RUPRECHT-KARLS-
UNIVERSITÄT
HEIDELBERG

Gesund durch körperliche Aktivität

Warum Bewegung ein Geschenk für uns ist.

Ingelheim 11. September 2019

Prof. Dr. Gerhard Huber
Institut für Sport und Sportwissenschaft
der Universität Heidelberg

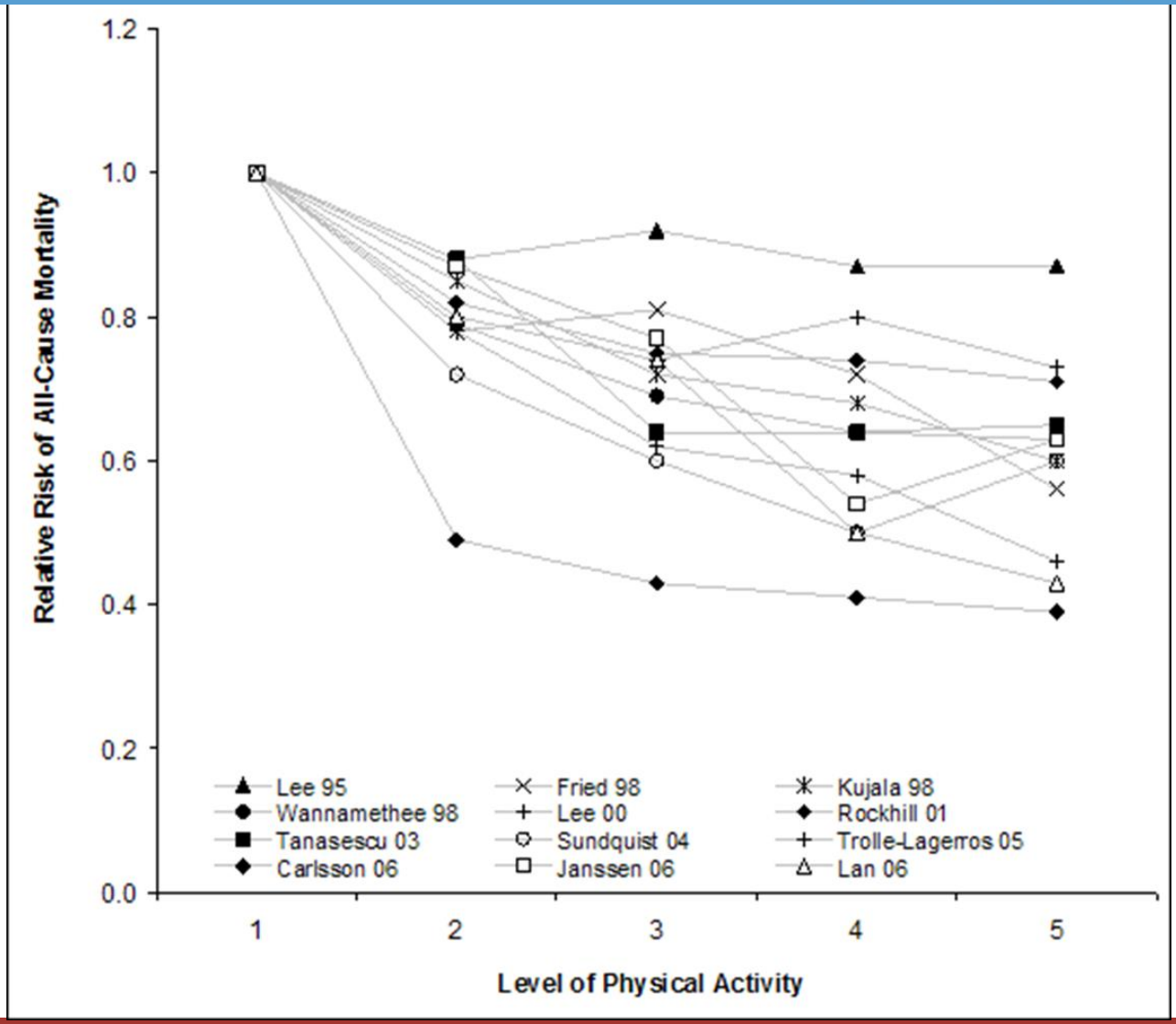
DStGB
Deutscher Städte- und Gemeindebund

PLAYGROUND@LANDSCAPE

Physical Activity Guidelines for Americans

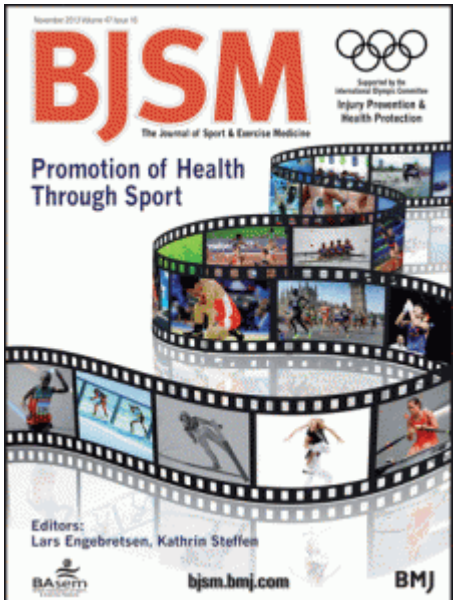
Shape of the Dose-Response Curve: Relative Risks of All-Cause Mortality
by Physical Activity Level (Studies With at Least 5 Levels of Physical Activity)

https://www.cdc.gov/physicalactivity/basics/index.htm



RUPRECHT-KARLS-
UNIVERSITÄT
HEIDELBERG

"Sport is one part, but is probably not a large part of lifetime physical activity."



Invited Commentary

Obesity, Fitness, Hypertension, and Prognosis
Is Physical Activity the Common Denominator?

Carl J. Lavie, MD; Parham Parto, MD; Edward Archer, PhD

Obesity has many adverse effects on cardiovascular risk factors, such as dyslipidemia, metabolic syndrome or type 2 diabetes mellitus, and hypertension, as well as on cardiovascular structure and function. Therefore, it is not surprising that the prevalence of cardiovascular diseases is markedly increased in the setting of overweight and obesity.[1] Considering that increased fat accumulation causes increases in total blood volume, stroke volume, and cardiac output, it is expected that obesity markedly increases the prevalence of hypertension and places a heavy strain on the left and right sides of the heart, which not surprisingly increases the prevalence of heart failure, even in a setting of metabolically healthy obesity.[1]

Related article

In this issue of *JAMA Internal Medicine*, Crump and colleagues[2] demonstrate in a study of more than 1.5 million male Swedish military recruits that the finding of obesity, determined by elevated body mass index (BMI), at age 18 years was a predictor for the development of hypertension during a mean follow-up of 25.7 years. A study by Chandra et al[3] of 903 participants in the Dallas Heart Study who were followed up for 7 years for the development of hypertension demonstrated that increased visceral adiposity, but not total or subcutaneous fat, was robustly associated with incident hypertension.

Cardiorespiratory fitness (CRF), on the other hand, is a strong predictor of risk factors for cardiovascular diseases, as well as morbidity and mortality. Some studies suggest that higher CRF can attenuate or even potentially eliminate the harmful effects of fatness, suggesting that individuals who are overweight but physically fit may not experience health or cardiovascular problems.[1] In the present study by Crump et al,[2] although higher CRF at age 18 years did not totally prevent the development of hypertension, higher CRF was associated with lower risk of hypertension across the total distribution. Although the combination of a high BMI and low CRF was the strongest predictor of risk of hypertension during follow-up, both were independently associated with the development of hypertension. Moreover, a low CRF was a particular risk factor for the development of hypertension in young men with a normal BMI. Interestingly, low muscular strength in these young men was not a significant predictor of subsequent hypertension risk, although there was a modestly positive interaction between low CRF and low muscular strength for predicting the risk of subsequent hypertension.

