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Review

Reflections on Physical Activity and Health: What Should We Recommend?

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See editorial by Stone, pages 407-409 of this issue.

ABSTRACT

The health benefits of regular physical activity are irrefutable; virtually everyone can benefit from being active. The evidence is overwhelming with risk reductions of at least 20%-30% for more than 25 chronic medical conditions and premature mortality. Even higher risk reductions (ie, ≥ 50%) are observed when objective measures of physical fitness are taken. International physical activity guidelines generally recommend 150 minutes per week of moderate- to vigorous-intensity physical activity. A critical review of the literature indicates that half of this volume of physical activity might lead to marked health benefits. There is compelling evidence to support health promotion strategies that emphasize that health benefits can be accrued at a lower volume and/or intensity of physical activity. Public health policies are needed that reduce the barriers to physical activity participation such that everyone can reap the benefits of physical

RÉSUMÉ

Les bienfaits de la pratique régulière de l'activité physique sur la santé sont irréfutables. Pratiquement chacun peut tirer avantage de l'activité physique. Les données probantes ont clairement démontré une réduction des risques d'au moins 20 % à 30 % dans plus de 25 affections chroniques et de mortalité précoce. Une réduction des risques encore plus grande (c.-à-d. ≥ 50 %) est observée lorsque des mesures objectives de la forme physique sont prises. Les lignes directrices internationales en matière d'activité physique recommandent généralement 150 minutes par semaine d'activité physique d'intensité modérée à vigoureuse. Une revue primordiale de la littérature indique que la moitié de ce volume d'activité physique entraînerait des bienfaits marqués sur la santé. Des données probantes irréfutables soutiennent des stratégies de promotion de la santé qui insistent sur le fait que les bienfaits sur la santé peuvent être acquis à un volume

The health benefits of physical activity (PA) and exercise are irrefutable; virtually everyone can benefit from becoming more physically active (or fit).[1] Regular PA/exercise is an effective primary and secondary preventive measure for more than 25 chronic medical conditions (including cardiovascular disease) and premature mortality.[1-4] According to the World Health Organization, physical inactivity is the fourth leading risk factor for global mortality accounting for approximately 3.2 million deaths annually.[5] The prevalence (and population attributable risk) of physical inactivity is similar and often higher than all other risk factors (Fig. 1).[6]

The amount of evidence supporting the importance of an active lifestyle for optimal health and well-being has grown exponentially.[7-10] Collectively, this research has helped shape our understanding of the dose-response relationship between PA/exercise and various health outcomes. Recent research has also clearly shown the need to reduce the barriers for PA/exercise participation for everyone.[11] Routine PA and/or exercise participation is an essential medicine for the primary and secondary prevention of multiple chronic medical conditions. Unfortunately, this evidence has often been interpreted inappropriately and/or incorrectly creating unnecessary barriers to PA participation for those who serve to benefit the greatest from becoming more active.[12,13] Accordingly, the primary purpose of this review was to examine more closely the dose response relationship between PA and health and the implications for effective knowledge translation at the population level. We directly address the current controversies and inconsistencies, and the myths that have arisen from the misinterpretation of the literature.

The Dose of PA

Various international bodies (including the World Health Organization[5]) have created PA guidelines on the basis of an overwhelming body of evidence.[3] Current international guidelines generally recommend 150 minutes per week of moderate to vigorous PA (MVPA). In systematic reviews of the literature,[3,14] we showed that 150 minutes per week of MVPA was associated (in a dose-dependent fashion) with significant health benefits including a reduced risk for various chronic conditions (Table 1) and premature mortality (Fig. 2).

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activity. It is also important to highlight that sedentary time (particularly sitting time) carries independent health risks. The simple message of "move more and sit less" likely is more understandable by contemporary society and is formed on the basis of a strong body of evidence. For practitioners who work directly with clients, it is recommended that an individualized prescription (dosage) that takes into consideration the unique characteristics and needs of the client is provided. Physical activity or exercise promotion should not be done in isolation; it should be part of an integrated approach to enhance healthy lifestyle behaviours.

et/ou une intensité plus faibles d'activité physique. Des politiques en matière de santé publique qui réduisent les obstacles à la participation à des activités physiques de manière à ce que chacun puisse tirer des avantages de l'activité physique sont nécessaires. Il est également important de souligner que le temps consacré à des activités sédentaires (particulièrement le temps passé en position assise) comporte des risques indépendants pour la santé. Le simple message « ASSOYEZ-VOUS MOINS (et bougez plus) » qui est probablement plus facile à comprendre pour la société contemporaine se fonde sur un corpus imposant de données probantes. Pour les praticiens qui travaillent directement auprès des clients, il est recommandé de remettre une ordonnance individuelle (« posologie ») qui prend en considération les caractéristiques et les besoins particuliers du client. La promotion de l'activité physique ou de l'exercice ne devrait pas être faite de manière isolée. Elle devrait faire partie d'une approche intégrée pour améliorer les comportements liés au mode de vie en matière de santé.

