Sedentarism and light intensity physical activity (in COPD)

Kylie Hill[1,2] BSc (Physiotherapy), PhD

Zoe McKeough[3] BAppSc (Physiotherapy), PhD

Daniel F. Gucciardi[1] BSc (Hons) (Psychology), PhD

[1]School of Physiotherapy and Exercise Science, Faculty of Health Science, Curtin University, Perth, Western Australia, Australia

[2]Institute for Respiratory Research, Sir C

harles Gairdner Hospital, Perth, Western Australia, Australia

[3]Discipline of Physiotherapy, Faculty of Health Sciences, The University of Sydney, Sydney, New South Wales, Australia

Address correspondence to:

Kylie Hill, BSc (Physiotherapy), PhD
School of Physiotherapy and Exercise Science
Faculty of Health Science
Curtin University
GPO Box U1980
Perth, WA, Australia 6845
Tel: + 61 9266 2774
Email: K.Hill@curtin.edu.au

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Abstract

Sedentary behaviour refers to postures or activities undertaken during waking hours in a sitting or reclined position that require low levels of energy expenditure. In people with chronic obstructive pulmonary disease (COPD), increased time spent in sedentary behaviour contributes to the risk of mortality and development of cardio-metabolic disease. This chapter summarises what we currently know about sedentary behaviour in people with COPD, in terms of measuring this domain, total volume and patterns of accumulation during daily life. The physiological mechanisms proposed to give rise to the deleterious health consequences are provided. This chapter also provides a rationale for the relevance and importance of including a reduction in sedentary time as a lifestyle target in this population. Practical strategies, informed by behaviour change theory are provided for clinicians to consider when working with people to achieve this target.

Key messages

- People with COPD spend the majority of their waking hours accumulating time in sedentary behaviour, which is detrimental to their health.
- Although clinicians who provide pulmonary rehabilitation programs often encourage increased participation in physical activity, especially moderate to vigorous physical intensity physical activity, achieving and sustaining this behaviour change by people with COPD is rarely seen.
- Even if following pulmonary rehabilitation, people with COPD do engage in a 30 minute walk once a day, this is unlikely to counteract adequately the metabolic consequences of spending the rest of their waking time in largely sedentary pursuits.

- Targeting reductions in sedentary time is an emerging lifestyle goal for people with COPD, and consideration should be given to introducing theoretically informed approaches to achieve this behaviour change during pulmonary rehabilitation.

Sedentary behaviour refers to postures or activities undertaken during waking hours in a sitting or reclined position that require low levels of energy expenditure (defined as ≤ 1.5 metabolic equivalent tasks [METs]) (1). Common examples include watching television (TV), reading and activities on the computer. Time spent in these postures or activities is referred to as sedentary time and is characterised by skeletal muscle unloading. The domain of sedentary time is discrete from inactivity, which is defined as little participation in physical activity (1). The possible combinations of sedentary and activity profiles, with examples of behaviours in each category are summarised in Table 1. The distinction between these domains is important because for some people, reducing sedentary time can be a separate lifestyle goal to increasing participation in physical activity.

Since the mid-2000s, it has been well established that people with chronic obstructive pulmonary disease (COPD) engage in low levels of physical activity when compared with peers of similar age and gender proportion (2, 3). Epidemiological studies have shown that, in this population, low levels of physical activity influence important disease outcomes such as risk of hospitalisation and mortality (4). These data have sparked an interest in investigating strategies to increase participation in physical activity by people with COPD. The results of these studies have been at best, modest (5). Most notably, pulmonary rehabilitation, which is known to reduce symptoms of dyspnoea and fatigue as well as increase exercise tolerance (6) does little to change participation in daily physical activity (5, 7). After more than a decade of work in this area, we now understand that increasing participation in physical activity in this population is very challenging and is likely to require a multimodal, long-term and interdisciplinary approach.

Although our energy expenditure during waking time can fluctuate from that associated with sedentary time (i.e. very low), to that required during vigorous intensity physical activity (i.e. very high) (8), in both health and disease, there has been a focus on the health benefits associated with participation in moderate to vigorous intensity physical activity (MVPA) (9). Numerous public health campaigns promote the importance of adults accumulating at least 150 minutes each week of MVPA. The primary focus on promoting MVPA is surprising as participation in the amount of physical activity recommended to produce health benefits (e.g. about 30 minutes per day) will equate to < 5% of their waking hours (8). In many populations, especially adults living with a chronic condition such as COPD, the rest of the day is spent in low energy expenditure pursuits, which includes a large amount of sedentary time (10-12). We now understand that this ubiquitous accumulation of sedentary time has detrimental health consequences. Even if we are able to increase the participation in MVPA by people with COPD, a 30 minute walk once a day is unlikely to counteract adequately the metabolic consequences of spending the rest of their waking time in largely sedentary pursuits (13).

