Psychological health benefits of nature

Prof. Kalevi Korpela,
Univ. of Tampere, School of Social Sciences & Humanities / Psychology

Areas of Accumulating Evidence - 1

• Epidemiological studies and quasi-experiments and are documenting associations between percentage of (access or proximity to) outdoor green space and various health outcomes (self-rated health, morbidity, mortality).

Maas et al. (2009). *J Epidemiol Community Health 2009;63:967-973*

- **Morbidity** data were derived from electronic medical records of 195 general practitioners in 96 Dutch practices.
- Only people who had been registered with their current GP for longer than 12 months prior to the study (n=345143) were included.
- Morbidity was classified by the general practitioners according to the International Classification of Primary Care.
- The **percentage of green space within a 1 km radius around the postal code coordinates** was derived from an existing database and was calculated for each household.

Mental

Percentage of green space in 1 km radius

	Odds ratio, p<0.01
Depression	**0.96 (0.95** to **0.98)**
Anxiety disorder	**0.95 (0.94** to **0.97)**

ORs are derived from multilevel logistic regression analysis, controlling for demographic and socioeconomic characteristic and urbanicity.

Prevalence rates per 1000 in living environments with 10% and 90% green space within a 1km radius around their home for different disease clusters.

Cluster	Prevalence per 1000	
	10% green space	90% green space
Cardiovascular		
High blood pressure	23.8	22.4
Cardiac disease	4.7	4.0
Coronary heart disease	1.9	1.5
Stroke, brain haemorrhage	0.92	0.76
Musculoskeletal		
Neck and back complaints	125	106
Severe back complaints	99.2	65.8
Severe neck and shoulder complaints	75.6	63.3
Severe elbow, wrist and hand complaints	23.0	19.3
Osteoarthritis	21.8	21.3
Arthritis	6.7	6.2
Mental		
Depression	32	24
Anxiety disorder	26	18
Respiratory		
Upper respiratory tract infection	84	68
Bronchi(oli)tis/pneumonia	16.0	14.7
Asthma, COPD	26	20
Neurological		
Migraine/severe headache	40	34
Vertigo	8.3	6.6
Digestive		
Severe intestinal complaints	14.9	12.3
Infectious disease of the intestinal canal	6.5	5.1
Miscellaneous		
MUPS	237	197
Chronic eczema	5.5	4.9
Acute urinary tract infection	23.2	19.4
Diabetes Mellitus	10	8
Cancer	4.9	4.4

Independent variable	**Mediating Processes**	Dependent /outcome variable
	Restoration = Stress Reduction and Reduction of Attentional Fatigue	
	Other psychological processes: Self-esteem, vitality, autonomy	
Natural settings/ Green Space	Physical Activity	Health and well-being outcomes
	Social relationships / social cohesion	
	Noise, Air Pollution	

Areas of Accumulating Evidence - 2

• Experiments are improving our understanding of the (co-occurring, mediating and moderating) processes involved in the well-being and health effects (restoration/stress, mood, self-esteem, energy) their temporal characteristics, and the features of environments that promote them.

Attention Deficit-Hyperactivity Disorder ADHD

- The same 7-12-year-old children with ADHD walked for 20 minutes in each of three environments that differed from one another in the level of greenery:
- a park,
- a neighborhood, and
- a quiet downtown area (Faber Taylor & Kuo, 2009).
- After each walk, concentration was measured using Digit Span Backwards -test.
- The findings confirmed that the attention of children with ADHD functions better after spending time in more natural settings.
- Effect sizes were substantial (Cohen's d =.52 in a park vs. a downtown walk and .77 in a park vs. a neighborhood walk) and comparable to those reported for methylphenidate-based drugs.

Areas of Accumulating Evidence - 3

• Intervention studies are helping us to appreciate the ways in which natural settings can be used in caring for and treating people suffering from debilitating conditions such as depression and burnout syndrome.