It is important to highlight that PA (a behaviour) and health-related physical fitness (an attained state) are inversely related to chronic disease and all-cause mortality. However, health-related physical fitness is consistently associated with greater risk reductions.[15-18] This is thought to be (in part) due to the increased precision of measurement for physical fitness compared with PA (which is often measured subjectively)[17]; however, other environmental, genetic, and constitutional factors[19] likely also play a role.[19,20] Key recent reviews have established the importance of considering the independent and interrelated natures of PA and health-related physical fitness when considering the risk for morbidity and premature mortality.[21,22] Myers and colleagues have recently reported risk reduction for premature mortality of 10%-25% for every 1-metabolic equivalent (MET) increase in aerobic fitness (in men and also in women.[22] Even greater risk reductions (approximately 30% per 1-MET increase) are seen in those with lower aerobic capacities (ie, < 5 METs).[22] An elevated or increased aerobic fitness over the life span reduces the risk for multiple chronic medical conditions and premature mortality (Fig. 3).[23-26]

The minimal and optimal dosage of PA has been debated for years. Many agencies prefer to focus on the health benefits that are achieved with 150 minutes per week of MVPA. Moreover, a threshold of 150 minutes of MVPA has been used extensively for surveillance purposes to separate inactive from active participants. The shape of the dose-response relationship is such that the greatest relative health benefits

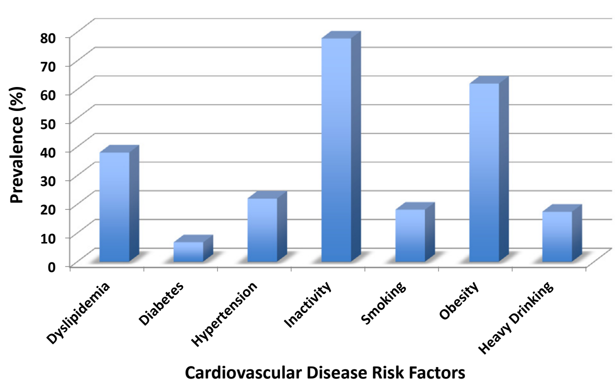

Figure 1. Prevalence of traditional risk factors for cardiovascular disease in Canadian society according to sex. Dyslipidemia was defined as having unhealthy blood concentrations of low-density lipoprotein cholesterol ($\geq$ 3.5 mmol/L), or a total cholesterol:high-density lipoprotein cholesterol ratio $\geq$ 5.0, or self-reported use of a lipid-modifying medication. Diabetes (in individuals 12 years of age and older) was diagnosed via a health professional. Hypertension was defined as a measured systolic blood pressure $\geq$ 140 mm Hg, or a measured diastolic blood pressure $\geq$ 90 mm Hg, or a self-reported diagnosis of high blood pressure, or the self-reported use of antihypertensive medication. Physical activity (for individuals aged 18-79 years) was evaluated via accelerometry. Inactive individuals were considered those who engaged in < 150 minutes of moderate to vigorous physical activity (in 10-minute bouts). Smokers (aged 12 years and older) included those who reported being a current smoker. Obesity was directly measured according to body mass index of $\geq$ 30. Heavy drinking (aged 12 years and older) included those who reported having 5 or more drinks on 1 occasion, at least once a month in the past 12 months. Data from the Canadian Health Measures Survey (2012-2013) from a nationally representative sample of Canadians (http://www.statcan.gc.ca).

Table 1. Relative risk reduction observed when comparing active/fit vs inactive/unfit individuals

Premature all-cause mortality
• 31% risk reduction
• 45% risk reduction when aerobic fitness is assessed
Cardiovascular disease
• 33% risk reduction
• $\geq$ 50% risk reduction when aerobic fitness is assessed
Stroke
• 31% risk reduction
• $\geq$ 60% risk reduction when aerobic fitness is assessed
Hypertension
• 32% risk reduction
• $\geq$ 50% risk reduction when aerobic fitness is assessed
Colon cancer
• 30% risk reduction
Breast cancer
• 20% risk reduction
Type 2 diabetes
• 40% risk reduction
• $\geq$ 50% risk reduction when aerobic fitness is assessed
Osteoporosis
• Bone adaptations to exercise are load-dependent and site-specific
• Routine physical activity is associated with improved bone health

Data from Warburton et al.[3]