What do we know about sedentary time in people with COPD?

Sedentary time in COPD has been measured using both self-report methods (i.e. questionnaires/diaries) and activity monitors (i.e. device-measured). A systematic review and synthesis of ten studies that compared self-report and device-based methods indicated that the median time people with COPD spend sitting during waking hours is roughly 359 minutes per day (range 269 to 390 minutes per day) (14). As self-report measures tend to underestimate sedentary time (15, 16), the next section will specifically focus on device-measured sedentary time in people with COPD.

There have been several studies around the world which have reported on device-measured sedentary time in people with COPD (2, 11, 17-25). Absolute sedentary time has varied from approximately 434 to 763 minutes per day. This large variation is most likely related to two main measurement issues. First, activity monitors can be worn on different parts of the body and use different sources of information to derive their measure of sedentary time. Some activity monitors determine sedentary time based on a set level of activity counts (e.g. Actigraph wGT3X-BT reports vector magnitude counts of <2000 per minute as sedentary time) or levels of energy expenditure (e.g. SenseWear Armband reports time spent at ≤1.5 METs as sedentary time), whereas others sample acceleration data combined with body position (e.g. activPAL, waist-worn Dynaport Activity Monitor with leg sensor). The latter devices are often regarded as the gold standard as body position needs to be considered when classifying behaviour as sedentary (1).

Second, the time over which the activity monitors were worn differed considerably with the majority of early studies in COPD measuring sedentary time for 12-hours after waking in the morning (2, 17-19, 26), whereas recent work has focused on 24-hour wear time. Importantly, as sleep is distinct from sedentary behaviour, studies which ask their participants to wear activity monitors for 24 hours must describe how they excluded overnight sleep time from the measurement of sedentary time (11, 22). Unsurprisingly, the reported absolute sedentary time in studies with the 12-hour wear time protocol have been smaller (approximately 434 to 487 minutes per day) (2, 19) than those using a 24-hour wear time protocol (approximately 676 to 763 minutes per day) (11, 22). To account for differences in wear time, sedentary time is often reported as a percentage of waking wear time, and ranges from 58% to 72% of waking wear time in people with COPD. Even after expressing sedentary time as a percentage of wear time, it may still be more accurate to use a 24-hour wear time protocol as a recent population-based study in Belgium on older adults indicated that those aged ≥65 years are least sedentary in the morning and accumulate most of their sedentary time in the evenings (27); data which would be missed using a 12-hour wear time protocol.

Several studies have compared sedentary time in people with COPD to a comparator group of healthy peers (2, 20-23, 25, 26). Briefly, the participants with COPD spent, on average, more time in sedentary behaviours than their healthy counterparts. Of note, when comparing sedentary time between people with COPD and their resident loved-ones, this greater accumulation of sedentary time occurred despite both groups having relatively similar motivation to exercise (28). More complex analysis of the frequency and duration of sedentary bouts provides insight into the way in which sedentary time is accumulated. One study in COPD has reported that when all bouts >1 minute were considered during the analysis, 40% of these bouts were spent in sedentary time, 46% were spent in light intensity physical activity (LIPA) and only 14% were spent in MVPA (24). The median bout duration for sedentary time was considerably longer than those for both LIPA and MVPA, being 7, 3 and 2 minutes, respectively (24).

What are the health consequences of sedentary behaviour in health and people with COPD?

Substantial evidence exists on the effects of sedentary time on various health outcomes. One review of studies undertaken in the general adult population concluded that sedentary time was associated with a greater risk of developing cardiovascular disease, cancer and type 2 diabetes and morality associated with cardiovascular disease, cancer and from all causes (29). It is important to note that several of the studies included these reviews used TV viewing time as a surrogate of total sedentary time (29). This has been the source of some debate as TV viewing time may be confounded by other factors such as snacking, poor socioeconomic factors and mental health factors which will also contribute to poor health outcomes (30). More recent prospective studies where direct sitting time has been measured suggests no association with diabetes (31, 32) so further studies are still required to understand fully the context of sitting to poor health outcomes in the general adult population. Although it appears that the risk of poor health outcomes associated with prolonged sedentary time can be offset by engaging in very high levels of physical activity (i.e. 60 to 75 minutes of moderate intensity physical activity per day) (29, 33), this finding is of little relevance to people with COPD who rarely engage in this volume of physical activity.