- The effect of cognitive behavior therapy on clinical depression (remission) when applied
- **in a forest environment (forest arboretum) n = 23,**
- **inside the hospital room n = 19**
- **in a control group receiving usual outpatient management n = 21**

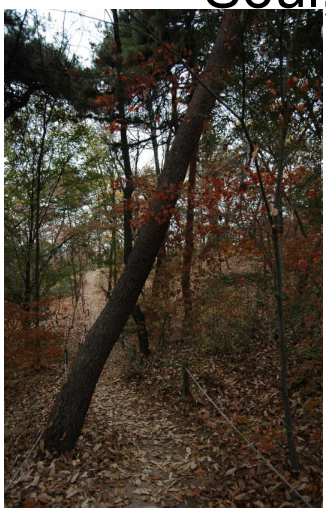
- All patients had had medical treatment 3 months before the experiment and the mediaction continued during the experiment.
  Kim et al., 2009

TABLE 1. The demographic characteristics of all participants

		Forest group (n=23)	Hospital group (n=19)	Controls (n=21)	p
Age (years)		43.39±12.14	44.26±13.49	48.76± 9.63	0.093
Sex (male : female)		3 : 20	2 : 17	4 : 17	0.727
Weight (kg)		54.90± 8.32	59.94±13.87	61.72±10.20	0.141
Height (cm)		161.15± 4.72	160.13±11.37	161.50± 9.21	0.892
Education	<9 year	5	4	6	0.860
	9-12 year	10	6	8	
	>12 year	8	9	7	
Marital status	Married	14	10	15	0.470
	Single	9	9	6	
Age of onset (years)		38.57±10.99	43.60±13.64	43.25± 8.35	0.266
Number of psychiatric admission		0.96± 1.75	1.19± 2.07	1.43± 1.36	0.601
Number of depressive episode		1.67± 1.59	1.89± 2.09	1.79± 2.64	0.583

Mean±SD, n

Hong-Reung forest arboretum, Soul, South-Korea



- 4-week therapy once a week, 3 hours per session.
- **Forest group** reflected their problems and tried to reconstruct cognitive errors (typical for depression) after strolling in the forest and hearing stories about trees.

  Mindfulness-meditation: Maintain awareness of the moment by focusing on breath, wind in the forest and sounds.

- **Hospital room**: forest observation was substituted with watching window scenery or objects in the room. Use of forest objects in the meditation was substituted with use of objects inside the room.

- HRSD (physical symptoms) , MADRS (psychological symptoms), BDI (Beck's depression inventory), SF-36 salivary cortisol.

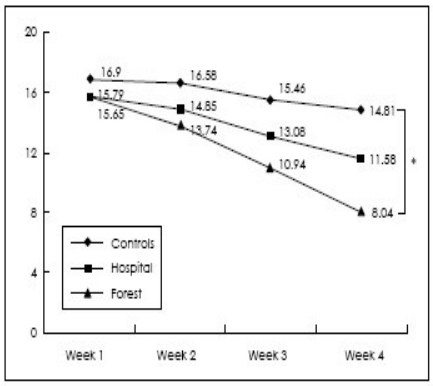


FIGURE 1. The change of HRSD scores in forest group, hospital group, and controls during 4 week program. The repeated measure ANOVA showed a significant time effect (F=43.16, p<0.001) and a significant between-group effect (F=3.95, p=0.025). *Post hoc analysis showed only the difference between forest group and controls, p=0.020. HRSD: Hamilton Rating Scales for Depression, repeated ANOVA: repeated measure of analysis of variance.

marized in Table 1. There was no group difference in de-

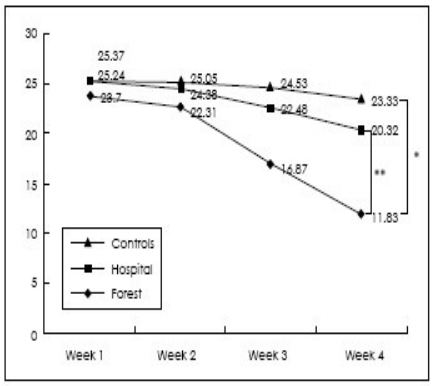


FIGURE 2. The change of MADRS scores in forest group, hospital group, and controls during 4 week program. The repeated measure ANOVA showed a significant time effect (F=43.25, p<0.001) and a significant between-group effect (F=5.69, p=0.005). *Post hoc analysis showed not only the difference between forest group and controls (p<0.007), **But also the difference between forest group and hospital group (p<0.048). MADRS: Montgomery-Asberg Depression Rating Scales. repeated ANOVA: repeated measure of analysis of variance.

The number of persons showing remission (HRSD <7) of depressive symptoms was largest in the forest group.

