A. WinBUGS model code

Here we present the code for both the 2-component poly-Weibull model, discussed in Section 2, and a Weibull model, which ignores the cause specific effect.

```
# TWO COMPONENT POLY-WEIBULL MODEL (SECTION 2)

## Weibull likelihood for the population data (Section 2.1)
model{
    for (i in 1:n){
        # survival times for cause of interest  (censored if die from other cause)
        ons1[i] ~ dweib(r[1], lambda1[1])I(ons1.cens[i],)
        # survival times for other cause  (censored if die from cause of interest)
        ons2[i] ~ dweib(r[2], lambda1[2])I(ons2.cens[i],)
    }

## Poly-Weibull likelihood for the study data (Section 2.2)
# nd.polyweib() distribution available from
# http://www.winbugs-development.org.uk/, ``WBDev Shared Components''
# thanks to David Lunn and Nikolaos Demiris
# requires the WBDev interface to be installed
    for (j in 1:m){
        t[j] ~ nd.dpolyweib(2, r[], lambda2[])I(t.cen[j],)
    }

## Priors for parameters of cause-specific Weibull models
   log(r[1]) <- log.r[1]
   log(r[2]) <- log.r[2]
   log.r[1] ~ dnorm(0.5, 1.633)
   log.r[2] ~ dnorm(0.5, 1.633)
   meansurv[1] ~ dunif(0, 60) # mean survival time
   meansurv[2] ~ dunif(0, 60)
   beta0[1] <- r[1]*(loggam(1 + 1/r[1]) - log(meansurv[1]))
   beta0[2] <- r[2]*(loggam(1 + 1/r[2]) - log(meansurv[2]))
   lambda1[1] <- exp(beta0[1])
   lambda1[2] <- exp(beta0[2])

## constraint that r[2] > r[1] to identify the poly-Weibull
    b <- 1
    b ~ dbern(delta)
    delta <- step(r[2] - r[1])

## Difference between general population and study patients
    lambda2[1] <- lambda1[1] * exp(beta)
    lambda2[2] <- lambda1[2]
    beta ~ dnorm(0.0, betaprec)
    betasd <- 2.5; betaprec <- 1/pow(betasd, 2)
}
```

```
# WEIBULL MODEL
# Ignores causes of death and assumes proportional hazards for
# overall mortality between the population and study data

model{
## Population data: survival times from all causes
    for (i in 1:n){
        ons[i] ~ dweib(r, lambda1)
    }

## Study data: survival times from all causes
    for (j in 1:m){
        t[j] ~ dweib(r, lambda2)I(t.cen[j],)
    }
## Priors
# SD = (log(log(100) /log(2) + 1) - 0.5) / 1.96:
# 100 is upper 95 quantile for HR over doubled time
    log(r) <- logr
    logr ~ dnorm(0.5, 1.633)

    lambda1 <- exp(beta0)
    meansurv ~ dunif(0, 60)
    beta0 <- r*(loggam(1 + 1/r) - log(meansurv))

## Difference between general population and study patients
    lambda2 <- lambda1 * exp(beta)
    beta ~ dnorm(0.0, betaprec)
    betasd <- 2.5; betaprec <- 1/pow(betasd, 2)
}
```

B. Supplementary Tables and Figures - Application

This appendix presents basic parameter estimates for each model for everybody and by sex (Table 5), followed by the results of the sensitivity analysis to misclassification of causes of death (Table 6), empirical and fitted survival curves and hazard functions for men and women, respectively (Figure 7), and goodness of fit of polyhazard models to the long-term general population data (Figure 8).

Table 5. Posterior means and 95% credible intervals for parameters in each model, for everybody and by sex