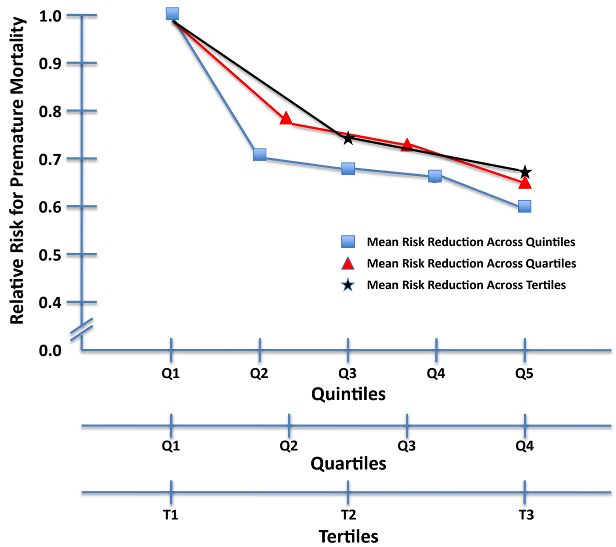

Figure 2. Relative risk for premature all-cause mortality across physical activity/fitness categories. Data were compiled from studies involving over 1.5 million participants, evaluated in a systematic review by Warburton et al.[3]

are observed in physically inactive individuals who become more physically active (Figs. 2, 4, and 5).[1-3]

From a knowledge translation perspective, it is important to highlight that relatively minor increases in PA (or fitness) in inactive individuals will lead to marked reductions in the risk for chronic disease and mortality (Figs. 2-5). Health benefits can be achieved at remarkably low volumes of activity/exercise (eg, less than half of what is currently recommended) in apparently healthy individuals and also in persons living with

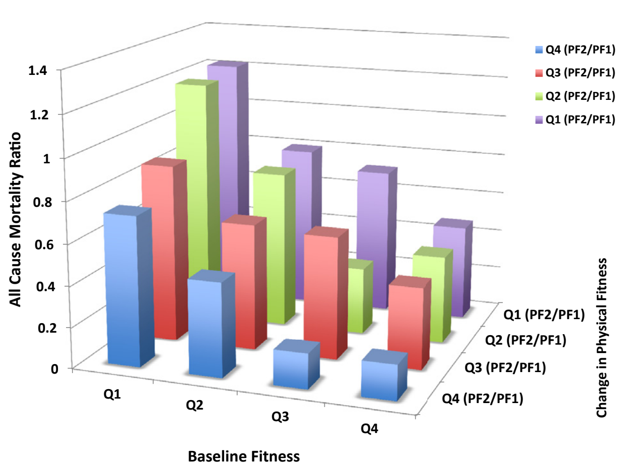

Figure 3. The relationship between changes in aerobic fitness and mortality over time. Participants were evaluated at baseline (PF1) and again 13 years later (PF2). The ratio of PF2/PF1 × 100 was calculated to evaluate changes in fitness over the study period compared with fitness level at baseline. For this figure, participants were grouped according to fitness quartiles (Q1 = least fit, Q4 = most fit) for the baseline evaluation and into quartiles for change in fitness from baseline to 13-year follow-up (Q1 PF2/PF1 = least change, Q4 PF2/PF1 = most change). Data from Erikssen et al.[24] Reproduced from *The Lancet* with permission from Elsevier. © 1998.

chronic medical conditions. Support for this statement is derived from numerous epidemiological studies (including early foundational work),[16,29-36] randomized controlled trials,[37] and recent systematic reviews/meta-analyses of the literature.[3,14,38] For instance, several recent studies have shown the potential health benefits at relatively small volumes of PA.[28,39,40] Wen and colleagues[39] recently reported that 15 minutes per day (or 90 minutes per week) of moderate intensity PA significantly reduced the risk for deaths related to all cancers, cardiovascular disease, diabetes, and all causes. Importantly, 15 minutes per day of PA conferred a risk reduction of approximately 14% for all-cause mortality. Every additional 15 minutes of daily PA (up to a maximum of 100 minutes a day) provided an additional risk reduction of 4% for all-cause and 1% for all-cancer mortality.[39] The largest health benefits were seen from the first 1-2 hours of PA. Similarly, Lee and colleagues[40] reported recently that weekly running of < 51 minutes, < 6 miles, 1 to 2 times per week, < 506 MET-minutes, or < 6 miles per hour (9.6 km per hour) decreased the risk for premature mortality. The authors emphasized that running at slow speeds for only 5-10 minutes per day can lead to marked health benefits. Arem et al.[28] recently revealed that engaging any level of PA (eg, 0.1 to < 7.5 MET hours per week) was associated with a lower risk of mortality (20%). Engaging in recommended levels of activity was associated with a mortality benefit (ie, 31%) that was closer to the optimal benefit with a threshold occurring at approximately 3-5 times the PA recommendation (ie, 39% risk reduction; Fig. 5). This group also showed that engaging in ≤ 50% of the recommended minimum (ie, 0.1-3.75 MET hours per week of leisure time MVPA [equivalent to up to 75 minutes of brisk walking per week]) resulted in approximately 2 years of life gained.[41]

