The effect of smoking on reaction times over lifespan

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Abstract

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Keywords: first keyword; second keyword

Word count: X

The effect of smoking on reaction times over lifespan

Reaction times are shown to change across lifespan (Blomkvist et al., 2017). Blomkvist et al. (2017) provided reaction time data for various ages. From these data we can test to what extent age-related changes are affected by smoking.

Method

Participants

We analysed the data from 345 participants. The median age of the sample is 58 years with a *SD* of 20.71 with a minimum of 20 and a maximum of 99 years of age.

Data analysis

Average response times larger than 5000 msecs were removed from the analysis (N = 1, 0.07%). Reaction time changes over age are shown in Figure 1.

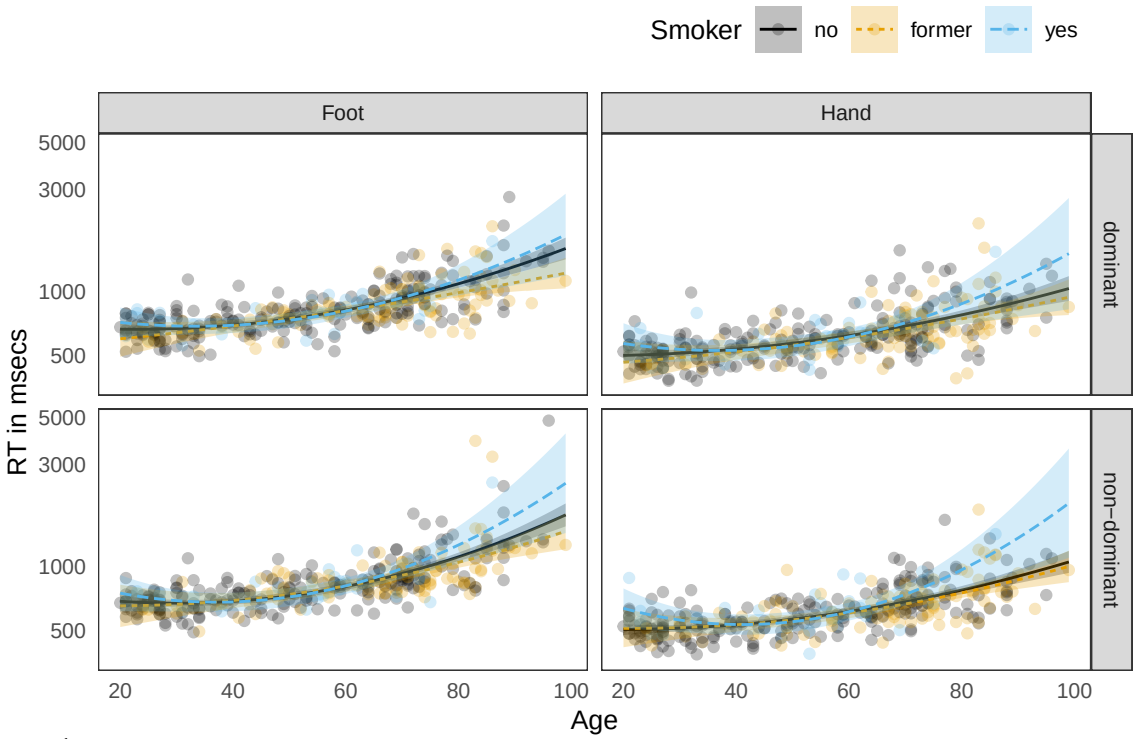

Figure 1

Raw reaction times with locally fitted functions.

Theoretical model

Equation 1 is a regression model with age, smoker (levels: yes, no, former) and their interaction as predictors (ANCOVA) formally expressed as

$$\begin{aligned} y_i = \beta_0 + \beta_1 \cdot age_i + \beta_2 \cdot age_i^2 + \beta_3 \cdot smoker_i + \\ \beta_4 \cdot age_i \cdot smoker_i + \beta_5 \cdot age_i^2 \cdot smoker_i + \epsilon_i \end{aligned} \tag{1}$$

where ϵ is the residual error term that is assumed to be normally distributed around 0

$$\epsilon \sim N(0, \sigma^2)$$

with a standard deviation σ^2.

Model results

Fixed effects were added incrementally and evaluated using a Likelihood-ratio test. Here is a table in Table 1 showing the results of the likelihood-ratio test.

The Likelihood-ratio test revealed that including age as quadratic predictor rendered a better fitting model compared to age as linear predictor $F(1, 685) = 31.29$, $p < .05$.

The overall model is significant; $R^2 = .42$, 90% CI $[0.37, 0.46]$, $F(8, 679) = 62.17$, $p < .001$.[1] Slowdown in reaction times across age has a quadratic function; $b = 1.76$, 95% CI $[1.13, 2.39]$, $t(679) = 5.45$, $p < .001$. The slowdown across age was more prominent for smokers compared to former smokers and non-smokers; $b = 0.80$, 95% CI $[0.24, 1.37]$, $t(679) = 2.79$, $p = .005$.