Clearly, in a perfect world, all young people would have a normal BMI and a high level of fitness (both CRF and muscular fitness), and with aging, CRF would be maintained without significant increases in body fatness. However, this ideal is far from the case in our current society, when obesity has increased even in children, and progressive increases in BMI and reductions in CRF occur with aging.[1] In a study of 3148 healthy adults without hypertension, metabolic syndrome, or dyslipidemia, increases in BMI and reductions in CRF over time predicted the development of these disorders during a 6-year follow-up, although changes in CRF were slightly superior to increases in body fatness for predicting the development of hypertension, metabolic syndrome, or dyslipidemia.[4] In fact, every 1 metabolic-equivalent improvement in CRF over time was associated with a 7%, 22%, and 12% lower risk of hypertension, metabolic syndrome, and hypercholesterolemia, respectively. In another study of 13 953 individuals without hypertension or cardiovascular disease who were followed up for a mean of 4 years, higher CRF prevented the trajectory of increasing blood pressure with aging.[5] This finding suggests that higher CRF extends the time during which an individual has healthy systolic and diastolic blood pressure, thus delaying the development of hypertension. In another study of 14 345 individuals followed up for a mean of 11.4 years, increases in BMI and reductions in CRF over time predicted a higher mortality. However, after adjusting for changes in CRF, changes in BMI over time were no longer a significant predictor of mortality.[6] In fact, this study demonstrated reductions in mortality from cardiovascular disease of 27% and 42%, respectively, in those who either had no change or had improvements in CRF at their second examination at a mean of 6.3 years later; for every 1 metabolic-equivalent increase in CRF over time, all-cause and cardiovascular disease mortality were reduced by 15% and 19%, respectively. Although these studies suggest that prevention of fat gain and loss of CRF with aging are both important, maintaining or improving CRF may be even more important for preventing the development of risk factors for cardiovascular diseases, such as hypertension, but particularly for preventing cardiovascular diseases and all-cause mortality.

Since CRF and obesity are important predictors of cardiovascular disease risk factors and subsequent prognosis, it is important to identify the common denominators for both of these factors. A main factor is physical activity.[1,7] Although there is a non-exercise or inherited component of CRF, the strongest predictor of CRF is physical activity or levels of exercise training.[1,7] In addition, although excess caloric load has been suggested as a major contributor to obesity,[1] we believe that marked declines during the past 5 decades in leisure time and occupational physical activity explain the notable increase in BMI over time.[1,7] Regardless of the argument regarding whether increases in obesity prevalence over time are owing to increases in caloric intake, marked reductions in physical activity, or both, clearly the decline in physical activity over time is also a major determinant in reducing the level of CRF.[1,7,8]

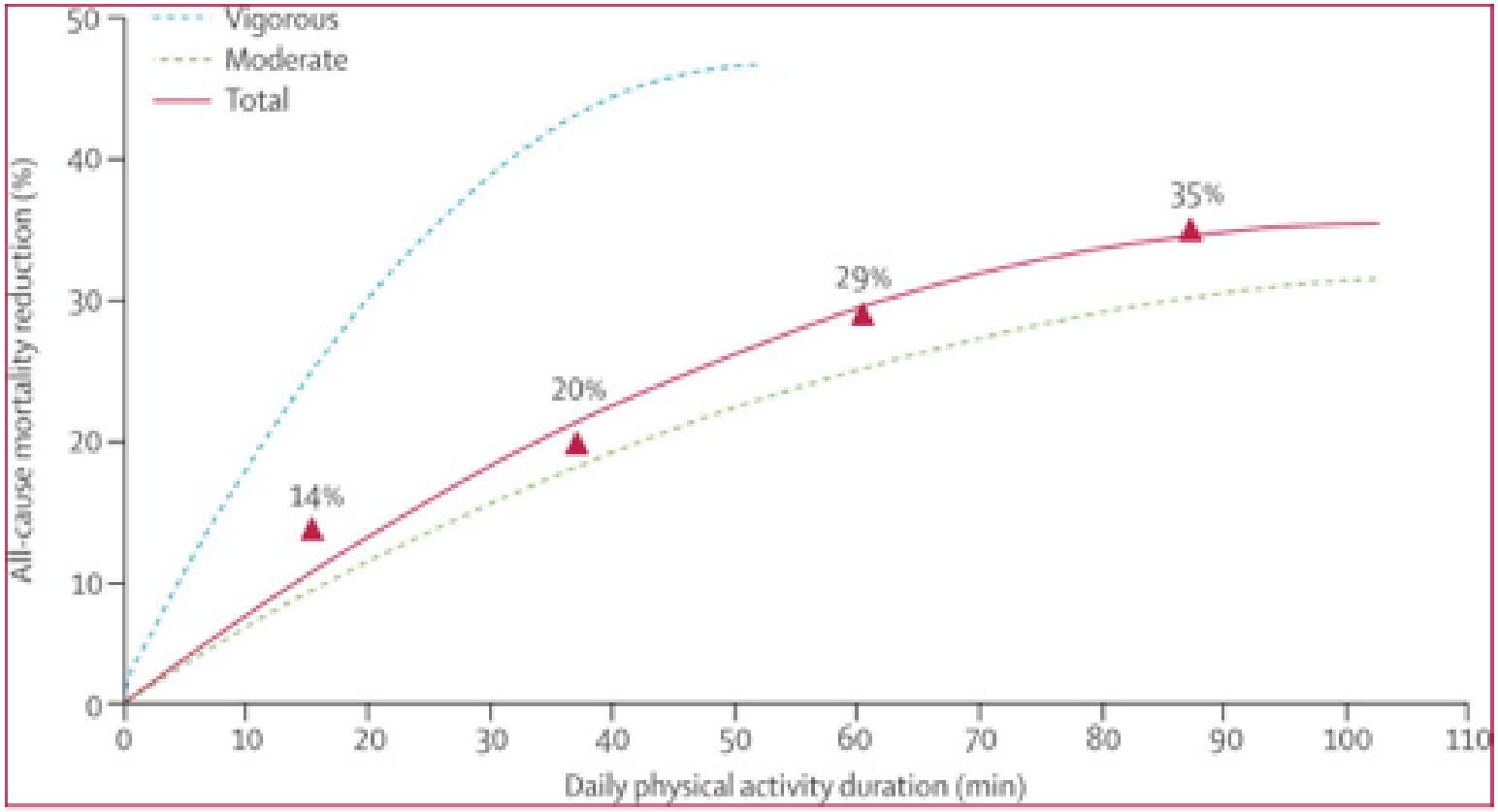
RUPRECHT-KARLS-
UNIVERSITÄT
HEIDELBERG

Gliederung

1. Einführung
2. Körperliche Aktivität macht gesund!
3. Warum ist das so?
4. Etwas genauer ? Zwei Beispiele:
    - Körperliche Aktivität in der Onkologie
    - Sitzen als Gegenspieler
5. Fazit

RUPRECHT-KARLS-
UNIVERSITÄT
HEIDELBERG

Daily physical activity duration and all-cause mortality reduction (Wen et al. 2011)