In addition to our systematic reviews,[3,14] several other recent systematic reviews/meta-analyses have shown marked risk reductions with relatively small volumes of exercise. For instance, a recent meta-analysis[38] of the effects of different exercise intensities on all-cause mortality showed a clear dose-response relationship with inactive participants benefitting greatly from low to moderate exercise intensities. There was only a minor additional mortality reduction with a further increase in the activity level and intensity. The meta-analyses of Sattelmair and colleagues[42] showed that individuals who were physically active at half of the current recommendations showed a 14% lower risk of coronary heart disease (relative risk, 0.86; 95% confidence interval, 0.76-0.97). The authors stated "…the biggest bang for the buck for coronary heart disease risk reduction occurs at the lower end of the activity spectrum: very modest, achievable levels of PA."

Research from clinical populations and/or the elderly population has also shown that health benefits can be achieved at remarkably low volumes of exercise. For instance, the Canadian Association of Cardiovascular Prevention and Rehabilitation advocates an exercise prescription that is well below the 150 minutes per week.[43] This is on the basis of a strong body of evidence and established clinical practice for cardiac rehabilitation (wherein it is not uncommon for rehabilitation programs to involve a 40 minutes per week exercise intervention depending on the clinical status of the patient). These findings extend to various clinical conditions.[12,44-47] Hupin and colleagues[48] in a recent systematic review

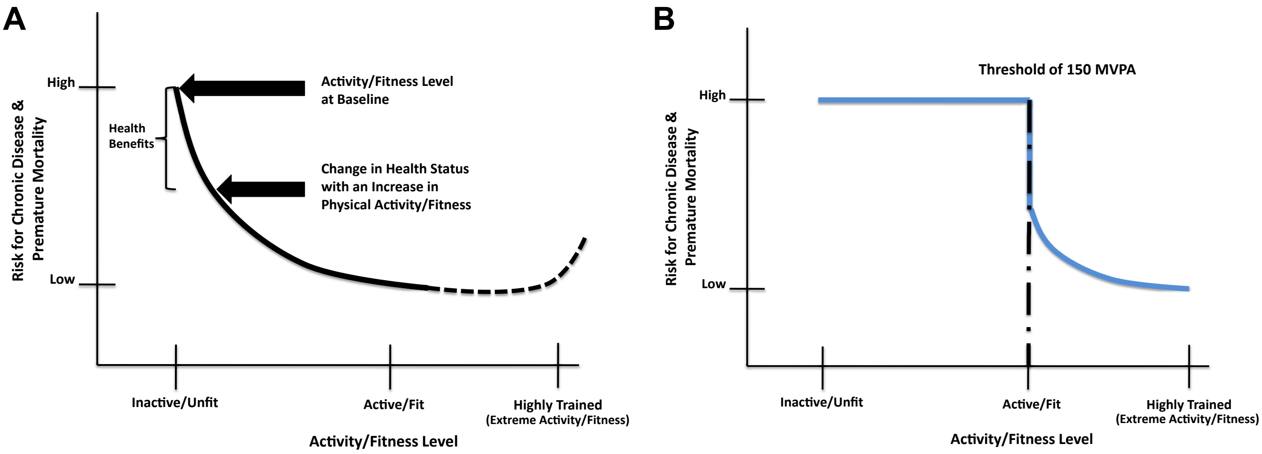

Figure 4. Theoretical dose-response relationship between physical activity/fitness and health status. (**A**) In individuals who are physically inactive/unfit, a small change in physical activity/fitness will lead to a significant improvement in health status including a reduction in the risk for chronic disease and premature mortality. **Dashed line** represents the potential attenuation in health status seen in highly (extremely) trained endurance athletes. (**B**) If current messaging regarding physical activity (ie, individuals should engage in at least 150 minutes of weekly moderate to vigorous physical activity [MVPA] for health benefits) were evidence-based the shape of the dose response curve (**blue line**) would show a clear threshold at 150 minutes of MVPA wherein the benefits are accrued. Thus, the relationship would be "L-" or "S-" shaped. However, the overwhelming evidence indicates that this not the case. (**A**) Modified from Bredin et al.[27] with permission.

showed that a low dose of MVPA (1-499 MET-minutes per week or 15 minutes per day) led to a 22% reduction in all-cause mortality risk in older adults (younger than 60 years). Further benefits were seen in those achieving current recommendations (28%) and those who engaged in more than 1000 MET-minutes per week (35%). Consistent with other systematic reviews, the greatest relative benefits were seen at the lowest doses of activity.[49] The authors further stated "…we believe that the target for PA in the current recommendations might be too high for older adults and might discourage some of them."

