

Educational differences in duration of working life and loss of paid employment: working life expectancy in The Netherlands¹

by Suzan JW Robroek, PhD,² Daan Nieboer, MSc, Bengt Järnholm, MD, PhD, Alex Burdorf, PhD

1. *Appendix*
2. *Correspondence to: Suzan JW Robroek, Erasmus University Medical Center Rotterdam, Department of Public Health, PO Box 2040, 3000 CA Rotterdam, the Netherlands. [E-mail: s.robroek@erasmusmc.nl]*

Supplementary file S1

R scripts to calculate WLE and 95% CI

```
rm(list=ls())

setwd("H:/WLE")
library(data.table)
library(mstate)

subsets <- expand.grid(gender = c("men", "women"), education = c("low", "mid", "high"))
n_boot <- 1000

# Transition matrix. The same for each subset.
x <- list()
for(i in 1:7){
  x[[i]] <- (1:8)[1:8!=i]
}
x[[8]] <- NULL

# tmat stratum for every transition
tmat <- transMat(list(2:8, c(1, 3:8), c(1:2, 4:8), c(1:3, 5:8), c(1:4, 6:8), c(1:5, 7:8), c(1:6, 8), c()), names = 1:8)

for(i in 1:nrow(subsets)){
  # Read in the relevant data.
  file_name <- paste0("H:/WLE/data/", subsets$gender[i], "_", subsets$education[i], "_edu.csv")
  dta <- fread(file = file_name)

  dta[, new_state := shift(state, n = 1, type = "lead")]
  dta[, end_time := shift(age, type = "lead")]

  # Remove last observation in each group, not needed anymore information already in the
  # preceding row.
  dta[, c("trans_nr", "max_trans"):= list(1:.N, .N), by = id]
```

```

dta <- dta[trans_nr!=max_trans]

# Similarly remove all rows with state equal to 8. No transition possible from
# death to a different state.
dta <- dta[state!=8]

# Expand the data.table to start the analysis using mstate.
dta[, trans_nr:=1:N, by = id]
dta[, freq:=8]

ids <- unique(dta$id)

dta_expanded <- dta[, .(rep(rep(1, .N), freq)), by = .(id, trans_nr, age, end_time, state, new_state)]
dta_expanded[, c("to", "status"):=list(1:N, as.numeric(1:N==new_state)), by = .(id, trans_nr)]

setnames(dta_expanded, c("age", "end_time", "state"), c("Tstart", "Tstop", "from"))
dta_expanded <- dta_expanded[from!=to]
dta_expanded[, c("new_state", "V1"):=NULL]

dta_expanded[,trans:=NA_integer_]
for(k in 1:7){
  for(l in 1:8){
    stratum <- tmat[k, l]
    dta_expanded[from==k&to==l, trans := stratum]
  }
}
setkey(dta_expanded, "id")

for(j in 1:n_boot){
  id_boot <- sample(ids, replace = TRUE)

  dta_boot <- dta_expanded[J(id_boot)]

  cx <- coxph(Surv(Tstart, Tstop, status) ~ strata(trans), data = dta_boot, method = "breslow")
  fit <- msfit(cx, variance = FALSE, trans = tmat)
  prob_hzd <- probtrans(fit, predt=16, variance = FALSE) # predt is the age at which you want the prediction
  res <- ELOS(prob_hzd, tau = 66)

  file_name <- paste0("H:/WLE/bootstrap/", formatC(j, width = 4, flag = "0"), "_", subsets$gender[i], "_",
subsets$education[i], ".Rdata")
  save(res, file = file_name)
}
}

rm(dta_boot)