TABLE 2. The numbers of remitter after 4 week program in forest group, hospital group, and controls

	Forest group	Hospital group	Controls	χ^2	p
Numbers of remitter	14	4	1	17.5	<0.001
Numbers of non-remitter	9	15	20		
Total	23	19	21		

Post hoc analysis showed also the difference between forest group and hospital group (χ^2=6.74, p=0.027)

Salivary cortisol was lower after the experiment only in the forest group.

TABLE 4. Salivary cortisol concentrations before and after 4 week program in forest group, hospital group, and controls

Salivary cortisol (μg/dL)	Before the 4 week program	After the 4 week program	t	p
Forest group	0.113 (0.053)	0.082 (0.044)	2.97	0.008
Hospital group	0.125 (0.052)	0.132 (0.057)	-1.62	0.121
Controls	0.137 (0.100)	0.148 (0.106)	-1.31	0.206

Mean (SD), paired t-test

Gonzalez, Hartig ym. 2010

- A single-group study with a convenience sample of 28 people with diagnosed clinical depression.
- Data were collected before (3 baseline measurements), twice during, and immediately after a 12-week therapeutic horticultural programme (in spring 2009), and at 3-month follow-up.
- 25-64-year old (mean age 44,1 yrs.), 7 male, 21 female

- Research setting: four farms in natural landscapes.
- Therapy: 3 months, twice per week, 3 hours at a time in 4-7 person groups; many possibilities for being alone.
- Activities: sowing, germinating, potting, planting and cultivating vegetables, flowers and herbs.
- Passive: sitting on benches, watching and listening to birds, the weather, and the landscape.

Results

- Mean depression scores (Beck Depression Inventory) declined significantly during the intervention.
- This decline was clinically relevant (score change $\geq$ 6) for half (50%) of the participants.
- Participants maintained their improvements in depression scores at 3-month follow-up.
- Attentional capacity scores increased significantly.

Areas of Accumulating Evidence - 4

•Surveys and experiments are increasing our understanding of the ways in which people make deliberate use of environments for restorative experiences, stress-regulation and self-regulation over extended periods of time.

- In our studies of favourite places we have proposed that **visits to a close-to-home <u>favourite place</u> are one of the "windows" (units of analysis)** through which well-being and restorative experiences can be fruitfully studied in an everyday context.
- These places are selected by the respondents themselves not by the researchers.
- They use and visit these places over extended periods of time.

Kaupunkien viheralueet ja ihmisten hyvinvointi
Suomen Akatemia, proj.no 211031
Data and methods

Data:

- a mail survey conducted autumn 2005
- a random sample of 3000 residents in Helsinki and Tampere
- respondents 15-75 years old
- Response rate: 42.6 (1273 responses)

Main themes of the questionnaire:

- wishes and expectations concerning urban green areas
- use of urban green areas and other nature areas
- Self-reported health and well-being
- background information of respondents (age, gender etc.)

Sum variables of green areas

Variables:	Factors:			
	F1 woods and other nature areas	**F2** built green areas	**F3** city sites	**F4** functional green areas
large, continuous forest areas	**,986**	-,286	,083	,028
small forested areas	**,741**	,118	,046	-,053
landscaped fields and meadows	**,688**	,030	-,006	,075
small, pristine areas	**,620**	,128	-,018	-,037
traffic green areas	,060	**,704**	,025	-,015
block green areas	,108	**,686**	-,048	-,002
decorative plantations	-,098	**,666**	,061	-,055
built parks	-,074	**,449**	,329	,147
spacious and green sites/lots	,390	**,403**	-,202	,010
streets and outdoor spaces of city centers	,053	,072	**,808**	-,024
service areas and indoor spaces of city centers	-,001	-,016	**,799**	-,014
playgrounds	-,068	,009	-,072	**,657**
running tracks, sports fields, and built exercise areas	,001	-,092	,058	**,520**
allotment gardens and plot cultivation	,086	,014	-,034	**,430**
dog exercise areas	,086	,066	,024	**,251**
Rotation	3,23	2,81	1,78	1,66
Cumulative % of Variance	24,4	37,9	42,7	47,0