There are data in the general population to show that the way in which sedentary time is accumulated also contributes to health risk. Data from both Australia (34) and the America (35) have shown that, independent of total sedentary time, when compared accumulating sedentary time in shorter bouts, the accumulation sedentary time in prolonged uninterrupted bouts is associated with higher cardio-metabolic risk factors such as increased waist circumference and fasting plasma glucose. Nevertheless, the finer details, such as how often and for how long people should break up sedentary time to ameliorate this increased risk, are not yet known.

Evidence of the deleterious effects of sedentary time are now emerging in people with COPD. Sedentary time appears to have similar consequences in terms of the development of cardio-metabolic risk factors and diabetes and both all-cause and COPD-related mortality (36-38). The relationship between TV viewing time and COPD-related mortality has only been evaluated in one study (37). Results indicated that Japanese men who watched TV for four or more hours per day were 1.64 times more likely to die of COPD compared to those who watched TV for less than two hours per day (37). Two studies in people with COPD reported device-measured sedentary time (36, 38) with one study (38) showing a four times higher risk of mortality in people with COPD who spent more than 8.5 hours per day being sedentary and the other study (36) reporting a positive association of sedentary time with metabolic variables such as waist circumference and glucose levels. There has also been preliminary evidence to suggest that greater sedentary time in people with COPD is associated with more severe disease (39, 40) and poorer perceived health including mental health (40).

What is the physiological basis for sedentary behaviour being harmful?

The way in which sedentary time increases the risk of cardio-metabolic risk is likely to be distinct from the way in which participation in MVPA reduces cardio-metabolic risk. Epidemiological data shows the risks associated with too much sitting often hold true when adjusted for low to moderate time spent in MVPA (41, 42). The most well-established mechanism for the reduction in cardio-metabolic risk associated with MVPA is flow-mediated improvements in endothelial function (43). This adaptation appears to be dependent on the intensity of physical activity with LIPA having minimal effect (43, 44). In contrast, too much sitting impairs the metabolism of skeletal muscle to utilise triglycerides and glucose (45). This is because a loss of muscle contraction results in a dramatic loss of skeletal muscle lipoprotein lipase activity, which reduces the capacity of skeletal muscle to siphon off and use triglycerides for energy and impairs glucose uptake (45). Lipoprotein lipase is also involved in anti-inflammatory processes and has been linked to the signalling for mitochondrial biogenesis (13). In people with COPD, sedentary time, when expressed relative to the time spent in moderate intensity activity was strongly correlated with gene expression involved in signalling pathways for oxidative stress, inflammation and aging (12) and contributes to cardio-metabolic risk (46). It follows that if high sedentary time is hazardous to our health, then frequent muscular loading is likely to be beneficial to our health (13). Indeed, data from both animal and human studies, markers of impaired skeletal muscle metabolism, induced by too much sitting, have been ameliorated by participation in LIPA (45, 47, 48). When people with COPD do engage in physical activity, it is almost exclusively LIPA (11), which appears to have health benefits in this population (49).

Considerations when applying an intervention to reduce sedentary time in COPD

Implementing interventions that aim to reduce sedentary time seems to be a particularly pragmatic option for people with COPD. That is, people with COPD have a high prevalence of both cardiovascular and metabolic disease when compared with their peers (50, 51). Further, as many people with COPD, particularly those with advanced disease and /or multiple co-morbid conditions are unable to participate in sufficient intensity or duration of physical activity to reduce the risk of developing cardiovascular or metabolic diseases, focusing on substituting sedentary time for participation in LIPA should be considered as a realistic lifestyle target (8). It is also likely to be a more realistic option in those experiencing or recovering from severe dyspnoea during an acute exacerbation (52).