THE LANCET

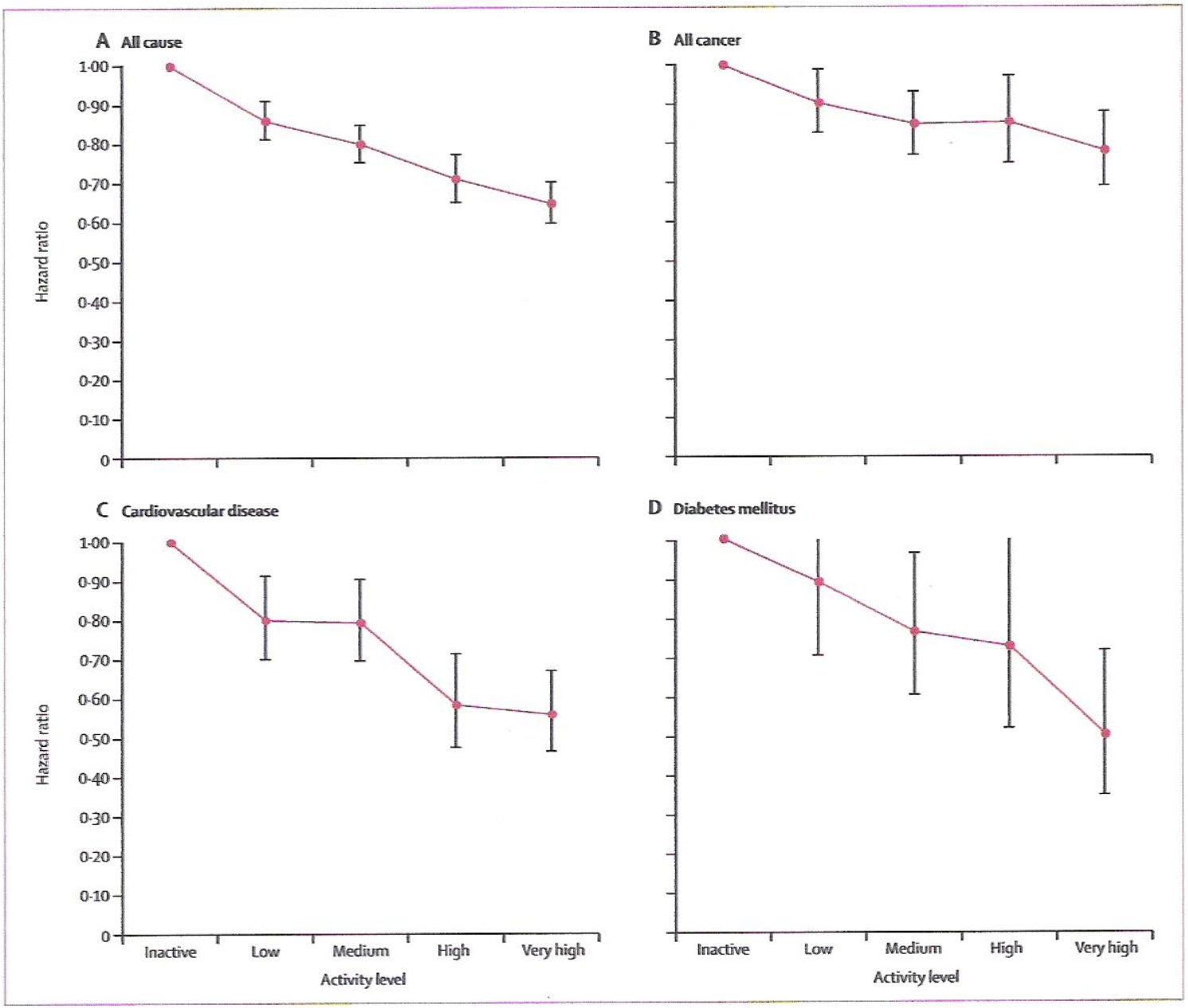
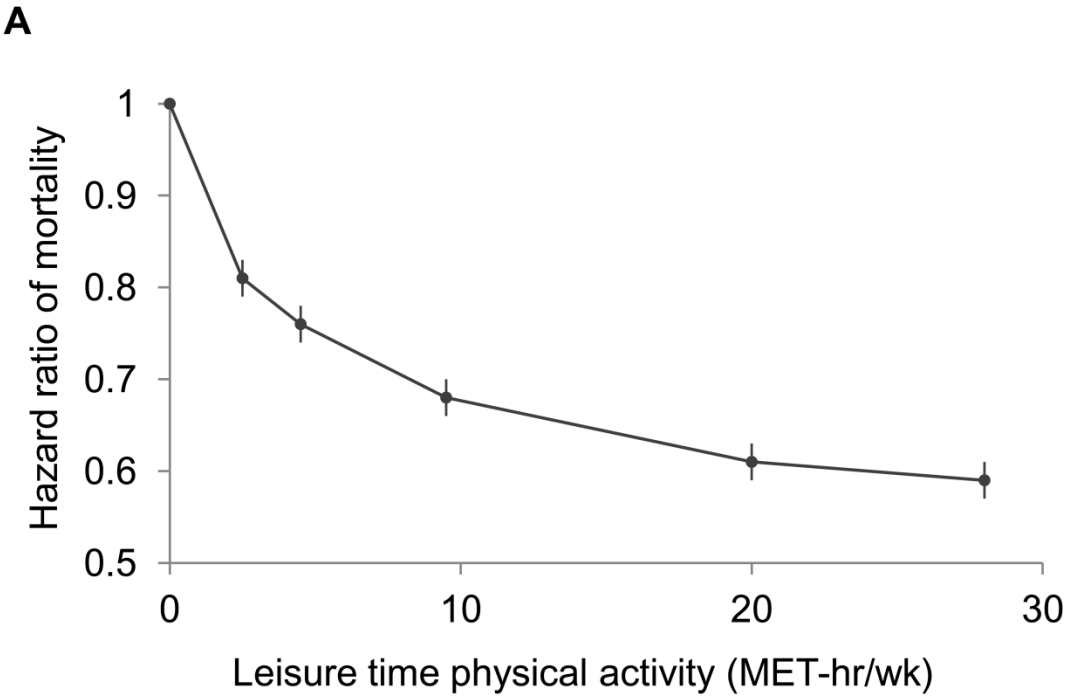
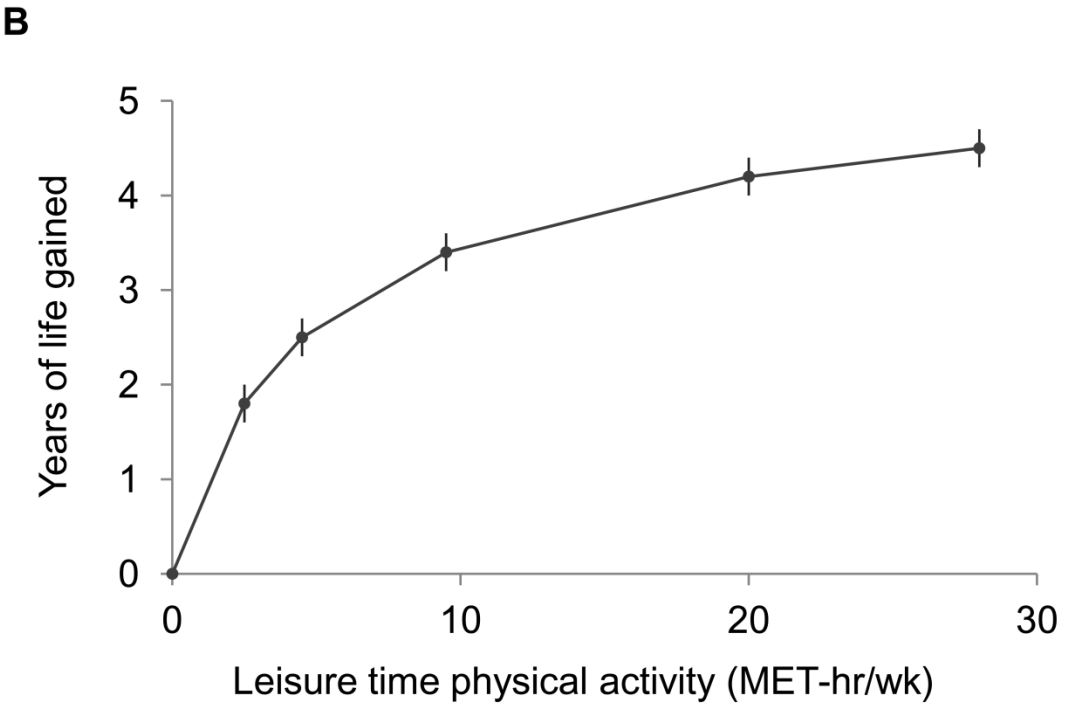


Figure 1: **Relation between physical activity volume and mortality reduction compared with individuals in the inactive group**
Bars show 95% CIs.

RUPRECHT-KARLS-
UNIVERSITÄT
HEIDELBERG

Leisure Time Physical Activity of Moderate to Vigorous Intensity and Mortality: A Large Pooled Cohort Analysis
N = 654 827
Moore et al . 2012