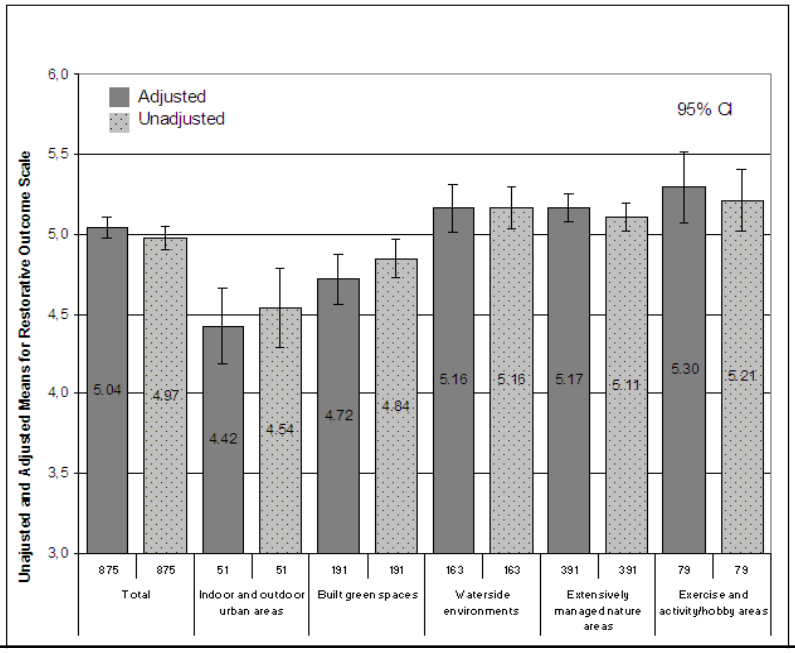
Favourite places of the participants aged 15-75 yrs. (Tampere and Helsinki), the distance to the place from home being equal or less than 15 km.

	f	%
Extensively managed nature areas	466	43 %
Built green spaces	253	23 %
Waterside environments	203	19 %
Exercise and activity/ hobby areas	99	9 %
Indoor and outdoor urban areas/places	68	6 %
	1089	100 %

Restorative experiences and benefits in the favourite place (measured with six items)

- "This item describes my experience"… rated on a Likert scale ranging from 1 to 7 (1 = not at all, 7 = completely).
- Three of the items reflected **relaxation and calmness**:
  - "I feel myself calmer after being here"
  - "After visiting this place I always feel restored and relaxed"
  - "I get new enthusiasm and briskness to my everyday routines from here",
- One item reflected **attention restoration**:
  - "My concentration and alertness increase clearly here"
- Two items reflected **clearing one's thoughts:**
  - "I can forget my everyday worries here"
  - "Visiting this place is a way of clearing and clarifying my thoughts".
- Internal consistency (Cronbach's alpha) for the six-item scale (mean item response, n = 1242) was α = .92

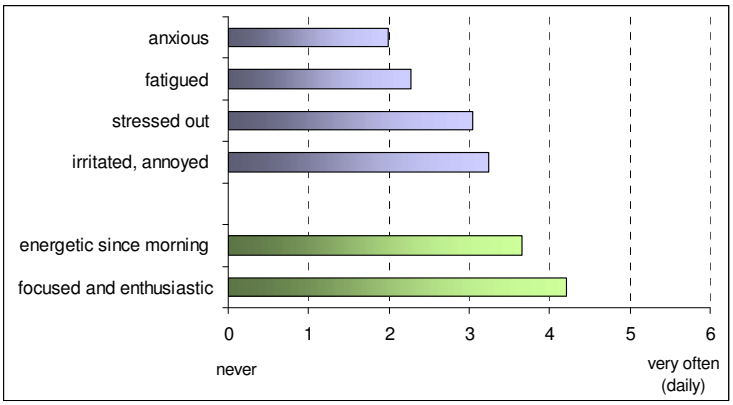
Results



Through multiple regression we found nine **determinants of restoration outcome (ROS) scores**; these were adjusted for in ANCOVA analyses.