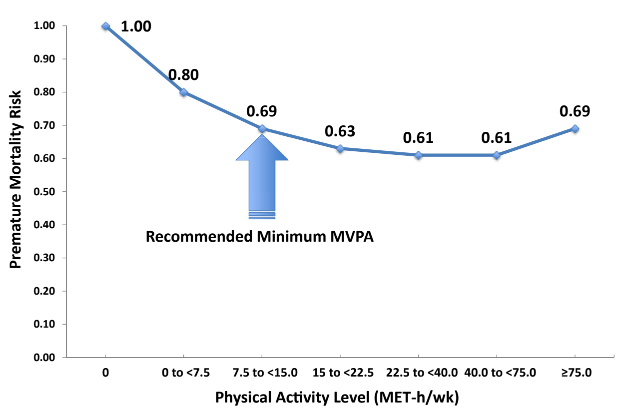

Figure 5. Dose-response relationship between physical activity and mortality risk considering minimum international physical activity recommendations. The relative risk for mortality was compared across physical activity levels related to the minimum recommended level of 7.5 metabolic equivalent (MET)-h/wk. The greatest health benefits were seen when moving from an inactive state to the next activity category. In relative terms, the threshold of 150 moderate to vigorous physical activity (MVPA; 7.5 MET-h/wk) was closer to the optimum health benefits than the minimum. Modified from Arem et al.[28] with permission from the American Medical Association.

There is certainly debate on this topic[49,50]; however, this research collectively challenges current messaging that presents a threshold of 150 minutes per week of MVPA for health benefits. Although 150 minutes per week of MVPA can lead to marked health benefits, a volume of PA of half (or less) of current recommendations is also associated with significant health benefits (including morbidity and premature mortality risk reductions).[3,14,39] There is growing evidence that inactive individuals are more likely to engage in lower volumes of PA, and many have advocated promoting this message rather than the arguably arbitrary threshold of 150 minutes per week of MVPA.[39,49]

Extremes of the Fitness Continuum

Like any medicine, there appears to be an optimal dosage for PA/exercise after which point there might be diminishing returns.[1,3,18,38,51,52] As outlined, from a risk reduction perspective current PA guidelines and recommendations are arguably closer to the optimal levels than the minimal levels required for health. Many PA guidelines recommend the goal of 150 minutes per week MVPA and suggest "more is better." However, earlier[53] and recent[52] evidence has shown that there is an attenuation (and perhaps a reversal) of benefits at the extreme of the PA continuum.

Recent studies have started to further explore individuals who engage in volumes of activity that are well beyond current recommendations. This evidence is emerging and as such somewhat controversial. For instance, a recent epidemiological trial reported that there was an attenuation of benefit at the highest volumes of running (eg, $\geq$ 1840 MET-minutes per week).[40] Arem and colleagues[28] indicated that there was no evidence of harm at 10 or more times the recommended level, despite an attenuation of benefit.

Elite highly trained endurance athletes and/or those who engage in repeat bouts of prolonged strenuous exercise are seldom included in epidemiological evidence.[52] Ultra-endurance athletes commonly engage in daily vigorous exercise ranging from 90 to 300 minutes (1.5-5 hours) per day equating to 630-2100 minutes per week of vigorous intensity exercise.[52] Recent research has highlighted the risks associated with exercising "too much" and/or with "too little recovery."[52] Individuals participating in repeat ultraendurance events (with little time for recovery) might have an increased risk for the development of ventricular fibrosis, atrial and ventricular arrhythmias, adverse myocardial remodelling (particularly of the right side of the heart), cardiovascular disease, and/or sudden cardiac death.[3,54-57] Further research is certainly required; however, more might not necessarily be better for individuals who engage in extreme volumes of PA/exercise with little time for recovery.

Other Considerations

When evaluating the health benefits of routine PA it is important to recognize that health status is multifaceted and should not be considered as simply longevity.[19] Moreover, multiple dose-response relationships might exist depending on the end point (Fig. 6) as originally postulated by Drs Norman Gledhill and Veronica Jamnik at York University.[53] Their pioneering theories have been supported by several studies that showed distinct, graded, dose-response relationships for various end points (such as blood pressure, glucose homeostasis, and functional status), chronic medical conditions, and premature mortality. Considerable research is still required to determine the optimal dosage for each medical condition and primary end point further reflecting the importance of avoiding the arbitrary application of generic PA recommendations in clinical practice.