Model	Parameter	Overall	Male	Female
Weibull	α	1.4209 (1.3990, 1.4430)	1.4319 (1.4080, 1.4560)	1.5732 (1.5190, 1.6290)
	β	1.2587 (1.0290, 1.4740)	1.2181 (0.9672, 1.4550)	1.6639 (1.0370, 2.2210)
	λ	0.0112 (0.0104, 0.0121)	0.0122 (0.0112, 0.0132)	0.0044 (0.0036, 0.0054)
Cox-like	β	1.1996 (1.1222, 1.2784)	1.1488 (1.0658, 1.2343)	1.6412 (1.4412, 1.8569)
Poly-Weibull	α_1	1.3692 (1.3290, 1.4110)	1.3945 (1.3520, 1.4380)	1.4834 (1.3970, 1.5730)
	α_2	1.4412 (1.4160, 1.4660)	1.4453 (1.4190, 1.4720)	1.6066 (1.5350, 1.6720)
	β	1.2742 (1.0520, 1.4800)	1.2575 (1.0320, 1.4880)	1.6578 (1.0560, 2.1590)
	λ_1	0.0034 (0.0029, 0.0040)	0.0036 (0.0031, 0.0042)	0.0014 (0.0010, 0.0019)
	λ_2	0.0078 (0.0071, 0.0085)	0.0086 (0.0078, 0.0094)	0.0031 (0.0024, 0.0040)
Poly-Gompertz	α_1	0.0319 (0.0316, 0.0322)	0.0328 (0.0324, 0.0332)	0.0377 (0.0371, 0.0383)
	α_2	0.0320 (0.0317, 0.0323)	0.0331 (0.0327, 0.0335)	0.0380 (0.0374, 0.0386)
	β	1.8108 (1.7025, 1.9267)	1.7413 (1.6270, 1.8665)	2.1230 (1.8823, 2.4350)
	λ_1	0.0071 (0.0070, 0.0072)	0.0079 (0.0077, 0.0080)	0.0038 (0.0037, 0.0040)
	λ_2	0.0187 (0.0185, 0.0189)	0.0209 (0.0206, 0.0211)	0.0106 (0.0103, 0.0108)

Table 6. Sensitivity of estimates of expected survival to different rates of misclassification of causes of death in the population data. Posterior means and 95% credible intervals from the poly-Weibull model.

	Proportion of deaths coded as arrhythmia which are wrongly classified		
	None	10%	20%
OVERALL			
ICD mean survival	9.18 (7.82, 10.78)	8.99 (7.67, 10.57)	8.83 (7.61, 10.29)
AAD mean survival	6.06 (4.64, 7.76)	5.99 (4.60, 7.68)	5.94 (4.60, 7.54)
Life years gained	3.12 (1.91, 4.31)	3.00 (1.83, 4.14)	2.89 (1.76, 3.98)
MALE			
ICD mean survival	8.72 (7.36, 10.29)	8.66 (7.33, 10.24)	8.60 (7.32, 10.13)
AAD mean survival	5.80 (4.42, 7.47)	5.80 (4.41, 7.46)	5.78 (4.42, 7.42)
Life years gained	2.91 (1.76, 4.03)	2.86 (1.74, 3.97)	2.82 (1.72, 3.90)
FEMALE			
ICD mean survival	9.96 (7.05, 14.68)	9.97 (6.94, 14.53)	9.87 (6.97, 14.20)
AAD mean survival	6.85 (4.51, 10.74)	6.89 (4.50, 10.61)	6.85 (4.53, 10.40)
Life years gained	3.11 (1.76, 4.75)	3.08 (1.76, 4.66)	3.02 (1.73, 4.59)