RUPRECHT-KARLS-
UNIVERSITÄT
HEIDELBERG

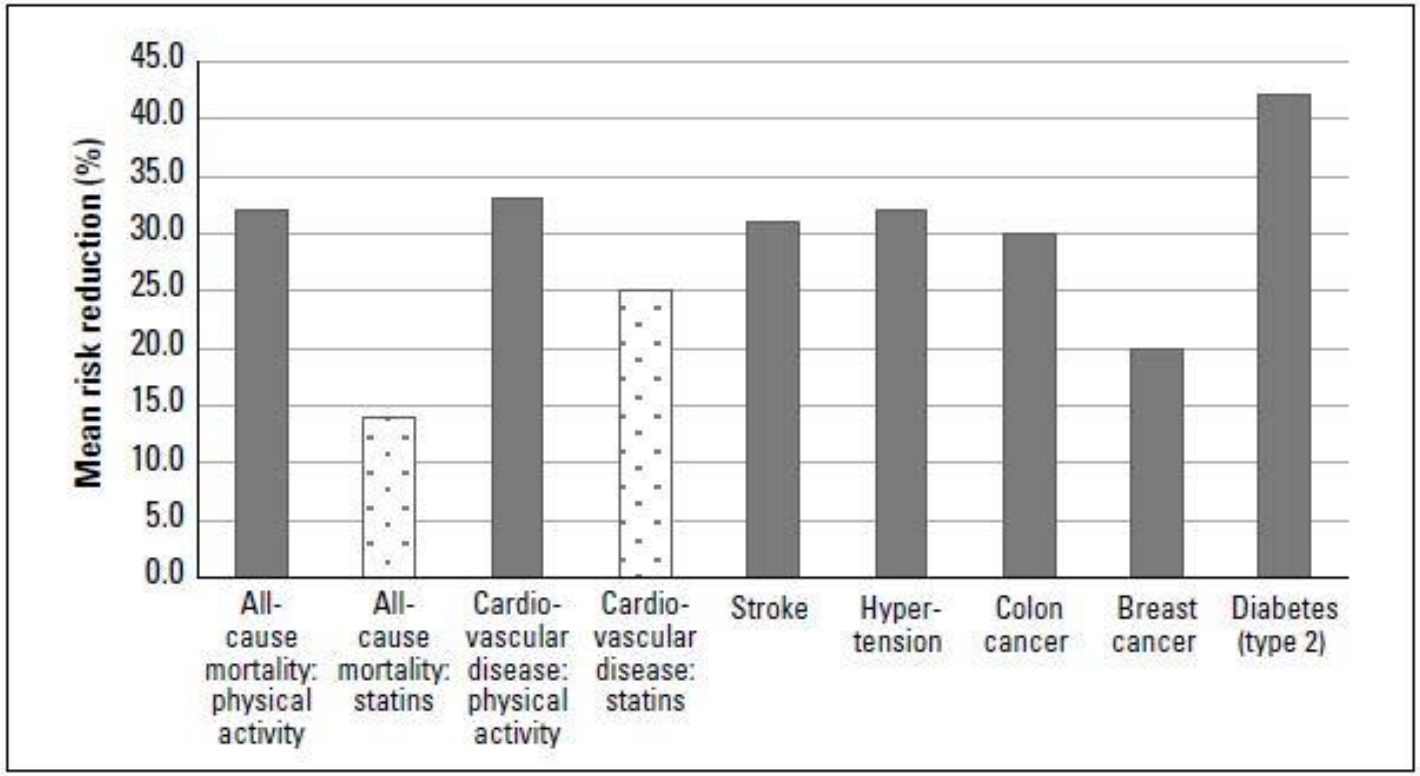


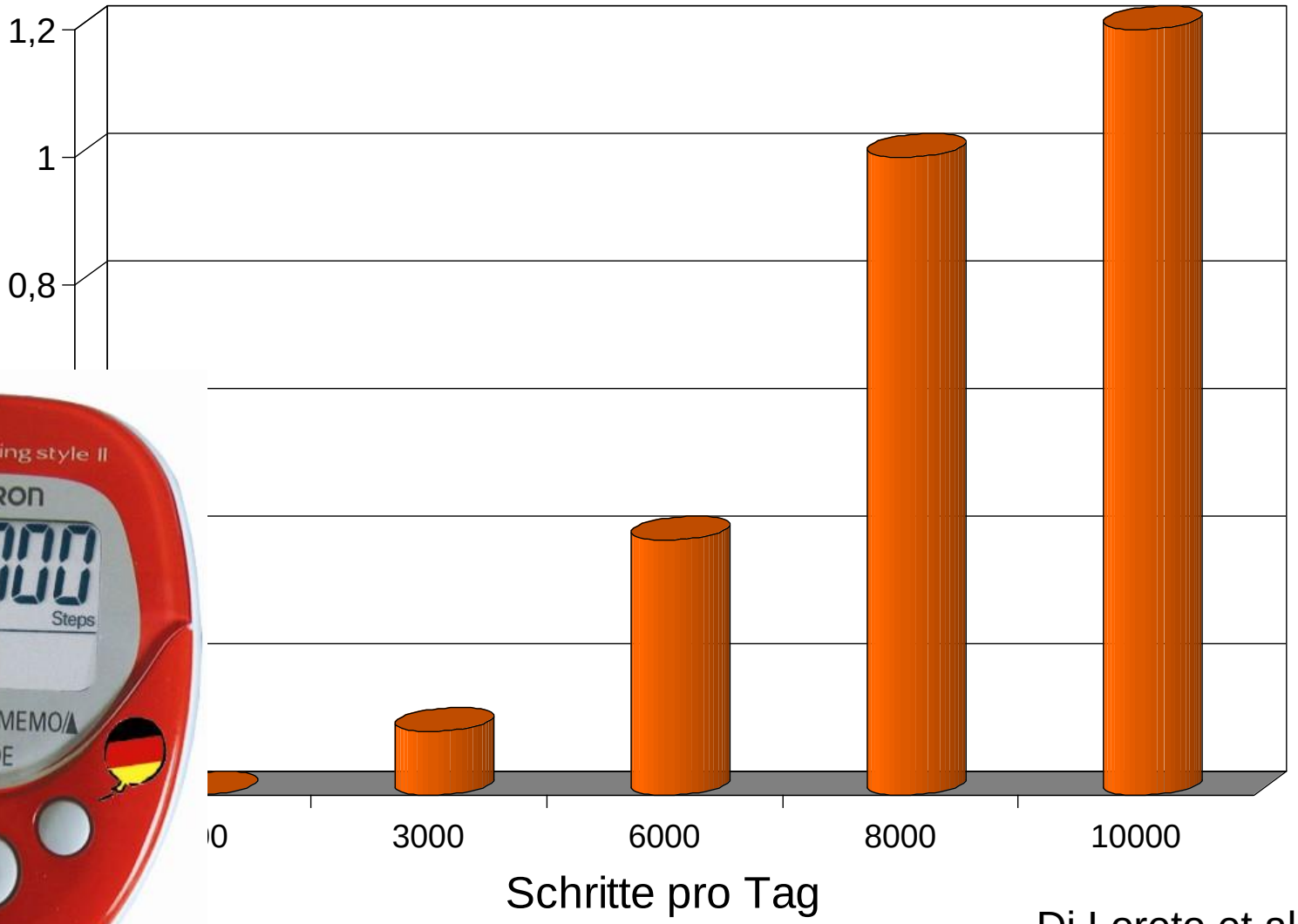
Figure 2. Risk reduction for all-cause mortality and chronic disease seen in physically active subjects.

Mean estimates of risk reduction for statins and all-cause mortality and cardiovascular disease from Taylor and colleagues,[10] cancer mortality risk estimates from Cholesterol Treatment Trialists' Collaboration,[11] and remaining mean risk reduction estimates from Warburton and colleagues.[8]

McKinney, J., Lithwick, D. J., Morrison, B. N., Nazzari, H., Isserow, S. H., Heilbron, B., & Krahn, A. D. (2016). The health benefits of physical activity and cardiorespiratory fitness. British Columbia Medical Journal, 58(3), 131-137.

RUPRECHT-KARLS-
UNIVERSITÄT
HEIDELBERG

Wie viele Schritte muss ich gehen…?



Di Loreto et al. 2005

RUPRECHT-KARLS-
UNIVERSITÄT
HEIDELBERG

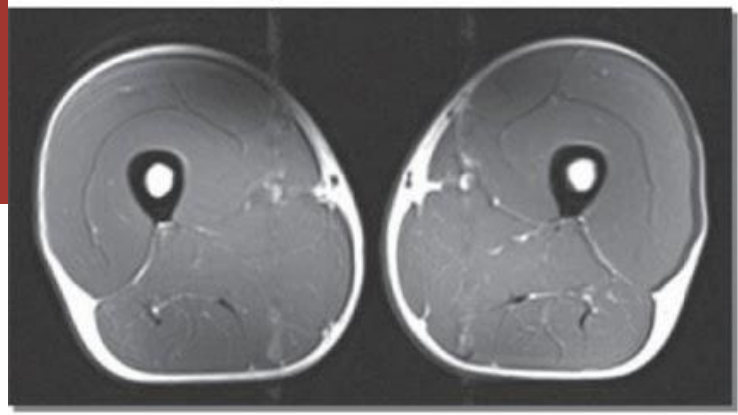
Gliederung

1. Einführung
2. Körperliche Aktivität macht gesund
3. Warum ist das so?
4. Etwas genauer ? Zwei Beispiele:
    - Körperliche Aktivität in der Onkologie
    - Sitzen als Gegenspieler
5. Fazit

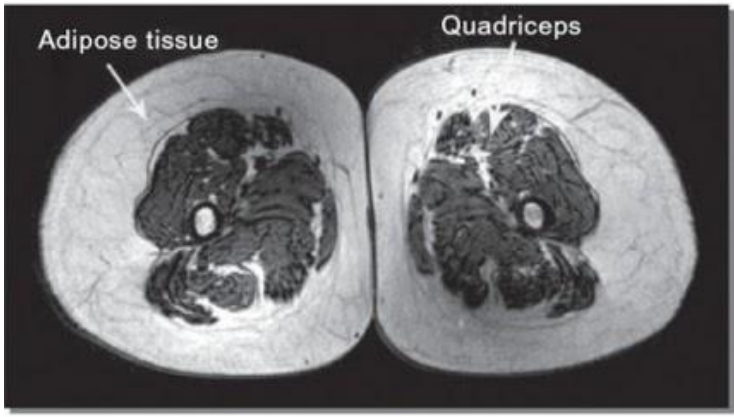
RUPRECHT-KARLS-
UNIVERSITÄT
HEIDELBERG

Der menschliche Körper ist sehr anpassungsfähig.