1. Length of stay in favorite place (1 item)
2. Nature orientedness (scale, 5 items)
3. Frequency of visiting the fav. place (1 item)
4. Uplifts derived from social relations (1 item)
5. Nature being important as such before 16 yrs. of age (1 item)
6. Nature hobbies (1 item)
7. Hassles/worries related to money (1 item)
8. Satisfaction with life (scale, 5 items)
9. Hassles/worries with work (1 item)

Reported emotions



Connection between pastime green area exposure and emotions

	Usage of urban green areas: (h /month)				
	under 5	5–10	10–20	over 20	Significance
Positive emotions	3,73 N = 319	3,90 N = 239	4,00 N = 312	4,09 N = 346	F = 6,81 p = 0,000

	Green area exposure from outside city limits: (trip/month)				
	under 1	1-3	3-6	over 6	Significance
Negative emotions	2,72 N = 268	2,76 N = 363	2,71 N = 310	2,36 N = 290	F = 6,65 p = 0,000
Positive emotions	3,67 N = 269	4,03 N = 368	3,95 N = 310	4,02 N = 294	F = 7,16 p = 0,000

Connection between green area exposure related to work and emotions

	Journey to school or work passes through green areas:			
	not at all/very little	at most half	over half	Significance
Positive emotions	3,91 N = 254	3,97 N = 283	4,26 N = 98	F = 4,48 p = 0,012

	Work or studying includes spending time in nature at least once a week:		
	No	Yes	Significance
Negative emotions	2,83 N = 805	2,53 N = 99	t = -2,36 p = 0,019
Positive emotions	3,98 N = 810	4,20 N = 99	t = 2,01 p = 0,045

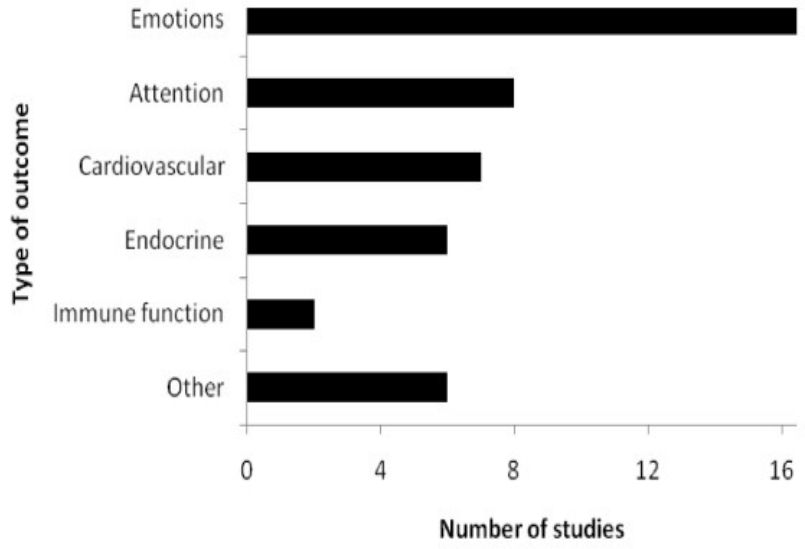
- What kind of overview can be made of these studies?
- What is the quality of the evidence?

Restorative outcomes include

- Physiological relaxation (measured by alpha-waves in the brain, muscle tension in the forehead, skin conductance, pulse transit time, blood pressure, heart rate, cortisol) -> 7 min.
- Decrease in negative feelings (**anger, sadness, anxiety and fatigue** (meta-anal. Bowler et al. 2010) and increase in positive mood (**tranquility and energy**, inconsistent results Bowler et al. 2010) -> 20 min.
- Recovery of the **ability to concentrate** (to work etc.), **attentional** focus (not when effect sizes are adjusted for pretest differences Bowler et al. 2010) -> 40 min.

- A meta-analysis of 25 studies (published in 2009 or earlier) comparing measurements of health or well-being in natural vs. urban/built indoor/outdoor environments.

- Bowler *et al. BMC Public Health* 2010 **10**:456



The number of studies that measured health or well-being data within different categories (total number of studies = 25). 'Emotions' included self-reported emotions based on questionnaire scores; 'Attention' included tests of attention (e.g. Digit Span test) and symptoms of ADD/ADHD; 'Cardiovascular' included blood pressure and pulse; 'Endrocrine' included measurements of hormone concentrations; 'Immune function' included measurements of factors involved in immune function and 'Others' are detailed within the text. Bowler *et al. BMC Public Health* 2010 **10**:456

Bowler et al. 2010 Main Result

- **The most consistent evidence over several studies concerns <u>emotional outcomes.</u>**
- **The pooled effect sizes (Hedges *g*) when comparing data <u>before and after</u> the activity in the natural environment** showed significant effect sizes for
- decrease in negative feelings (**anger, sadness, anxiety and fatigue**
- increase in positive mood (**tranquility and energy**) but there was some inconsistency in the results

Other outcomes

- Self-esteem; a meta-analysis of 10 UK studies (Univ. of Essex) on “green exercise” with 1252 participants (Barton & Pretty, 2010).
- “green exercise” = activity in the presence of green places/nature
- The overall effect size for improved self-esteem was d = .46 (CI 95% .34-.59, p >. 001).