People with COPD who accumulate long periods of sedentary time are characterised by worse spirometric measures of lung function (12), a higher number of exacerbations in the previous 12 months, lower exercise capacity and less autonomous motivation, use of long term oxygen therapy and are more likely to live with a partner (53). The characteristics of those with COPD who participate in low levels of physical activity have been reported to be co-morbid conditions, worse COPD Assessment Tool (CAT) and body-mass index, obstruction, dyspnoea and exercise capacity (BODE) scores, greater functional limitation resulting from dyspnoea and more likely to live with a loved one who engaged in very little physical activity

(28, 54, 55). It seems that people with moderate to severe COPD also have a fear of movement (i.e. kinesiophobia), which is strongly associated with their perception of dyspnoea (56). It is likely that such issues will need to be considered when planning an intervention to reduce sedentary time in people with COPD.

Although there are several studies that have explored the effect of an intervention on physical activity in COPD (5), studies reporting the effect of interventions on sedentary time are sparse. Most studies in this area have focused on generic interventions such as pulmonary rehabilitation or have targeted increases on physical activity rather than specifically targeting reductions in sedentary time as a discrete lifestyle goal. Studies which explore the effect of rehabilitation have offered little promise in producing changes in physical activity (5, 7) and therefore, unsurprisingly, the impact on sedentary time has also been, at best, equivocal (11, 23). Those more likely to demonstrate a change in their sedentary time or show increased participation in LIPA following a program of exercise training have better exercise-specific self-efficacy (10, 57), exercise tolerance (23) or have received a specific behaviour change intervention (58, 59). As with other forms of rehabilitation applied during or immediately following an acute exacerbation (60), attempts to reduce sedentary time appear to the thwarted by limited adherence and engagement (61).

Although current clinical practice guidelines for the management of people with COPD provide no information regarding approaches to minimise sedentary time (62), data exists to guide clinical practice. First, a review of studies in non-clinical populations (i.e. mainly office workers) reported that the behaviour change techniques which offered the most promise in terms of successfully changing sedentary time included; education, persuasion, problem solving, goal setting, review of behavioural goals, feedback and self-monitoring behaviour, social support, information on health consequences, prompts / cues, behaviour substation, restructuring the social environment (63). The use of wearable technology to assist with goal setting, self-monitoring and the provision of prompts or cues is a growing area of interest (64) and seems to be well-accepted and feasible in most people with COPD (65). Second, a meta-analysis of randomised controlled trials undertaken in an adult population (mainly overweight and obese) that explored the effect of interventions on sedentary time revealed greater change in those studies which had a clear intervention message targeting sedentary time as a separate construct from physical activity (66). This suggests the specificity of the intervention message may be important. Finally, a Delphi study has been conducted in which experts in COPD and people with the condition were asked about approaches that would be considered important when attempting to reduce sedentary time (67). Consensus was reached on the following approaches likely to be important; management of dyspnoea and fear of dyspnoea, addressing low motivation, optimising self-efficacy for symptom management and behaviour change, goal setting, education, exercise training, management of co-morbid conditions and social support (67).

Targeting sedentary behaviour constitutes a paradigm shift from the traditional messages pertaining to increasing participation in MVPA. It involves conceptualising activity as frequent, brief ‘boluses’ or ‘snacks’ of skeletal muscle loading (13). Participation in LIPA boluses (e.g. slow walking) appears to offer a similar effect as moderate intensity physical activity (e.g. brisk walking) on improving postprandial metabolism (47). Although speculative, it is possible that targeting reductions in sedentary time, especially sedentary time that is accumulated in prolonged uninterrupted bouts, through encouraging boluses of LIPA may assist to maintain the gains achieved following pulmonary rehabilitation. Studies specifically targeting reductions in sedentary time in people with COPD are now emerging (61, 68).

A behavioural science approach to sedentarism in COPD

Given the complexities of sedentary behaviour and its pattern of accumulation, both intentional and unintentional, across numerous life contexts (e.g. transportation, leisure), it is essential to take a multifactorial approach to understanding key determinants across multiple ecological levels (e.g. home, social, community) (69). An interdisciplinary approach that is informed by theories and approaches to behaviour change offers the most viable way to address the behavioural target of breaking up and reducing sedentary time (70). The behaviour change wheel is a widely employed framework for the design of evidence-based and theory-informed interventions because it provides a systematic and comprehensive approach to identifying the sources of behaviour that need to be addressed to effect behaviour change, intervention functions that can be used to foster change, and policy categories that can support efforts to effect change (71). In essence, people need the capability, opportunity, and motivation to perform a specific behaviour, and any combination of these components of the behaviour system may serve as targets for intervention. Theories of behaviour change (e.g. beliefs about capabilities) and associated constructs (e.g. self-efficacy, self-esteem) offer additional granularity and guidance on these key determinants, particularly in terms of salient barriers and enablers (72). An understanding of how to effect behaviour change is provided via consideration of nine intervention functions and 93 behaviour change techniques. For example, limited knowledge of the health risks of high levels of sitting (psychological capability) might require that individuals be provided with this knowledge (theoretical domain) via education (intervention function) about the health consequences of a behaviour (behaviour change technique) (73, 74). Finally, seven broad policy categories can be used to support the delivery of the interventions (e.g. fiscal, legislation, regulations). A visual depiction of the behaviour change wheel is provided in Figure 1.