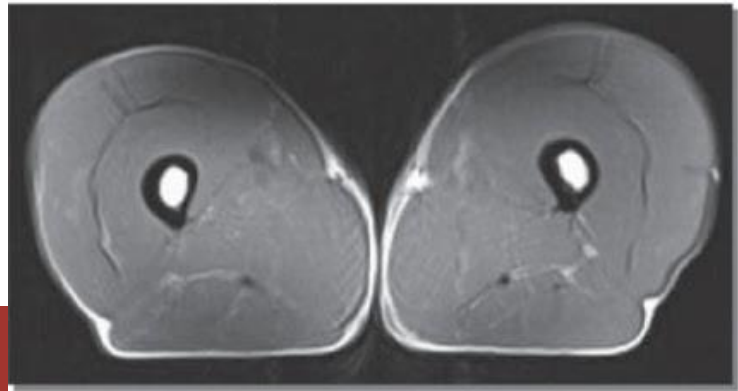
40-year-old triathlete



74-year-old sedentary man



70-year-old triathlete



Die Evolution

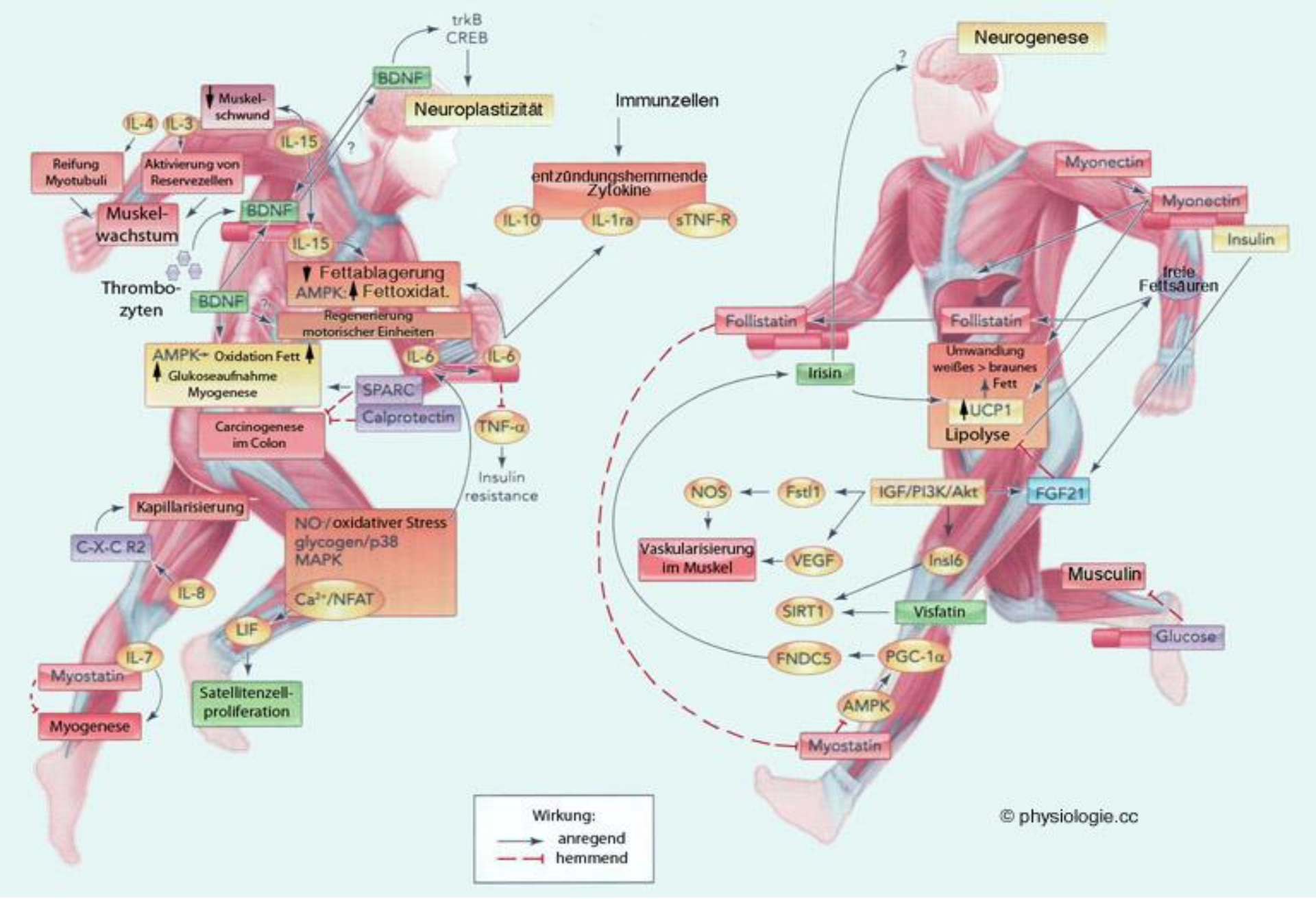
bevorzugte Menschen, die

- exzellent Fett speichern können,
- die körperliche Aktivität vermeiden,
- die essen, wenn immer etwas verfügbar ist.

Mindestens 1 000 000 Jahre seit ca. 70 Jahren

Mahlzeiten	Nahrung war unregelmäßig verfügbar, häufiger Wechsel zwischen Unterversorgung und Überversorgung (z. B. jahreszeitlich oder bei Jagderfolg: "feast and famine cycle") Hoher zeitlicher Aufwand zum Nahrungserwerb Nahrungserwerb mit Risiken verbunden	Nahrung mit hoher Kaloriendichte überall und für jeden ohne Zeitaufwand zugänglich, gänzlicher Ausfall von Hungerphasen Keinerlei Risiko beim Nahrungserwerb
Körperliche Aktivität	Regelmäßige ausdauernde körperliche Aktivität war überlebensnotwendig, auch noch lange nach dem sesshaft werden in der Jungsteinzeit	Keine Notwendigkeit zur täglichen körperlichen Aktivität, selbst bei sportlichen Menschen finden wir nur „periodische" Aktivitätsphasen
Speicherfähigkeit für Nahrung	Überlebensnotwendige Eigenschaft Eher seltene Speicherung, da Überangebot nicht sehr häufig. Je ausgeprägter diese Eigenschaft, desto bessere Chance nso lange zu leben, dass die eigenen Gene weitergegeben werden konnten	Funktionsverlust durch permanentes Nahrungsangebot Dieses führt zu häufigen Speichervorgängen und seltenem Verbrauch. Dieses Ungleichgewicht ist die Grundlage des Übergewichts und der metabolischen Erkrankungen

(Huber 2011; vgl. Chakravarty & Booth 2003, Power & Schulkin 2009)



