The dose response relationship between exercise intensity all-cause mortality.

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BACKGROUND

Aerobic exercise is known to improve cardiovascular health and decrease risk of all-cause mortality. It is important to know how to optimize the benefits of aerobic exercise given that cardiovascular diseases are the leading cause of death in the United States.

PURPOSE

- Determine which intensity is best for decreasing mortality in the general population.
- Determine whether high intensity interval training is better than moderate intensity continuous training for decreasing mortality in the general population.

CRF & Mortality

DeFina et al.- Meta-Analysis (2015)

- cardiorespiratory fitness (CRF) was correlated with mortality (greater percentile of CRF, the lower the risk)
- Greatest changes in mortality were found between the lower percentiles compared to the higher percentiles.

Figure 1. Risk of all cause mortality at different percentiles of PA and CRF[1]

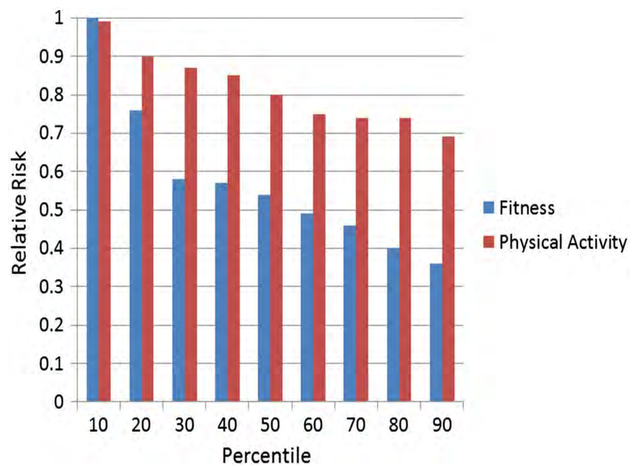


Figure 2. Change in risk of all cause mortality at different intensities of activity and durations[3]

		Combined RR (95% CI)		
Domain or type of physical activity	No. of studies	60 min (75 min)[a]	150 min[a]	300 min[b]
Vigorous exercise and sports[c]	8	0.91 (0.87–0.94) [0.89 (0.85–0.93)]	0.78 (0.72–0.88)	0.61 (0.51–0.74)
Moderate and vigorous leisure-time activities[d]	6	0.94 (0.92–0.97)	0.86 (0.80–0.92)	0.74 (0.65–0.85)
Moderate activities of daily living[e]	4	0.96 (0.93–0.98)	0.90 (0.84–0.96)	0.81 (0.71–0.92)
Walking[f]	10	0.97 (0.95–0.99)	0.93 (0.87–0.97)	0.86 (0.79–0.95)
Physical activity for transportation[g]	5	0.97 (0.94–1.00)	0.92 (0.86–0.99)	0.85 (0.74–0.99)

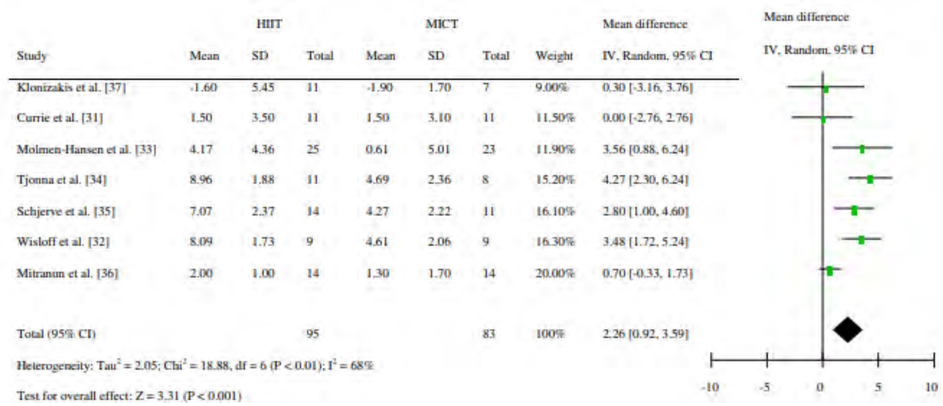
In a different meta-analysis by Samitz, Egger, and Zwahlen (2011), they compared activity levels in a general adult population over a period longer than 2 years using physical activity questionnaires. They found that exercise intensity and quantity had inverse relationship with all-cause mortality meaning that exercising at a greater intensity for more times per week is better for reducing mortality. However, even though the highest volumes and intensity of exercise had the greatest effect on all-cause mortality, there is still a significant reduction at a moderate volume and intensity.

HIIT vs MICT

Ramos, Dalleck, Tjonna, Beetham, and Coombes- Systematic Review (2015)

- high intensity interval training (HIIT) was better than moderate intensity continuous training (MICT) for improving CRF after 12 weeks
- Used randomized control trials that were tested on heart failure patients
  - most commonly used HIIT protocol was four, 4-minute intervals at 85-95% of peak heart rate with 3 minutes of active recovery at 60-70% of peak heart rate
  - primary metric used to determine CRF was increase in flow mediated dilation (FMD)
- HIIT was found to increase FMD from 5.14% to 9.45% while MICT increased FMD from 5.12% to 7.27%.

Figure 3. Forest plot of mean difference in FMD between MICT (left) and HIIT (right)[2]



CONCLUSION

- Individuals who are inactive and increase their CRF will have a greater reduction in their risk of all-cause mortality than individuals who increase their CRF who already have high CRF.
- Individuals who vigorously exercised for 300 minutes per week had a greater reduction in all cause mortality compared to both individuals who vigorously exercised 75 minutes per week and individuals who exercised at a lesser intensity for 300 minutes per week.
- Since it is known that CRF is inversely related to mortality, HIIT must therefore be better than moderate intensity continuous exercise for reducing risk of mortality.

REFERENCES

1) Defina, Haskell, Willis, Barlow, Finley, Levine, & Cooper. (2015). Physical Activity Versus Cardiorespiratory Fitness: Two (Partly) Distinct Components of Cardiovascular Health? *Progress in Cardiovascular Diseases, 57*(4), 324-329.
2) Ramos, J., Dalleck, S., Tjonna, L., Beetham, C., & Coombes, A. (2015). The Impact of High-Intensity Interval Training Versus Moderate-Intensity Continuous Training on Vascular Function: A Systematic Review and Meta-Analysis. *Sports Medicine, 45*(5), 679-692.
3) Samitz, G., Egger, M., & Zwahlen, M. (2011). Domains of physical activity and all-cause mortality: Systematic review and dose-response meta-analysis of cohort studies. International Journal of Epidemiology, 40(5), 1382-1400.