The behaviour change wheel provides coherence and structure for professionals interested in behaviour change and maintenance via an 8-step process. Cavalheri et al. (75) detailed a hypothetical case example of this process for reducing sedentary time among people with COPD. From a research perspective, only one study has applied the 8-step process encompassed by the behaviour change wheel to develop interventions for people with COPD, namely early pulmonary rehabilitation and activity after exacerbations (76), though components of the behaviour change wheel have informed others (e.g. combination of self-initiated action plans and nurse support (77)). Nevertheless, there exist numerous examples of the application of the 8-step approach of the behaviour change wheel for intervention development with other clinical conditions (78) and in the general population (e.g. reduce sitting time among office-based workers (74); uptake and attendance at National Health Service stop smoking services (79)). Researchers are advised to consult such examples for inspiration as to how the behaviour change wheel can be applied or adapted to suit their goals in pulmonary rehabilitation.

Clinicians can also utilise the behaviour change wheel to guide processes that can inform the development of individualised and pragmatic strategies that can be deployed to achieve personalised goals related to breaking up and/or reducing sitting time. Engaging end-users (i.e. people with COPD) in the decision-making process is essential in this regard, particularly with regard to selecting and specifying the target behaviour, and identifying what needs to change for the behaviour to occur. Cox and colleagues (76) provided excellent examples of questions that can be adapted to guide discussions with people with COPD to understand their capability (e.g. What do you know about sedentary behaviour? How do you feel after standing up after sitting for prolonged periods?), opportunity (e.g. What support do you have from your partner to break up sedentary time by standing up for 30 sec every 30 min? How can you use your home environment or change it in any way to help you stand up regularly?), and motivation (e.g. How confident are you that you can stand up every 30 min? How can you reward yourself when you stand up to break up a sedentary period?) to engage in behaviours that break up and/or reduce their sedentary time. People with COPD can also be engaged via conversation to identify personalised strategies. In the effective Stand Up Victoria trial of a workplace intervention to reduce sitting time among desk-based workers (80), for example, participants generated strategies with the assistance of a health coach where they could stand up, sit less, and move more in ways that aligned with their preferences, job role, and work environment. Common strategies identified related to phone activities (e.g. stand when they completed a phone call), work tasks (e.g. walking to colleague for a face-to-face conversation rather than using email), bodily sensations (e.g. stand when you feel tired or uncomfortable), work environment (e.g. using stairs instead of the elevator), work structure (e.g. walking during lunch breaks), social dimensions (e.g. stand when you see someone else stand), transport and commuting (e.g. parking car further away from the office), and prompts (e.g. using a clock, stopwatch, or alarm). A similar approach has been adopted in a recent (unpublished) study people with COPD (68). Table 2 presents a worked example of the 8-step behaviour change process that targets clinicians who run pulmonary rehabilitation programs. In this example, the target behaviour to be addressed is one of inadequate delivery of advice (by the clinicians) to people with COPD who attend pulmonary rehabilitation regarding selecting a reduction in sedentary time as a lifestyle target.

Summary and conclusions

In both health and disease, to reduce the risk of developing cardiovascular disease, there has been a focus on increasing participation in physical activity, especially MVPA. However, in people with COPD, over a decade of research has shown that achieving sustained increases in MVPA following completion of a pulmonary rehabilitation program, is very unlikely. Even in people who do engage in the recommended volume of MVPA to reduce the risk of cardiovascular disease, this accounts for a small proportion of waking hours and is unlikely to offer protection from the risk associated with accumulating high amounts of sedentary time. In the general population, the health consequences of prolonged sedentary time are well established. Preliminary, but convincing data are emerging that demonstrate similar health consequences in people with COPD. This calls for consideration of alternative, pragmatic and achievable lifestyle targets, such as reducing sedentary time and increasing participation in LIPA. Although there are currently no evidence-based guidelines to support the implementation of a behaviour change process to address sedentary time in people with COPD, clinicians can be guided by earlier work in this area, such as; (i) strategies that have been effective in non-clinical populations, (ii) the recent Delphi study that presents approaches that are considered to be important by clinicians and patients when attempting to reduce sedentary time (67) and (iii) worked examples that have been shaped by change theory.