```

```

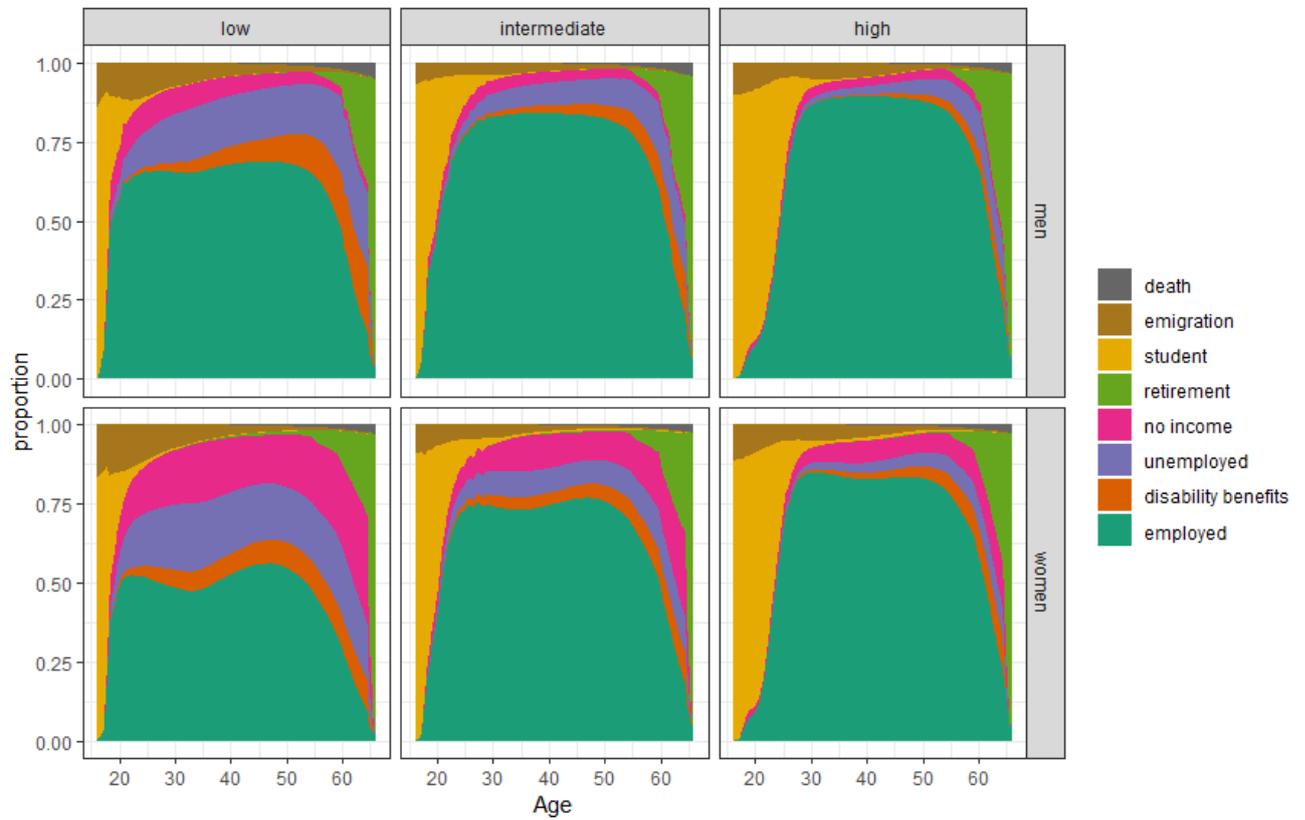
rm(cx)

for(i in 1:nrow(subsets)){
  boot_estimates <- expand.grid(index = 1:n_boot, from = 1:8, stay_in = 1:8, elos = NA)
  for(j in 1:n_boot){
    file_name <- paste0("H:/WLE/bootstrap/", formatC(j, width = 4, flag = "0"), "_", subsets$gender[i], "_",
subsets$education[i], ".Rdata")
    load(file_name)
    for(k in 1:8){
      for(l in 1:8){
        I1 <- boot_estimates$from==k&boot_estimates$stay_in==l&boot_estimates$index==j
        boot_estimates$elos[I1] <- res[k, l]
      }
    }
  }
  boot_estimates <- as.data.table(boot_estimates)
  ci.l <- boot_estimates[, quantile(elos, probs = 0.025, na.rm=T), by = list(from, stay_in)]
  ci.u <- boot_estimates[, quantile(elos, probs = 0.975, na.rm=T), by = list(from, stay_in)]
  file_name <- paste0("H:/WLE/bootstrap/", formatC(0, width = 4, flag = "0"), "_", subsets$gender[i], "_",
subsets$education[i], "_ci.Rdata")
  save(list = c("ci.l", "ci.u"), file = file_name)
}