Musculoskeletal Fitness

It is essential to consider the role that musculoskeletal fitness plays in optimal functional status and overall quality of life across the life span. Musculoskeletal fitness encompasses

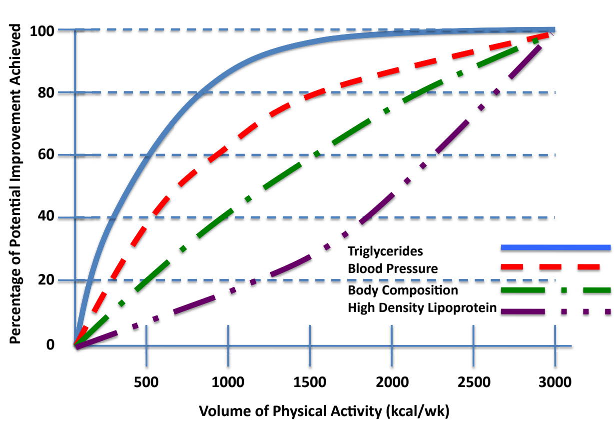

Figure 6. Theoretical relationship between physical activity and various determinants of health status as proposed by Gledhill and Jamnik.[53] The temporal relationship between physical activity might vary according to the end point, such that some end points require significantly greater changes in physical activity before marked improvements are seen. Modified with permission from Gledhill and Jamnik.[53]

muscular strength, muscular endurance, muscular power, flexibility, and back fitness.[58,59] Most epidemiological evidence relates largely to aerobic (or endurance-type) activities. However, there is clear evidence that musculoskeletal fitness is associated directly with health status.[1,58,59] In fact, many activities of daily living require a requisite level of musculoskeletal fitness without a significant aerobic output.[58,59] The level of evidence supporting the health benefits of musculoskeletal fitness is extremely strong. Musculoskeletal fitness has been associated positively with body composition, functional status, glucose homeostasis, bone health, mobility, psychological well-being, and overall quality of life, and negatively associated with fall risk, morbidity, and premature mortality.[58-63] A "paradigm shift" in exercise science and medicine has occurred wherein experts have increasingly advocated the importance of engaging in activities/exercises that tax the musculoskeletal system.[1] This includes providing detailed and individualized musculoskeletal exercise prescriptions for persons living with chronic medical conditions.[12,13,45]

Sedentary Behaviours and Health Status

When discussing physical inactivity, it is important to highlight the health hazards of engaging in too much sedentary behaviour.[64-67] Sedentary behaviour refers to behaviours conducted in the sitting or reclining posture (eg, watching television, playing computer games, driving a car, sitting, or reading) that have an energy expenditure $\leq$ 1.5 METs.[68] Sedentary behaviour is a construct distinct from physical inactivity. A person who is physically inactive often is not completely sedentary (unless confined to bed rest and/or dependent on others). Also, a person can be highly active and still engage in high levels of sedentary behaviours.[51]

A growing body of research has acknowledged the health hazards of engaging in too much sedentary behaviour (in particular sitting too much).[64-67] High levels of sedentary behaviour have been associated with an increased risk for the development of various chronic medical conditions and premature mortality.[47,65-67,69] This relationship appears to be independent of other risk factors such as body weight, eating behaviours, and PA.[65] Inactive participants with high levels of sedentary behaviour have the highest risk. Although high levels of PA can attenuate the risks associated with high sedentary behaviours,[70] it is prudent to recommend the avoidance of sitting for prolonged periods of time as well as engaging in routine PA. Stated simply, "Move more, sit less!"

Clinical Relevance and/or Minimally Important Change

In clinical practice, interventions that have the potential to improve the overall health and well-being of a client are often considered in terms of clinical relevance/significance or minimally important change. There is no clear consensus on the best method of determining a clinically relevant change.[71] However, levels of minimal clinical improvement are often defined according to the patient's perception of what is important (consistent with patient-centred care).[72] Current PA recommendations are not considered within this context, and no data exist to clearly define the level of change required that is clinically relevant or of importance from a clinician's and/or patient's perspective. However, the dose-response relationship between health and PA provides important insight into potentially clinically relevant changes.

Importantly, significant changes in clinical status can occur with relatively small changes in PA. Risk reductions of 15%-30% for premature mortality and chronic medical conditions are not uncommon,[38,42,53,59] which is of great clinical importance. For instance, a medication that reduces the risk for heart disease by 15%-30% would be highly regarded clinically. From a client's perspective, increasing PA/fitness levels by a small amount has also been shown to be associated with an improved capacity for activities of daily living.[59] As such, engaging in relatively low volumes of PA can lead to clinically relevant and minimally important changes particularly in those unaccustomed to routine PA participation. To make a clinical comparison, blood pressure-lowering medications have been shown to reduce the risk for myocardial infarction by 20%-25% in hypertensive patients.[73] Moreover, 2 recent studies have shown that the risk reduction for premature mortality seen with moderately high aerobic fitness was similar to that attained with statin therapy in dyslipidemic[74] and hypertensive[75] patients.