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Table 1: Possible combinations of sedentary and activity profiles

	High sedentary time	Low sedentary time
Sufficient participation in physical activity	Spends most of the day sitting reading / watching TV and goes for a 30 min walk every day	Volunteers at a local thrift shop (standing and serving customers) and goes for a 30 min walk every day
Low participation in physical activity	Spends most of the day sitting reading / watching TV and does not engage in any regular exercise	Volunteers at a local thrift shop (standing and serving customers) and does not engage in any regular exercise

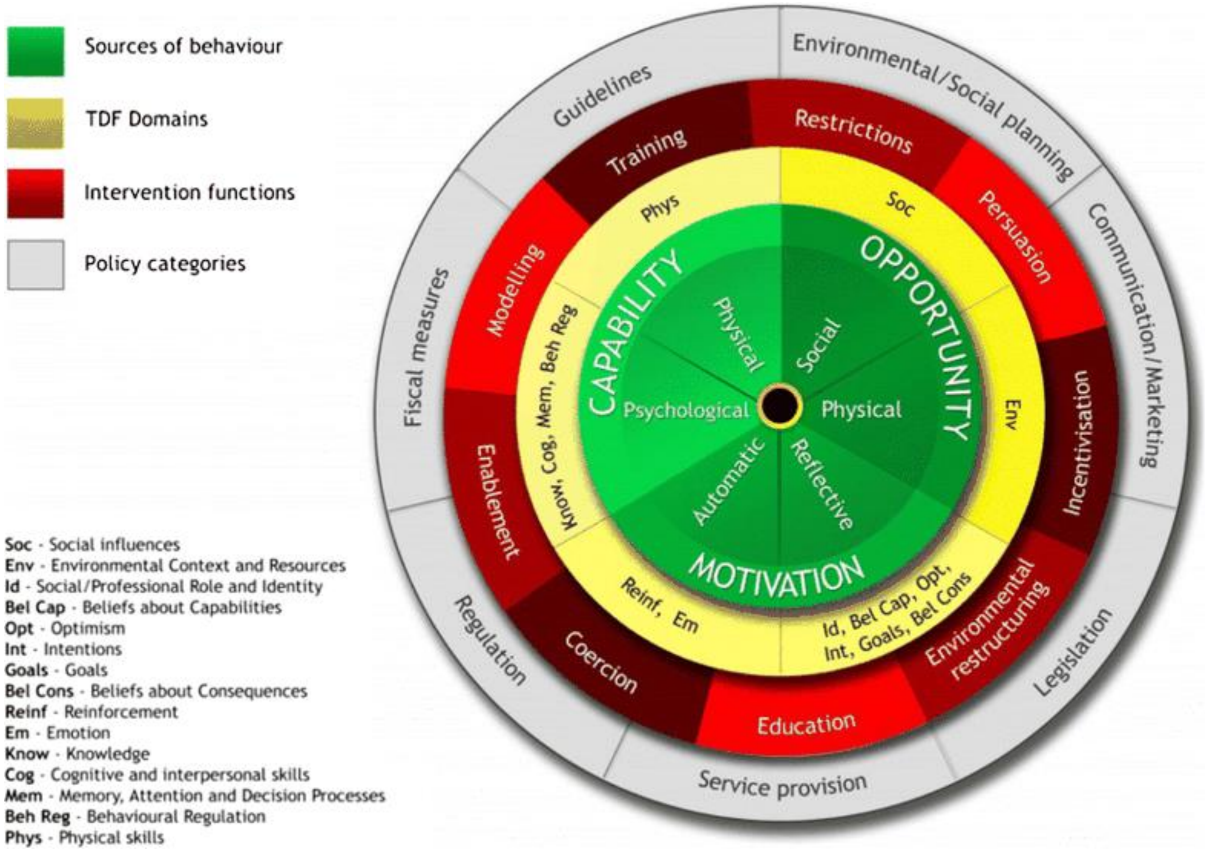

Figure 1: Behaviour change wheel. The COM-B model is at the core (green wheel), which is supported by the Theoretical Domains Framework (yellow wheel). The nine intervention functions (red wheel) surround the key determinants of behaviour within the inner circles. The outermost layer contains policy categories (grey wheel) the may influence the effectiveness of the nine intervention functions. *Source:* Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implement Sci.* 2011;6:42