```

Supplementary file S2

Figure Proportion in a specific (non-)employment state by age stratified by gender and educational level



Supplementary file S3

Table S1 Educational differences in working life expectancy (WLE) between age 16-66 among men and women in the Dutch workforce, given being in paid employment at the starting age.

	WLE at age 16 (95% CI)
<i>Men</i>	
Low	29.2 (29.1-29.4)
Intermediate	34.2 (34.1-34.4)
High	33.4 (33.3-33.5)
Difference (High-Low)	4.2
<i>Women</i>	
Low	23.0 (22.5-23.3)
Intermediate	31.2 (31.1-31.4)
High	32.5 (32.4-32.6)
Difference (High-Low)	9.5

Table S2 Total working years lost in the Dutch workforce between ages 16 – 66 through several pathways given paid employment at age 16, stratified by gender and educational level

	Disability benefits	Unemployment	(early) retirement	No income	Student	Emigration	Death
<i>Men</i>							
Low	3.6 (3.6-3.6)	7.7 (7.7-7.8)	2.0 (2.0-2.0)	2.8 (2.8-2.8)	1.9 (1.8-2.1)	1.6 (1.6-1.6)	1.2 (1.2-1.3)
Intermediate	1.9 (1.9-1.9)	3.9 (3.9-3.9)	2.3 (2.3-2.3)	1.6 (1.6-1.7)	4.1 (4.0-4.3)	1.1 (1.1-1.1)	0.9 (0.8-0.9)
High	0.8 (0.8-0.8)	2.0 (2.0-2.1)	2.4 (2.4-2.5)	1.3 (1.3-1.3)	7.8 (7.7-7.9)	1.7 (1.7-1.7)	0.5 (0.5-0.6)
Absolute difference (Low-High)	2.8	5.7	-0.5	1.5	-5.9	-0.1	0.7
<i>Women</i>							
Low	3.5 (3.5-3.5)	9.3 (9.3-9.3)	2.0 (2.0-2.1)	7.9 (7.9-7.9)	2.5 (2.2-2.9)	1.1 (1.1-1.1)	0.8 (0.7-0.8)
Intermediate	2.3 (2.3-2.3)	4.0 (4.0-4.0)	2.1 (2.1-2.1)	4.6 (4.6-4.6)	4.4 (4.2-4.5)	0.9 (0.9-0.9)	0.6 (0.6-0.6)
High	1.4 (1.4-1.4)	1.9 (1.9-1.9)	2.2 (2.2-2.3)	2.9 (2.9-2.9)	7.4 (7.2-7.4)	1.4 (1.3-1.4)	0.5 (0.4-0.5)
Absolute difference (Low-High)	2.1	7.4	-0.2	5.0	-4.9	-0.3	0.3

Supplementary file S4

Table S3 Educational differences in working life expectancy (WLE) until age 66 among Dutch men and women not in paid employment at the age of 30.