Fiuza-Luces C et al, Exercise is the real polypill. Physiology 2013; 28: 330-58

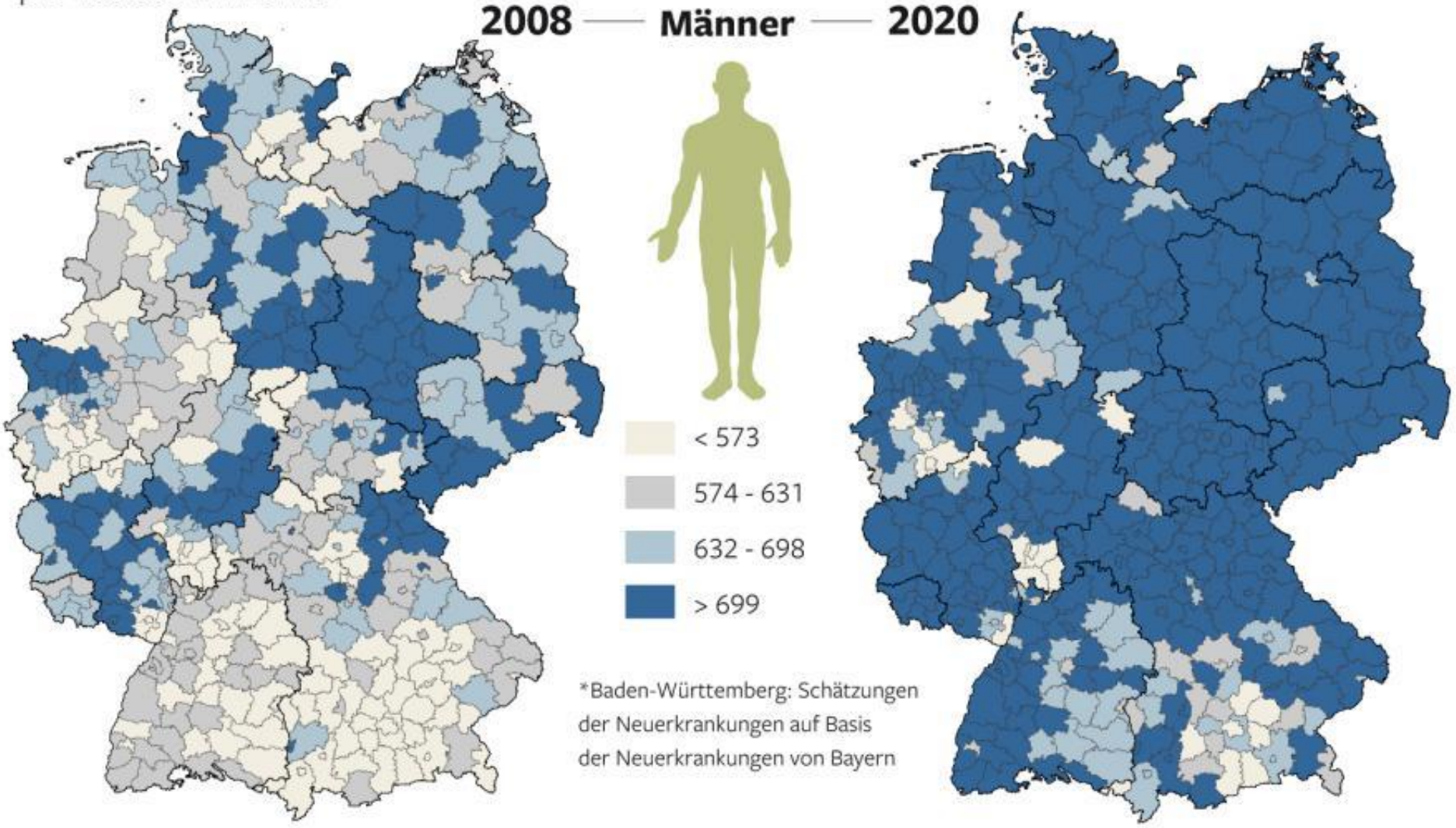
RUPRECHT-KARLS-
UNIVERSITÄT
HEIDELBERG

Gliederung

1. Einführung
2. Körperliche Aktivität macht gesund
3. Warum ist das so?
4. Etwas genauer ? Zwei Beispiele:
   - Körperliche Aktivität in der Onkologie
   - Sitzen als Gegenspieler
5. Fazit

Anzahl der Krebs-Neuerkrankungen

pro 100.000 Einwohner*

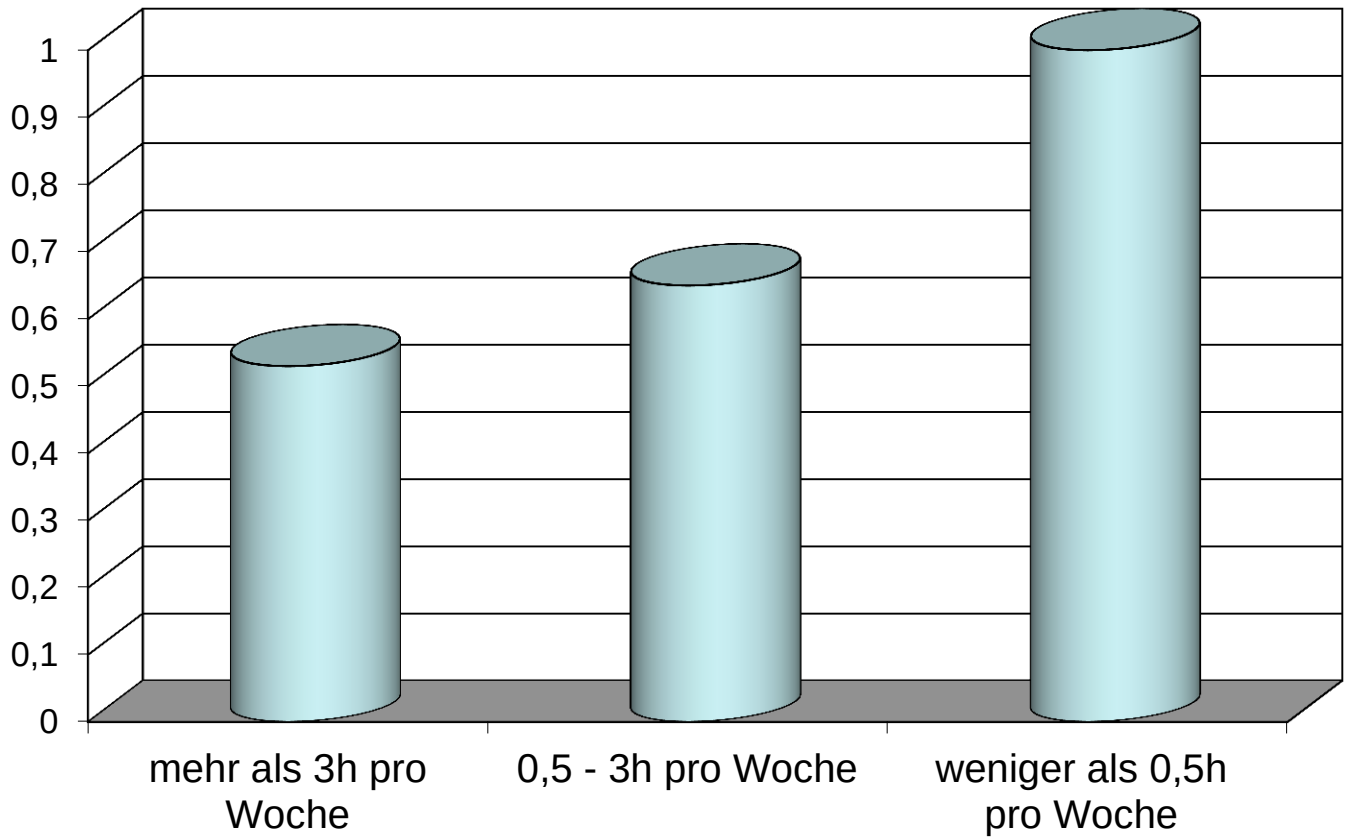


Quelle: ZfKD, Berlin; Stat. Bundesamt, Stat. Landesämter; © Institut für Community Medicine, 2012