Failure in Knowledge Translation

In Canada, an unfortunate knowledge translation error has been introduced since the publication of our systematic reviews that formed the evidence for the 2011 Canadian Physical Activity Guidelines for adults and older adults. A simple turn of phrase from "should" to "must" has had a significant effect on the knowledge translation of the evidence. For instance, promotional materials that state explicitly that individuals "must" attain 150 minutes per week MVPA to achieve health benefits have emerged. This statement is followed by additional messages that imply (or explicitly state) that health benefits cannot be accrued at lower volumes of activity. In Canada, our articles are often used to support these statements; however, as already identified, these statements are not evidence-based and as such are quite misleading. In practice, if this messaging were correct the dose-response relationship would be "L-" or "S-" shaped (Fig. 4), which is distinct from that observed in the preponderance of the literature (as discussed previously). This discrepancy has also been noted in other countries (eg, the United Kingdom and the United States) that include the recommendation of a minimum threshold of 150 minutes per week MVPA.[76,77] It can be argued that the original Health Canada guidelines were very close to the actual evidence when they stated "Every little bit counts, but more is even better—everyone can do it!" However, it should be noted that the statement "more is even better" might need to be tempered considering the current controversial evidence from ultraendurance athletes (a small proportion of society).[52]

There are several negative consequences of promoting threshold-based messages related to PA and health. For example, current threshold-based PA messaging is not evidence-based and as such might have limited utility within programs that require the strict adherence to evidence-based best practice.[78,79] Adhering to evidence-based best practice is essential, particularly when working in clinical settings. It would not be prudent (or wise) to prescribe a volume of exercise that is more than double what has been shown to be efficacious, particularly for those unaccustomed to PA participation.[52,80] Also, current guidelines do not contain sufficient detailed information for qualified exercise professionals and relative intensities of effort. Moreover, in actual practice the achievement of 150 minutes per week of MVPA is often deemed to be unrealistic for those unaccustomed to activity/exercise, elderly individuals, those near the functional threshold for dependence, and/or those living with chronic medical conditions.[78,79] A recent study from the United Kingdom by Knox and colleagues[76] revealed that a high threshold might be "off-putting for individuals with low levels" of PA. These authors highlighted that PA goals must be attainable and that for the average adult the 150 minutes per week MVPA message would translate to an increase of 100%-400%. Thus, attaining the 150 minutes per week MVPA message might not be practical for a large proportion of contemporary society. Knox et al. also reported that PA threshold messaging (ie, $\geq$ 150 minutes per week MVPA) was associated with lower perceived health benefits for more modest volumes of PA.[76] This potentially serves to create a significant barrier for PA participation, particularly for those who would benefit greatly from becoming more physically active.

Another significant knowledge translation error is the application of generic PA guidelines (on the basis of the literature from healthy individuals) to persons living with chronic medical conditions. An unfortunate outcome of our research[3,14] was the unilateral application of these findings to those living with chronic medical conditions. There is overwhelming evidence suggesting that marked health benefits can be observed in persons living with disability and/or chronic disease with volumes of activity that are well below the 150 minutes per week MVPA threshold. Unfortunately, this arbitrary threshold has too often been included in recommendations related to those living with disability and/or chronic medical conditions. Generic PA guidelines are not optimal for addressing the diverse needs of the general population and those living with chronic medical conditions. As such, in our recent development of clinical exercise prescriptions for prominent medical conditions (via the International Collaboration on Clinical Exercise Prescription) we have created individualized exercise prescriptions with diverse recommendations related to aerobic and musculoskeletal fitness and functional status.[12,13,45]

The results from the 2012-2013 Canadian Health Measures Survey has provided some very important insight into the actual and self-reported physical activities of Canadians. For instance, approximately 61.1%-90.4% of respondents reported meeting Canadian guidelines for PA. This was a marked difference from those achieving this level when direct measures of MVPA were derived using accelerometry (ie, 28.7%). In fact, self-reported MVPA can vary by 20%-60% from actual measures of MVPA, a finding that has been supported by several investigations[81] and in other nations.[82] For instance, Tucker and colleagues revealed that 62.0% of adults in the United States met PA guidelines when self-report data were used, but only 9.6% met these guidelines when actual PA levels were assessed via accelerometry.[82] This information is often excluded when discussing PA recommendations that focus on achieving a minimum of 150 minutes per week MVPA. It is imperative to recognize this inconsistency, because current PA guidelines are formed on the basis of a large body of epidemiological evidence that relied almost exclusively on self-report data. It is therefore expected that the volumes and/or intensities of activities reported are markedly overestimated. Therefore, it is likely that a volume of activity < 50% of what is recommended is likely closer to the actual activity patterns of the participants. This is consistent in recent trials, which showed that marked health benefits can occur at remarkably low PA volumes and/or intensities.[28,40,42,48] On the basis of the evidence, we must therefore re-examine current messaging that recommends the 150 minutes per week of MVPA threshold. On the basis of these limitations (and others), a growing body of criticism has been levied against the generic PA guidelines and related messaging within the international community.[76,83-85]

