Physical Activity for Pulmonary Rehabilitation Registry

Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure (World Health Organization, 2014) WHO. Essentially, it describes what a person actually does vs. what one is capable of doing (Thompson D, Circulation 2003). Consequences of inactivity include increased risk of COPD in smokers (Garcia Amyerich et al, Am J Respir Crit Care Med 2007) and skeletal muscle dysfunction. The odds ratio for development of comorbidites in inactive COPD patients is 3.06 (Van Remoortel, An J Respir Crit Care Med 2013). CDC recommendations identify physical activity as a major public health priority http://www.cdc.gov/physicalactivity/index.html. General recommendations for physical activity vary, although 30 minutes per day of moderate intensity exercise five or more days a week (or 2 hours and 30 minutes per week) are commonly accepted standards.

PR has the potential to improve physical activity; however, the mean increase in walking time following PR appears to be approximately five minutes per day (Troosters, ER Rev 2010). Clearly, strategies are needed to increase how PR influences sustainable improvements in long term physical activity. Models showing benefit include a study by Breyer, et al (Respir Res. 2010) of Nordic walking in Austrian COPD patients that significantly improved walking time with benefits enduring up to nine months. Nearly 2/3 of participants continued Nordic walking beyond the initial nine month evaluation period.

Step counters or pedometers are not uniformly accurate, particularly in slow walking COPD patients. However, these small, inexpensive devices can provide feedback and potentially increase motivation and physical activity (Hospes Pat Ed Counseling, 2008, De Blok Pat Ed Counseling 2006). PR providers should give patients physical activity recommendations and goals that can be monitored and reinforced over time. Additionally, clinicians should help patients identify safe settings for physical activity and strategies for ongoing support and motivation, e.g. walking with friends, family members, community-based options, etc.

Opportunities for improving physical activity in the future should include development and evaluation of wireless applications, e.g. smart phone apps and other e-health models to monitor progress, provide feedback with encouragement, and offer chat features, tips on activity, etc (Moy, Respir Med 2012). Based on expert recommendations, a few devices and questionnaires for potential use by PR programs and patients are listed below. The list is not all inclusive and may omit effective, accurate tools and devices.

Pedometers

Omron HJ-720 ITC (Bannockburn, Illinois) store.omronhealthcare.com/
https://www.omronfitness.com/device-help/pedometer-support/

- USB port and cable for downloading data.
- 41-day memory, resets at 12am. Displays steps, aerobic steps, distance, calories.
- Watch type battery
- 2-3 published validity studies.
- Somewhat complex to use. Holster to clip it onto belt is large and somewhat awkward
- 10 years of public use.
- $45

**Fitbit**: clothing clip or wristband. [http://www.fitbit.com/](http://www.fitbit.com/)

- Activity tracker uses connectivity with free app for smart phone / computer.
  - Estimates and displays steps, distance, calories;
  - Watch type battery (2-3 month battery life).
  - Small, easy to wear, however, small size may risk accidental machine washing of clip device.
  - New software for researchers allows data collection on hundreds of patients (similar to the Omron Healthcare software).
  - Underestimates some activity
  - $65- clothing clip; $95 for wristband

**SW-200 Yamax Digiwalker** [http://www.yamaxx.com/digi/sw-200-e.html]

- Internal sensor mechanism uses a coiled spring-suspended lever arm, Counts best on those who are not overweight or obese and at speeds greater than 2.5 mph.
- Battery life approximately 3 years
- $20
Accelerometers

ActiGraph GT3X+: [http://www.actigraphcorp.com/support/devices/gt3xplus/](http://www.actigraphcorp.com/support/devices/gt3xplus/)

- **Standard tri-axial research-grade accelerometer**
  - Used in 80-90% of physical activity studies. New version due at ACSM 5/2014. Device relatively constant over 20 yrs;
  - Currently does not clip onto waist band. New version will have a touch screen display, fit into a rubber holster for wrist or waist clip.
  - Software is very ‘researcher-oriented’; may be difficult for clinicians to use. Simplified software in development.
  - $250 retail plus about $1000 for ActiLife software.

- **DynaPort minimod triaxial accelerometer** (McRoberts, the Netherlands) [https://www.mcroberts.nl/products/movemonitor/dynaport](https://www.mcroberts.nl/products/movemonitor/dynaport)
  - Greater accuracy than some alternatives
  - May be expensive.
  - Software for analysis is well developed
  - Uses microSD, USB cable for communication and charging
  - 1-2 week battery life.

Multisensors

Sensewear Armband ([http://www.bodymedia.com](http://www.bodymedia.com) Bodymedia, Pittsburgh PA, USA)

- Activity monitor validated in patients with COPD (Rabinovich et al. ERJ 2013; 42:1205-1215). Multisensory device, which consists of an accelerometer plus a sensor that measures skin flux, galvanic skin response and skin temperature
- Typically worn on the upper right arm and provides steps and estimation of total energy expenditure (TEE) during free living. The data can then be uploaded and analyzed using well-developed computer software.

- The new version includes Bluetooth to allow connection through multiple applications on Smartphone or Tablet.

- Cost $99-119

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**Questionnaires**

- Minnesota Leisure Time Physical Activity Questionnaire (MLTPAQ) or Survey (MLTPAS) [http://appliedresearch.cancer.gov/paq/q038.html](http://appliedresearch.cancer.gov/paq/q038.html)
- Physical Activity Scale for the Elderly (PASE) [http://www.ndorms.ox.ac.uk/prove/documents/assessors/questionnaire/Pase_Questionnaire.pdf](http://www.ndorms.ox.ac.uk/prove/documents/assessors/questionnaire/Pase_Questionnaire.pdf)
- International Physical Activity Questionnaire (IPAQ – currently included as a registry data set [http://www.ipaq.ki.se/downloads.htm](http://www.ipaq.ki.se/downloads.htm))

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