Figure 2 shows marginal estimated development curves for the effect of smoking on reaction times in higher age. Towards the older ages, smokers shows longer reaction times

[1] Note, that this is just an example. This result is not surprising because the baseline is an intercept only model.

Table 1

Likelihood-ratio test

Model	SumSq	RSS	*df*	df_{res}	*F*-statistic	*p*-value
M_0		46		687		
M_{age}	17.71	28.29	1	686	452.8	< .05
M_{age^2}	1.22	27.07	1	685	31.29	< .05
M_{smoker}	0.19	26.88	2	683	2.46	.09
$M_{interaction}$	0.33	26.55	4	679	2.08	.08

Note. This is a note

Table 2

Model coefficients

Predictor	*b*	95% CI	*t*(679)	*p*
Intercept	6.45	[6.42, 6.47]	543.49	< .001
Polyage, 21	4.68	[3.96, 5.41]	12.69	< .001
Polyage, 22	1.76	[1.13, 2.39]	5.45	< .001
Smoker, quit smoking	-0.01	[-0.03, 0.01]	-1.25	.213
Smoker, smoking	0.03	[0.01, 0.05]	2.78	.006
Polyage, 21 × Smoker, quit smoking	-0.08	[-0.66, 0.50]	-0.27	.784
Polyage, 22 × Smoker, quit smoking	-0.11	[-0.61, 0.39]	-0.42	.672
Polyage, 21 × Smoker, smoking	0.36	[-0.28, 1.00]	1.10	.271
Polyage, 22 × Smoker, smoking	0.80	[0.24, 1.37]	2.79	.005

but also a larger variability in reaction times compared to former smokers and non-smokers.

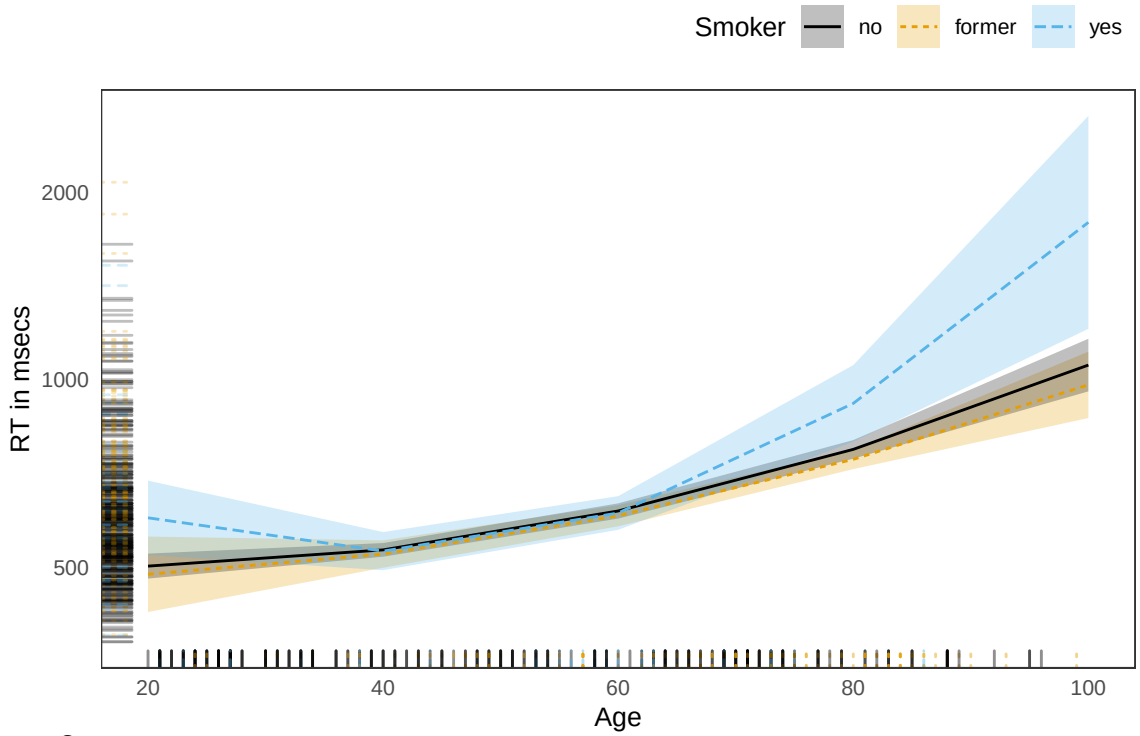

Figure 2

Marginal effects with distirbution of raw data in the margins.

References

Blomkvist, A. W., Eika, F., Rahbek, M. T., Eikhof, K. D., Hansen, M. D., Søndergaard, M., Ryg, J., Andersen, S., & Jørgensen, M. G. (2017). Reference data on reaction time and aging using the Nintendo Wii Balance Board: A cross-sectional study of 354 subjects from 20 to 99 years of age. *PLoS One*, *12*(12), e0189598. https://doi.org/10.1371/journal.pone.0189598