spirometry data indicate moderate airway obstruction, defined as $\leq 70\%$ FEV₁% predicted (Pellegrino *et al.* 2005). It is possible that this reflects poorly controlled asthma; however, the low numbers may also be due to difficulties experienced with assessing lung function in this population. When conducting spirometry with the athletes, there were

difficulties with communication and comprehension. Athletes were unable to perform repeatable measures according to American Thoracic Society (ATS) guidelines despite performing several trials. To our knowledge, no research exists on the feasibility of assessing spirometry in this population; however, based on our experience, assessing lung function in accordance with current guidelines may not be feasible. Therefore, alternate guidelines and/or instructions for spirometry may need to be developed to accurately assess lung function among adults with ID. For example, research has shown that assessing lung function using the interrupter technique is a feasible and reliable method of assessing lung function among adults with ID aged 50 years and older; however, the majority of asthma diagnoses are made based on self-reported symptoms, which may lead to an over treatment due to lack of objective monitoring of airway function (Pouls *et al.* 2009). SO International conducts Healthy Athlete screenings at local, national and international events (Special Olympics International, 2012); it is recommended that after instructions for spirometry in this population are created and tested, that spirometry is to be added to the Healthy Athlete protocols for better tracking, management and health promotion activities related to asthma in this population.

The moderate severity of obstruction observed in the present study may be a contributing factor to the suboptimal asthma control reported as per the ACQ. Suboptimal asthma control levels may also be a result of poor self-management of asthma among this population. Research has reported various barriers to proper self-management among adults with ID in areas of managing attacks, adherence, knowledge of side effects and sources of information on correct use of inhalers (Davis *et al.* 2016). Therefore, efforts should be made to better educate adults with ID and asthma. For example, implementing asthma related workshops within this population may provide additional information surrounding the condition and provide additional training on managing triggers and correct use of inhalers. Ultimately, this type of asthma related training may serve to better equip adults with ID and asthma in managing their condition and thus improve their asthma control.

The suboptimal knowledge levels and preparedness of coaches observed in our study were not surprising, as few coaches reported having received training on

EIA. In a 7-year longitudinal study, 61 asthma associated deaths occurred during or following exercise or physical activity among competitive and recreational athletes, many of whom were only reported to have mild asthma. These deaths were preventable as EIA can be effectively prevented and/or reversed using appropriate and timely medical intervention (Becker *et al.* 2003). Given the higher prevalence of EIA among athletes with ID, asthma education of all coaches, and particularly in this case SO coaches, is essential to ensure the safety of athletes and to ensure ongoing participation in sport and physical activity.

Strengths of this study include the sample size and the use of objectively measured lung function (spirometry), despite experiencing difficulties with instruction. The difficulties experienced with collecting spirometry among this population illustrate the need for more appropriate methods of collecting objective lung function data among this population. Furthermore, due to the inaccurate data obtained from spirometry, we are unable to comment on asthma severity. A weakness of the study is that the questionnaires used were not pretested in the target population and have not been validated for adults with ID and that we were unable to obtain three repeatable measures of FEV₁ and FVC on any of the athletes with asthma. Additionally, questionnaires were based on self-report data; thus increasing the risk of misclassification bias. Athletes struggled with performing the proper technique for accurate spirometry measures; thus, we were unable to perform spirometry in accordance with the ATS guidelines (Parsons *et al.* 2012). Future research is needed to develop instructions for spirometry in this population. Further, our criteria for currently or ever having a diagnosis asthma was based on self-report data; however, our sample was a high functioning group of adults with ID, and thus, using a self-report measure was deemed sufficient. An additional weakness of this study is that the questionnaire used with the coaches is not a validated tool. Future research is needed to create such tools to better understand knowledge levels of coaches working with athletes with asthma.

In conclusion, it appears that within this sample of Canadian SO, athletes with ID have a greater prevalence of asthma than the general population and have suboptimal asthma control levels. Future

research should aim to better understand how with ID and asthma or EIA use their medication before, during and after exercise. Further, it appears that coaches of athletes with ID and asthma may require training on asthma and EIA in order to better serve their athletes. Future research is needed to better understand whether engaging in sport is increasing incidence of EIA in this population and whether training coaches leads to improved knowledge and confidence dealing with athletes with ID and EIA.

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