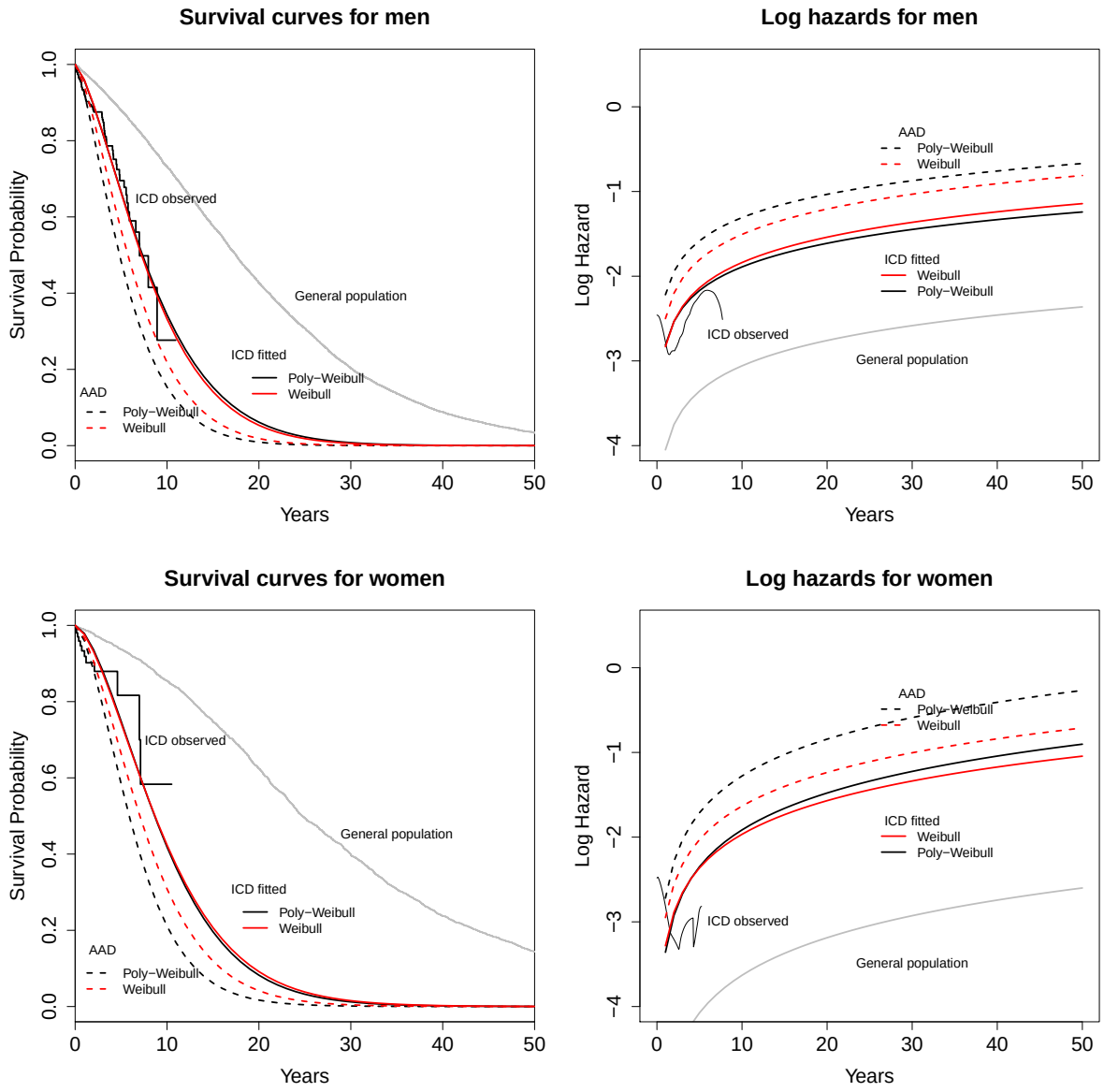

Figure 7. Survival curves and log hazards, for the ICD and AAD groups, fitted with the Poly-Weibull and Weibull models, for men (top) and women (bottom).

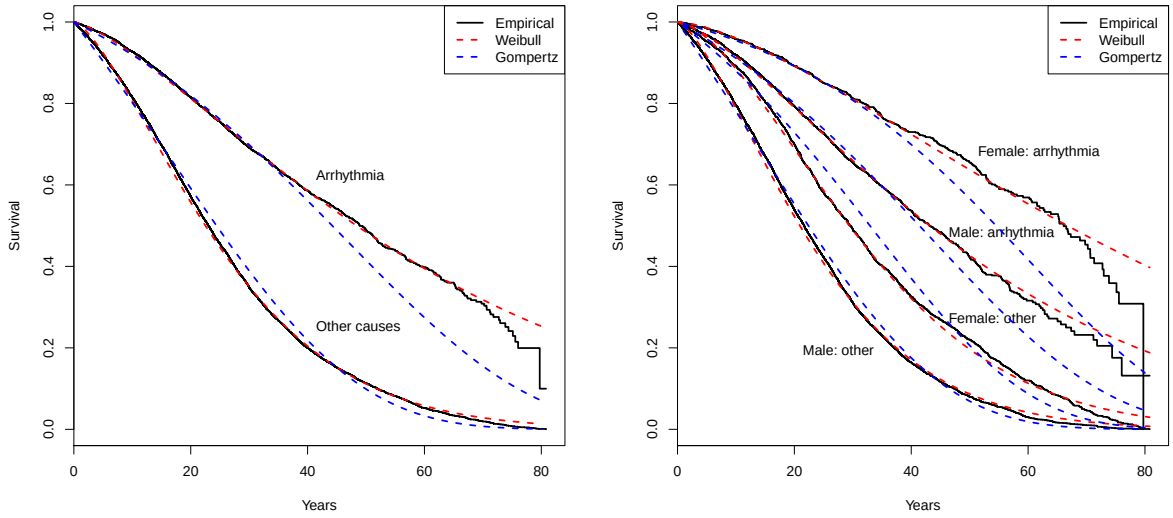

Figure 8. Fit of the Weibull and Gompertz distributions to the generated population cause-specific survival data (Kaplan-Meier estimates). Fitted values are the posterior means under the corresponding polyhazard models for the combined data. Left: overall, right: by gender.