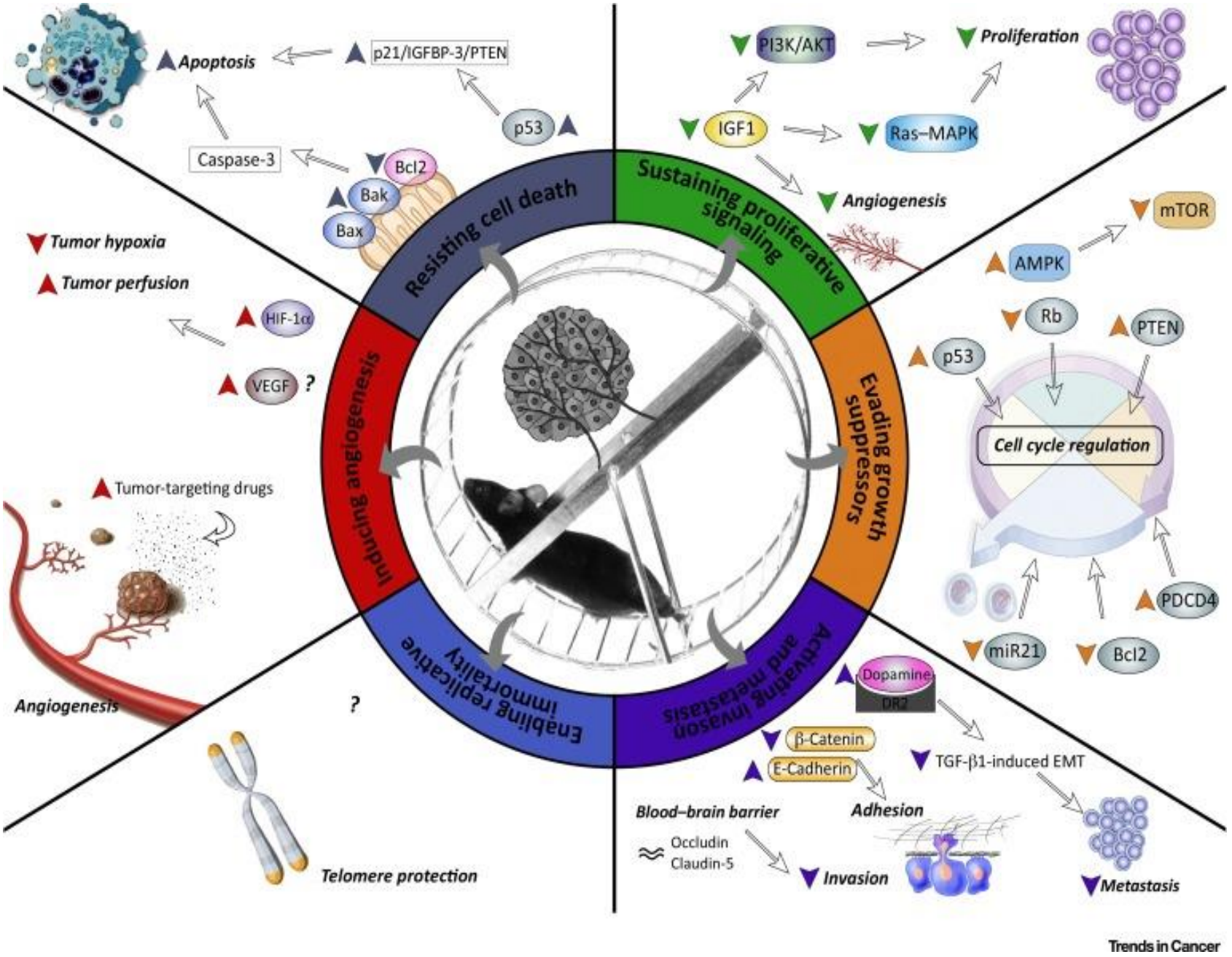
Summary of observational epidemiologic evidence on the association between physical activity and cancer

Cancer site	Consistency of evidence for decreased risk[1]	Strength of risk association		Dose-response[2]	Overall level of scientific evidence[3]
		Range of risk estimates	Average risk reduction		
Colon	43 of 51	0.3–1.0	40–50%	25 of 29	Convincing
Breast	32 of 44	0.3–1.6	30–40%	20 of 23	Convincing
Prostate	17 of 30	0.5–2.2	10–30%	9 of 13	Probable
Endometrium	9 of 13	0.1–1.0	30–40%	5 of 6	Possible
Lung	8 of 11	0.4–1.3	30–40%	4 of 5	Possible
Testis	3 of 9	0.5–3.3	10–30%	3 of 3	Insufficient
Ovary	3 of 7	0.3–2.5	20–30%	2 of 2	Insufficient
Kidney	2 of 6	NA[4]	NA	1 of 1	Insufficient
Pancreas	3 of 3	NA	NA	2 of 2	Insufficient
Thyroid	2 of 2	NA	NA	NE[5]	Insufficient
Melanoma	2 of 2	NA	NA	1 of 1	Insufficient

1 Of the total studies, number of studies demonstrating a reduction in risk of cancer with increased levels of physical activity.
2 Of the total studies examining trend, number of studies demonstrating a dose-response for decreased risk.
3 Definitions adapted from the World Cancer Research Fund and American Institute for Cancer Research (1). Convincing evidence is defined as evidence that is conclusive; probable evidence indicates evidence is strong enough to conclude that a causal relation is likely; possible evidence indicates a causal relation may exist; insufficient evidence indicates evidence is suggestive but too sparse to make a more definitive judgment.
4 NA, not applicable. Too few studies conducted to estimate a range in risk estimates.
5 NE. not examined.



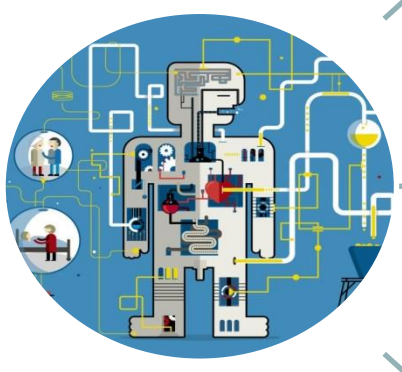
Wahrscheinlichkeit eines erneuten Auftretens des Brustkrebs in Abhängigkeit vom Umfang der körperlichen Aktivität (Daten aus West-Wright et al.; 2009)



Ruiz-Casado, A., Martín-Ruiz, A., Pérez, L. M., Provencio, M., Fiuza-Luces, C., & Lucia, A. (2017). Exercise and the Hallmarks of Cancer. Trends in cancer, 3(6), 423-441.

RUPRECHT-KARLS-
UNIVERSITÄT
HEIDELBERG

Biopsychosoziale Wirkmechanismen



Bio-logische Effekte

- DNA Reparatur
- Immunfunktion
- Inflammation
- „Adipokine“
- Insulinsensitivität

Psych-ische Effekte

- Selbstwirksamkeit
- Kontrollüberzeugung
- „Kohärenzsinn“

Soziale Effekte

- Soziale Unterstützung
- Information & Wissen
- Emotionale Unterstützung

RUPRECHT-KARLS-
UNIVERSITÄT
HEIDELBERG

Gliederung

1. Einführung
2. Körperliche Aktivität macht gesund
3. Warum ist das so?
4. Etwas genauer ? Zwei Beispiele:
   - Körperliche Aktivität in der Onkologie
   - Sitzen als Gegenspieler der körperlichen Aktivität
5. Fazit

WE ARE SITTING TOO MUCH

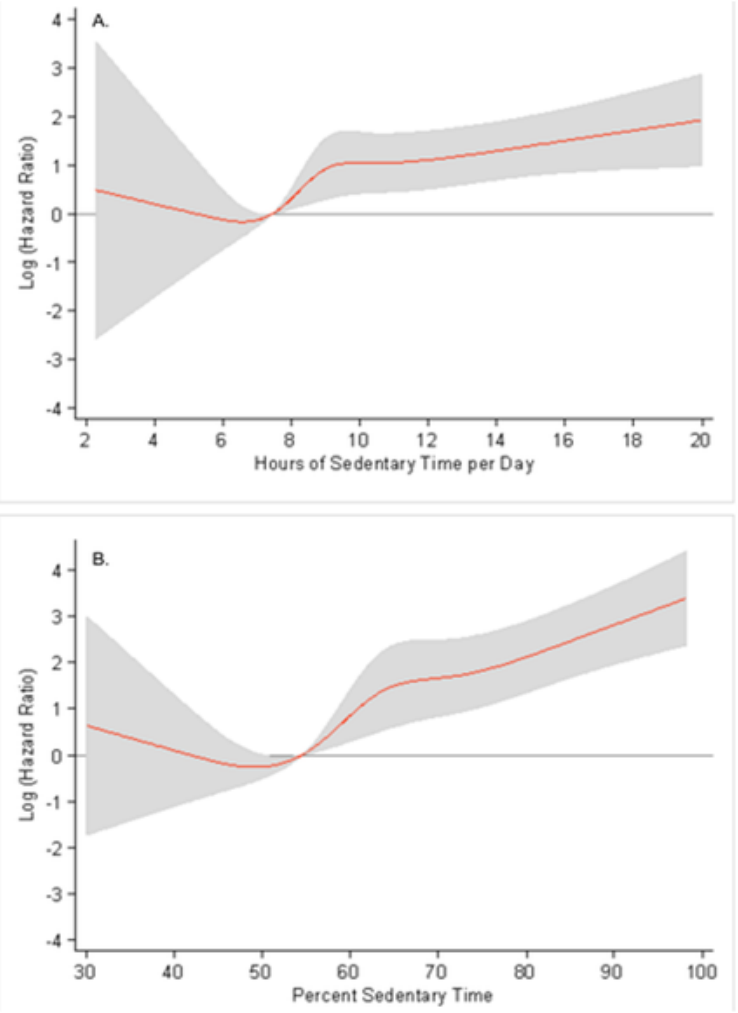
"Sitting Disease" by the numbers

Our modern sedentary lifestyles, both at home and in the workplace, are costly for us and for our employers.

Average hours of seated commute
+ average hours of seated homelife = too much sitting!

