

Birth cohort differences in cognitive aging: Secular trends in cognitive functioning  
and decline over 30 years in three population-based Swedish samples

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Avhandling för avläggande av filosofie doktorsexamen i psykologi, som med vederbörligt tillstånd av samhällsvetenskapliga fakultetsstyrelsen vid Göteborgs universitet kommer att offentligens försvaras fredagen den 25 maj 2018, klockan 10.00 i sal F1, Psykologiska institutionen, Haraldsgatan 1, Göteborg.

Fakultetsopponent: Professor Martin Lövdén, Institutionen för neurobiologi, vårdvetenskap och samhälle, Karolinska institutet

This thesis is based on the following studies referred to by their Roman numerals:

- I. Karlsson, P., Thorvaldsson, V., Skoog, I., Skoog, J., & Johansson, B. (Submitted). What can we expect of cognition after 70? A study of cognitive decline, stability, and gain between 70 and 79 years in three Swedish birth cohorts.
- II. Karlsson, P., Thorvaldsson, V., Skoog, I., Gudmundsson, P., & Johansson, B. (2015). Birth cohort differences in fluid cognition in old age: Comparisons of trends in levels and change trajectories over 30 years in three population-based samples. *Psychology and Aging, 30*(1), 83-94. doi:10.1037/a0038643
- III. Thorvaldsson, V., Karlsson, P., Skoog, J., Skoog, I., & Johansson, B. (2017). Better cognition in new birth cohorts of 70 year olds, but greater decline thereafter. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 72*(1), 16-24. doi:10.1093/geronb/gbw125
- IV. Karlsson, P., Johansson, B., Skoog, I., Skoog, J., Rydén, L., & Thorvaldsson, V. (Submitted). Cohort differences in the association of Cardiovascular Risk and cognitive aging.



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# Abstract

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Karlsson, P. (2018). *Birth cohort differences in cognitive aging: Secular trends in cognitive functioning and decline over 30 years in three population-based Swedish samples*

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The aim of this thesis was to investigate birth cohort differences in level of cognitive functioning and change in later life in three population-based representative samples drawn from the Gerontological and Geriatric Population Studies in Gothenburg (H70), Sweden. We used data from cohorts, born in 1901-02, 1906-07, and 1930, measured at ages 70, 75, and 79 on the same cognitive measures.

In *Study I* we investigated cohort differences in the proportions of individuals showing cognitive decline, stability, or gain. Our findings revealed significant cohort differences on all outcomes (logical reasoning, spatial ability, verbal meaning, and perceptual speed). Later born cohorts consisted of larger proportions of participants showing decline and smaller proportions of participants showing gain.

In *Study II* we investigated cohort differences in level of performance and rate of cognitive change on two measures of fluid ability (logical reasoning and spatial ability). Estimates from multiple-group latent growth curve models (LGCM) revealed substantial cohort differences in levels of performance were later born cohorts outperformed the earlier born. However, later born cohorts also showed, on average, a steeper decline over the study period than the earlier born. Gender and education partially accounted for the observed cohort differences.

In *Study III* we analyzed data concerning four fluid abilities (perceptual-motor-speed, long-term picture recognition memory, logical reasoning and spatial ability) and one crystallized ability (verbal ability). We fitted growth curve models to the data within a Bayesian framework. The results confirmed those reported in Studies I and II indicating, moderate to large cohort differences in levels of performance on all five cognitive outcomes. Later born cohorts showed steeper decline in logical reasoning, spatial ability, and perceptual-motor-speed but we found no differences in rate of decline regarding long-term recognition memory and verbal ability.

In *Study IV* we investigated the moderating effects of birth cohort on the associations between cardiovascular risk (defined as the Framingham Risk Score, FRS) and cognitive functioning and rate of change on two cognitive measures (spatial ability and logical reasoning). Multiple-group LGCMs revealed relatively weak associations between cardiovascular risk and cognitive functioning and change. These associations were even weaker in the 1930 cohort, especially regarding logical reasoning.

The findings that later born cohorts outperform earlier born cohorts in levels of performance are in line with previous findings. The findings that later born cohorts decline at a faster rate compared to earlier born cohorts on fluid measurements are novel. A potential explanation for the cohort differences in rate of cognitive decline relates to differences in the average age of onset of the cognitive decline due to cohort differences in cognitive reserve. To the extent that later born cohorts on average have higher cognitive reserve compared to earlier born, as indicated by their higher level of performance, they should- in line with the cognitive reserve hypothesis- start to decline at a later stage but then they should decline at a faster rate. Another explanation relates to possible cohort differences in selective survival. As life-expectancy has increased in Sweden, since the 19<sup>th</sup> century, a relatively higher proportion of more frail individuals may have survived to age 70 in later born cohorts.

Keywords: Aging, cardiovascular risk factors, cognitive decline, cohort differences, fluid and crystallized abilities, Flynn effect, longitudinal