Table 2: Worked example of the 8-step behaviour change process that targeting clinicians to select a reduction in sedentary time as a lifestyle goal

Stage	Step	Key Considerations	Hypothetical Example
1. Understand the behaviour	1. Define the problem in behavioural terms	High levels of uninterrupted sedentary time at home	Inadequate delivery of advice provided by clinicians to people with COPD around ST in the home
	2. Select the target behaviour	Reduce sedentary time by 30 min per day	Increasing amount advice provided by clinicians to people with COPD around reducing/breaking up ST
	3. Specify the target behaviour	Stand up every 30 min and move around for 1 min	Clinicians deliver advice to people with COPD on the importance standing up every 30 min at the start and end of a pulmonary rehabilitation session
	4. Identify what needs to change	Do clinicians have the capability (physical or psychological), opportunity (social or physical), and/or motivation (automatic or reflective) to achieve the target behaviour?	Physical capability: N/A Psychological capability: (i) limited knowledge of the potential health gains from breaking up sedentary time, (ii) need to remember to provide the advice, (iii) need knowledge of what to say and skills on how to say it Physical opportunity: (i) limited time for patient education in pulmonary rehabilitation, (ii) require resources on hand to provide information to patients Social opportunity is unnecessary: N/A Automatic motivation: (i) sedentary behaviour advice/counselling needs to become habitual/a routine part of patient education / goal setting Reflective motivation: (i) beliefs regarding positive consequences of breaking up sedentary time for COPD is low, (ii) need to believe that providing advice about sedentary behaviour is within their remit/professional role, (iii) confidence to deliver the advice

2. Identify intervention options	5. Identify appropriate intervention functions	What are the most salient intervention functions to effect behaviour change in terms of the key determinants identified in step 4? Consideration of the APEASE (affordability, practicability, effectiveness, acceptability, side-effects and safety, and equity) criteria for individuals and their contexts is essential. Linkages between the behavioural analysis, intervention functions, and behaviour change techniques can be mapped using a behaviour change wheel matrix (see: Michie S, Atkins L, West R. The behaviour change wheel: a guide to designing interventions. Great Britain: Silverback Publishing; 2014)	Intervention functions related to education, persuasion, training, environmental restructuring, modelling, and enablement meet the APEASE criteria Incentivisation (unaffordable, impractical, poor cost effectiveness), coercion (impractical, unacceptable), and restriction (impractical) are incompatible with the APEASE criteria
	6. Identify policy categories	This step is primarily of interest when clinicians or researchers are interested in changing policy	Communication/marketing, guidelines, regulation, environmental/social planning, and service provision meet the APEASE criteria Fiscal (impracticable, unacceptable) and legislation (impracticable, unacceptable) are incompatible with the APEASE criteria
3. Identify content and implementation options	7. Identify behaviour change techniques	What are the 'active ingredients' or individual techniques required to operationalise the intervention functions? Consideration of the APEASE criteria is essential for the selection of behaviour change techniques	Education: information about health consequences (5.1) Persuasion: information about the social and environmental consequences (5.3) Training: instruction on how to perform the behaviour (4.1) Environmental restructuring: adding objects to the environment (12.5) Modelling: demonstration of the behaviour (6.1)

			Enablement: goal setting behaviours (1.1), problem solving (1.2), action planning (1.4), and self-monitoring of behaviour (2.3) (The number in parentheses represent the Behaviour Change Techniques taxonomy category and number)[79]
	8. Determine the mode of delivery	How will the behaviour change techniques be delivered to clinicians (e.g., face-to-face, phone, technology, or some combination)? Consideration of the APEASE criteria is essential for tailoring the mode of deliver to suit the preferences and needs of individuals or groups	Educational seminar including critical information on sedentary time (e.g. determinants, consequences) combined with a training component (e.g. goal setting) Adding visually appealing posters in key areas of the rehabilitation site (e.g., in front of bikes, treadmills) Showing videos of 'real world' examples of experienced practitioners completing the behaviour