A 2008 Vanderbilt University study of 6,300 people published in the *American Journal of Epidemiology* estimated that the average American spends 55% of waking time (7.7 hours per day) in sedentary behaviors such as sitting.

Figure 1. Log hazard ratio (with 95%CI bands), for hours of sedentary time (A) and percent sedentary time (B).

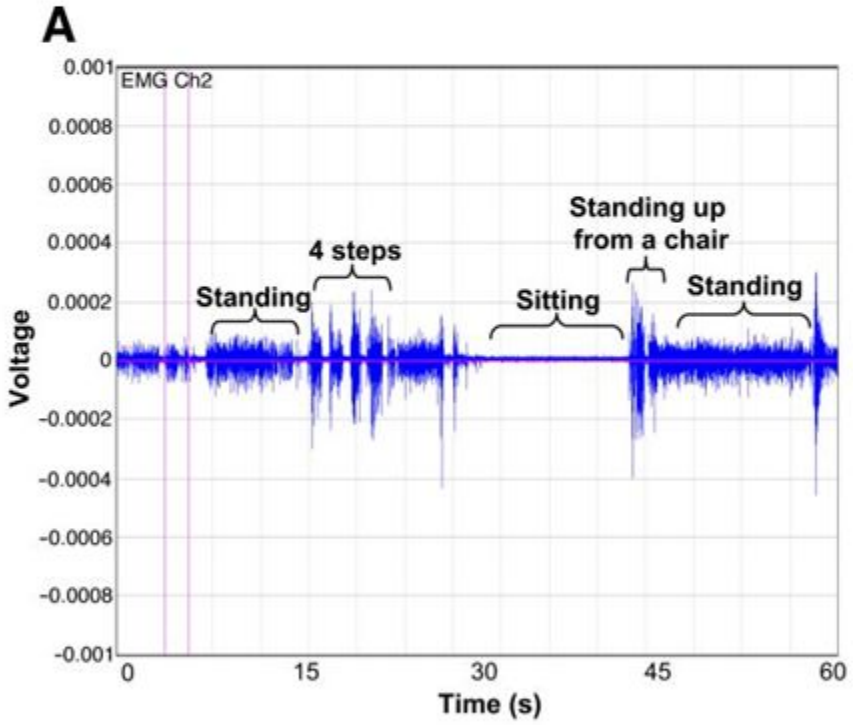


Koster A, Caserotti P, Patel KV, Matthews CE, Berrigan D, et al. (2012) Association of Sedentary Time with Mortality Independent of Moderate to Vigorous Physical Activity. PLoS ONE 7(6): e37696. doi:10.1371/journal.pone.0037696
http://127.0.0.1:8081/plosone/article?id=info:doi/10.1371/journal.pone.0037696

Inactive Physiology and Muscle

- Electromyogram recordings from a leg skeletal muscle during standing, stepping, sitting and rising from a chair reveal that only sitting results in no contractile activity (Hamilton et al., 2007).

- Rats prevented from both exercising and standing or walking have decreased LPL activity in postural muscles resulting in lower plasma HDL cholesterol. (Bey & Hamilton 2003 J Physiol)

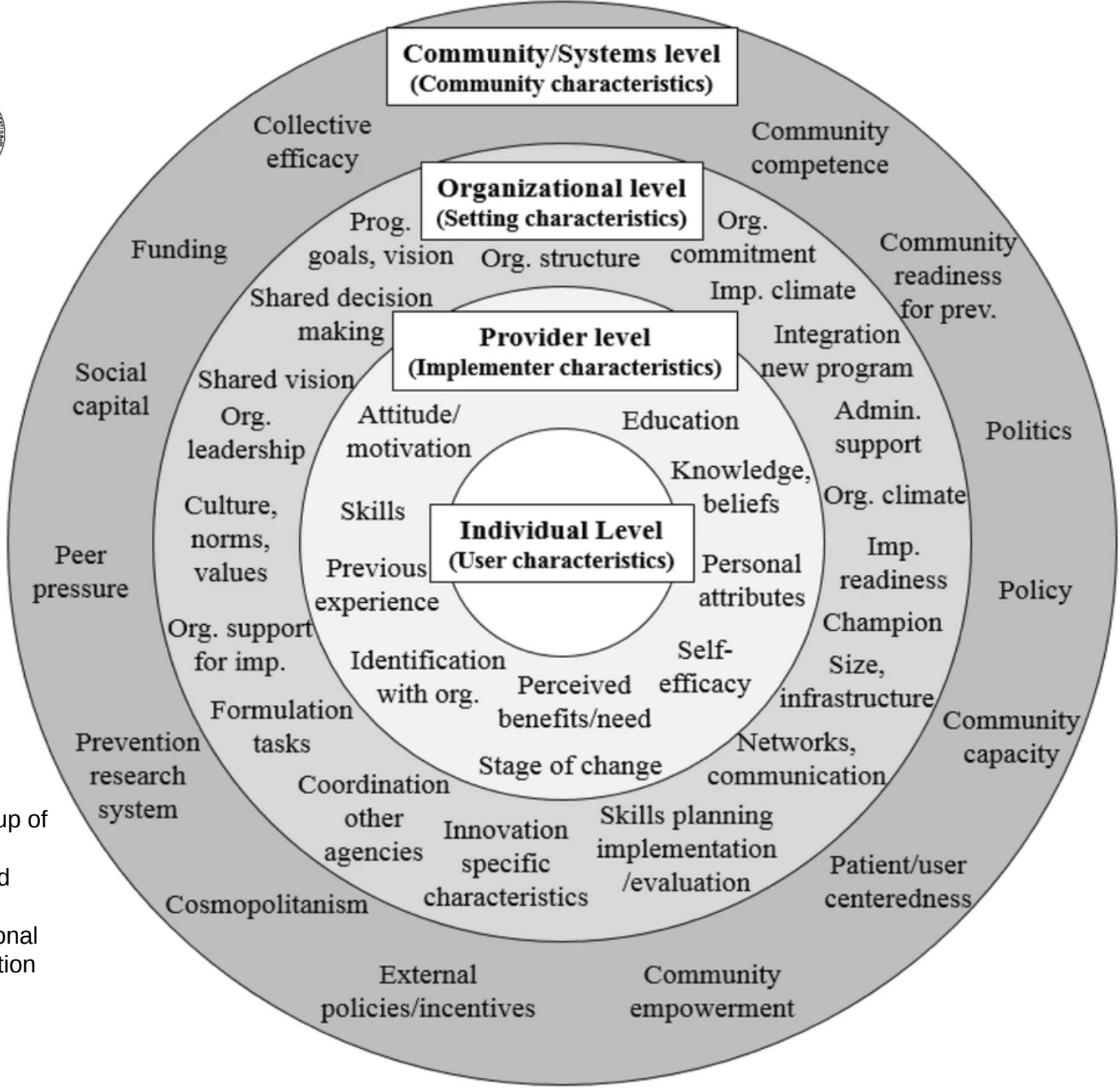


RUPRECHT-KARLS-
UNIVERSITÄT
HEIDELBERG

Gliederung

1. Einführung
2. Körperliche Aktivität macht gesund
3. Warum ist das so?
4. Etwas genauer ? Zwei Beispiele:
   - Körperliche Aktivität in der Onkologie
   - Sitzen als Gegenspieler
5. Fazit

RUPRECHT-KARLS-
UNIVERSITÄT
HEIDELBERG



Koorts, Harriet, et al.: Implementation and scale up of population physical activity interventions for clinical and community settings: the PRACTIS guide." International Journal of Behavioral Nutrition and Physical Activity 15.1 (2018): 51.

Was muss ich tun, um davon zu profitieren?

Ein MET = 1 kcal (or 4.184 kJ) . kg-1 . hr-1

RUPRECHT-KARLS-
UNIVERSITÄT
HEIDELBERG

FAZIT

"There is nothing miraculous about exer
long it is taking mainstream medicine to
activity. ….. builds on decades of epidem
identifying the "potential" health gain if
physical activity…..

MacAuley, D., Bauman, A., & Frémont, P. (2016). E
medicine. Br J Sports Med, 50(18), 1107-1108.

Leitlinien und Empfehlungen :

World Health Organization. (2018). Global action plan on physical activity 2018–2030: more active people for a healthier world. World Health Organization.
https://apps.who.int/iris/bitstream/handle/10665/272722/9789241514187-eng.pdf

Nationale Empfehlung für Bewegung und Bewegungsförderung
https://www.bundesgesundheitsministerium.de/fileadmin/Dateien/5_Publikationen/Praevention/Broschueren/Bewegungsempfehlungen_BZgA-Fachheft_3.pdf