	WLE at age 30 (95% CI) among individuals with the following state at age 30				
	Disabled	Unemployed	No income	Student	Emigration
<i>Men</i>					
Low	19.2 (19.2-19.3)	19.6 (19.5-19.6)	19.8 (19.7-19.8)	19.8 (19.7-19.9)	17.6 (17.6-17.7)
Intermediate	24.5 (24.4-24.5)	25.1 (25.00-25.1)	24.8 (24.7-24.8)	24.8 (24.7-24.8)	20.7 (20.7-20.8)
High	26.4 (26.3-26.5)	27.3 (27.2-27.3)	26.0 (26.0-26.1)	26.7 (26.6-26.7)	20.2 (20.2-20.3)
Difference (High-Low)	7.1	7.7	6.3	6.9	2.6
<i>Women</i>					
Low	14.8 (14.8-14.8)	14.8 (14.8-14.9)	15.3 (15.2-15.3)	15.4 (15.3-15.5)	13.0 (13.0-13.1)
Intermediate	22.0 (22.0-22.1)	22.4 (22.4-22.4)	22.2 (22.2-22.2)	22.3 (22.3-22.4)	17.8 (17.7-17.8)
High	25.4 (25.4-25.5)	25.9 (25.8-25.9)	24.9 (24.9-25.0)	25.3 (25.2-25.3)	19.3 (19.2-19.3)
Difference (High-Low)	10.7	11.0	9.7	9.9	6.3

Table S4 Prevalence of the different states at age 30.

	Employed %	Disabled %	Unemployed %	No income %	Student %	Emigration %
<i>Men</i>						
Low	43.3	5.8	24.4	21.1	1.0	4.5
Intermediate	50.1	4.0	22.5	17.2	3.3	2.9
High	56.0	1.0	12.8	18.9	6.1	5.3
<i>Women</i>						
Low	36.1	9.6	23.7	25.9	1.3	3.4
Intermediate	44.5	9.0	20.0	20.7	3.6	2.2
High	49.3	4.7	14.6	21.9	4.9	4.7

Table S5 Educational differences in working life expectancy (WLE) between age 30-66 among men and women in the Dutch workforce, stratified by paid employment at the starting age and all employment and non-employment states at the starting age.

	WLE at age 30 starting in employment (years)	WLE at age 30 independent of initial state (years)
<i>Men</i>		
Low	20.9	20.1
Intermediate	26.0	25.4
High	28.2	27.1
Difference (High-Low)	7.3	7.0
<i>Women</i>		
Low	16.9	15.6
Intermediate	23.7	22.8
High	26.8	25.7
Difference (High-Low)	9.9	10.1

Supplementary file S5

Table S6 Total working years lost in the Dutch workforce between ages 50 – 66 through several pathways assuming paid employment at age 50, stratified by gender and educational level

	Disability benefits	Unemployment	(Early) retirement	No income	Student	Emigration	Death
<i>Men</i>							
Low	1.8 (1.8-1.8)	2.8 (2.8-2.8)	2.0 (2.0-2.0)	0.4 (0.4-0.4)	0.0 (0.0-0.0)	0.1 (0.1-0.1)	0.5 (0.5-0.5)
Intermediate	1.1 (1.1-1.1)	1.9 (1.9-1.9)	2.3 (2.3-2.3)	0.4 (0.4-0.4)	0.0 (0.0-0.0)	0.1 (0.1-0.1)	0.4 (0.4-0.4)
High	0.6 (0.5-0.6)	1.3 (1.3-1.3)	2.5 (2.5-2.5)	0.4 (0.4-0.4)	0.0 (0.0-0.0)	0.1 (0.1-0.1)	0.3 (0.3-0.3)
Absolute difference (Low-High)	1.3	1.5	-0.5	0.0	0.0	0.0	0.2
<i>Women</i>							
Low	1.2 (1.2-1.2)	2.7 (2.7-2.7)	2.0 (2.0-2.0)	2.7 (2.7-2.7)	0.0 (0.0-0.0)	0.1 (0.1-0.1)	0.3 (0.3-0.3)
Intermediate	1.0 (1.0-1.0)	1.6 (1.6-1.6)	2.1 (2.1-2.1)	1.9 (1.8-1.9)	0.0 (0.0-0.0)	0.1 (0.1-0.1)	0.2 (0.2-0.2)
High	0.8 (0.8-0.8)	1.1 (1.1-1.1)	2.3 (2.2-2.3)	1.2 (1.2-1.2)	0.0 (0.0-0.0)	0.1 (0.1-0.1)	0.2 (0.2-0.2)
Absolute difference (Low-High)	0.4	1.6	-0.2	1.6	0.0	0.0	0.1