TABLE 1. Descriptive Data on the Green Exercise Interventions Included in the Meta-Analysis[a]

project number	no. participants	type of activities	type of environments	cohort
1	256	cycling, gardening, walking, fishing, boating, horse-riding	countryside/farmland, forest and woodland, urban green, waterside	individuals choosing to engage in GE activities
2	153	walking	countryside/farmland, forest and woodland, wild habitats	individuals at NT sites
3	38	farming activities	countryside/farmland	visitors to care farms
4	11	gardening	forest and woodland	students
5	57	walking	countryside/farmland, forest and woodland, waterside, wild habitats	members of local mind association
6	86	walking	forest and woodland	individuals choosing to engage in GE activities
7	447	walking	urban green	individuals at urban flower show
8	59	farming activities	countryside/farmland	visitors to care farms
9	10	walking, water based (sailing)	wild habitats, waterside	young offenders
10	135	gardening	urban green	individuals responsible for allotments

[a] Note: These studies were conducted with (1) Countryside Recreation Network, (2) National Trust, (3) National Care Farming Initiative, (4) University of Essex, (5) Mind, (6) Highwoods Country Park, (7) Royal Horticultural Society, (8) LEAF, (9) Wilderness Foundation, and (10) local allotment societies.

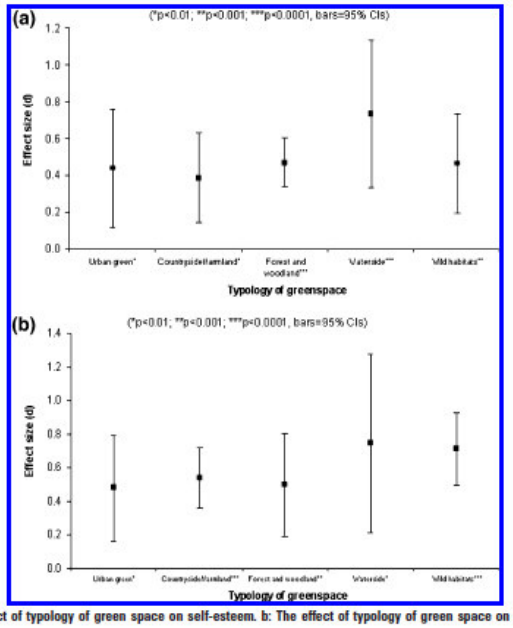


FIGURE 4. a: The effect of typology of green space on self-esteem. b: The effect of typology of green space on TMD.

1= Urban green 2 = countryside/farmland 3 = forest and woodland 4= waterside 5 = wild habitats

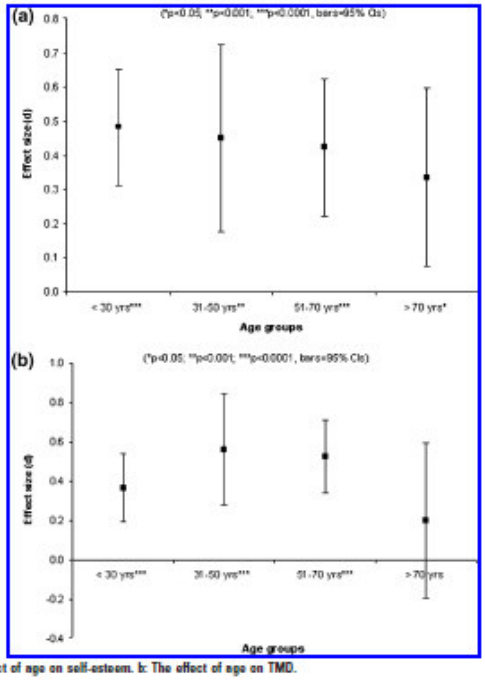


FIGURE 5. a: The effect of age on self-esteem. b: The effect of age on TMD.

- Thanks!