A recent publication has acknowledged the somewhat limited implementation of the "Canadian Physical Activity Guidelines" despite concerted efforts to increase the rate of adoption among key stakeholder organizations and public health units.[86] The authors showed that only 51% of targeted organizations included information related to the guidelines on their Web sites during the 9-month period after the release of the guidelines. The rate of uptake plateaued at the 6-month period. The authors addressed some of the reasons for the lack of uptake by targeted organizations including the failure to reach a critical mass and the innovation of the guidelines. Others have recently criticized the new guidelines for the failure to recognize the health benefits of diverse training programs (such as high-intensity interval training).[84] Moreover, generic guidelines are relatively underutilized in practice by qualified exercise professionals.[78]

Prevention of Chronic Disease via Healthy Lifestyle Behaviours

Addressing the burden of physical inactivity in contemporary society is of great importance; however, it is critical to recognize that optimal primary and secondary prevention involves a combination of approaches including addressing other modifiable risk factors (including various lifestyle behaviours) in an appropriate manner involving effective behaviour change theories. For instance, the INTERHEART study reported that 90%-94% of the risk for myocardial infarction was explained by 9 risk factors (including abdominal obesity, abnormal lipid lipoprotein profile, poor nutrition, diabetes, smoking, hypertension, physical inactivity, regular alcohol consumption, stress, and psychosocial factors[87]). The Atherosclerosis Risk in Communities Study cohort study[88] also recently reported that only 1 in 1000 people (0.1%) have optimal cardiovascular health evaluated according to various healthy lifestyle behaviours (nonsmoking, optimal body mass index, PA, healthy diet score). A recent analysis[89] of data from the Nurses' Health Study (71,243 women) and the Health Professionals Follow-up Study (43,685 men) reported that a combination of unhealthy lifestyle choices increases the risk for stroke (a finding that has also been observed with cardiovascular disease and diabetes; Fig. 7).[90-92] Clearly, addressing the burden of chronic disease across the world needs an integrated approach including addressing key lifestyle behaviours.[93]

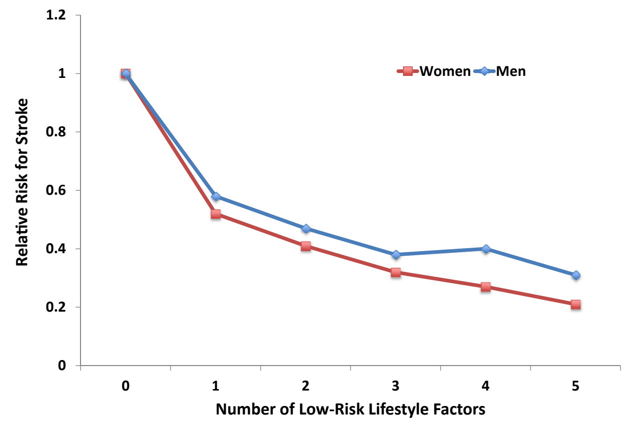

Figure 7. Relationship between healthy lifestyle choices (ie, low-risk lifestyle factors) with the relative risk for stroke. Individuals at the lowest risk included those who exhibited a higher number of healthy lifestyle behaviours including not smoking, a body mass index < 25, ≥ 30 min/d of moderate to vigorous physical activity, modest alcohol consumption (men, 5-30 g/d; women, 5-15 g/d), and a healthy diet. Adapted from Chiuve et al.[89] with permission from Wolters Kluwer Health.

Conclusions

The health benefits of PA are irrefutable; virtually everyone can benefit from being more physically active. Regular PA is a well-established primary and secondary preventative strategy against at least 25 chronic medical conditions.[1-3,18] The strength of the evidence is overwhelming with common risk reductions of 20%-30% when PA is related to hard morbidity and mortality end points. Studies on the relationship between health-related physical fitness (an attained state) reported even greater risk reductions (often > 50%). Various national and international campaigns have been developed that promote the importance of PA. International guidelines generally recommend 150 minutes per week of moderate intensity PA for health benefits. However, a careful review of the current (and early) evidence indicates that a volume of PA/exercise less than half of this level might lead to marked health benefits. It could be argued that one of the greatest myths perpetuated within PA promotion, the exercise sciences, and exercise medicine is the belief that you need to engage in 150 minutes per week of MVPA for health benefits. The preponderance of evidence simply does not support this contention. It is our sincere hope that this current article will help address this significant knowledge translation error, such that all Canadians can reap the health benefits of PA. Important also, is the associated evidence that sedentary time (in particular sitting time) has its own health risk, even for persons who are physically active. The simple message of "Move more and sit less" is likely more palatable by contemporary society and is evidence-based. Ensuring that most of contemporary society is able to realize the benefits of routine PA is an important public health policy. PA promotion should not be done in isolation, but rather part of a larger promotion of the importance of engaging in healthy lifestyle behaviours (such as smoking cessation, healthy nutrition, stress control, adequate sleep, and limited alcohol consumption).

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