Higher-Intensity Exercise Results in More Sustainable Improvements for VO$_{2peak}$ for Breast and Prostate Cancer Survivors

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Survivors often significantly reduce their physical activity levels after treatment and do not return to prediagnosis levels (Blanchard, Courneyea, & Stein, 2008). As many as 70% of survivors do not engage in sufficient exercise to achieve health guideline recommendations (Peeters et al., 2009). Low levels of physical activity and associated losses of cardiovascular fitness increase the survivors' risks of all-cause and diseasespecific mortality (Hamer, Stamatakis, & Saxton, 2009; Irwin et al., 2008; Laukkanen, Rauramaa, Mäkikallio, Toriola, & Kurl, 2011). In addition, survivors are at higher risk of cardiovascular disease after treatment (Lakoski et al., 2013; Viale & Yamamoto, 2008). Even asymptomatic breast cancer survivors exhibit impaired cardiorespiratory fitness, as measured by peak volume of oxygen consumption (VO$_{2peak}$), have been associated with a decrease in mortality (Blair et al., 1996; Kodama et al., 2009; Laukkanen et al., 2011) and better quality of life among breast cancer survivors (Tolentino et al., 2010). VO$_{2peak}$ is considered the best practical surrogate for predicting survival in any adult population (Blair et al., 1996), with reduced mortality risks seen when adults reach greater than 27.7 ml/kg per minute (Kodama et al., 2009). For context within the populations studied in the current article, research indicates that breast and prostate cancer survivors have mean VO$_{2peak}$ of 25.4 ml/kg per minute (Burnett, Kluding, Porter, Fabian, & Klemp, 2013) and 28.1 ml/kg per minute (Scott et al., 2015), respectively, both of which would be rated as poor in healthy adults (American College of Sports Medicine [ACSM], 2009).

In 2010, the ACSM called for researchers to examine whether different exercise intensities affected targeted health outcomes among survivors (Schmitz et al., 2010). Some studies have shown the potential for higher-intensity exercise to make larger improvements in VO$_{2peak}$ among survivors (Adamsen et al., 2009; De Backer et al., 2007; Quist et al., 2006). However, those studies also identified potential risks of high-intensity exercise in some populations, such as those diagnosed...