How To Use the SPACE Program

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The Function of the SPACE Program

A set of PC SAS programs

- To estimate multi-state life table (MSLT) functions
- To estimate the standard errors of MSLT functions via the bootstrap method

Two approaches to calculation

- Deterministic approach: radix population
- Stochastic approach: micro-simulation

The Structure of the SPACE Program (1)

Multiple sets of programs with different capabilities

Programs that use the radix population

- SPACE_RAD, SPCACE_RAD1COV, SPACE_RAD2COV

Programs that performs micro-simulation

- SPACE_SIM, SPACE_SIM1COV, SPACE_SIM2COV

The Structure of the SPACE Program (2)

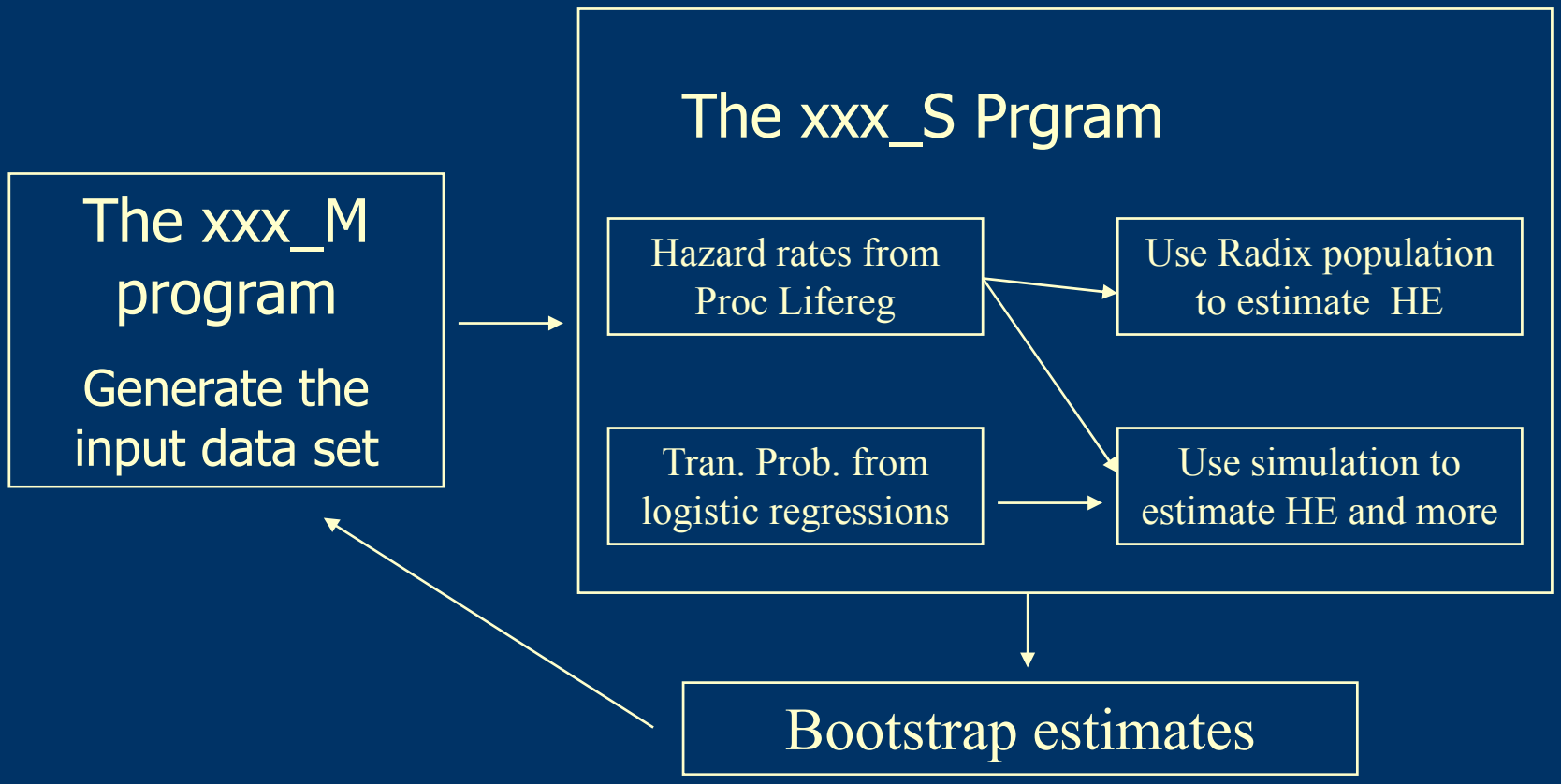
Each set contains two programs: the xxx_S and the xxx_M program

The xxx_S program estimates MSLT functions

The xxx_M program

- Generates the input data sets
- Runs the xxx_S program
- Collects the output from the xxx_S program for further analysis

The Structure of the SPACE Program (3)



Example 1. Use The RAD2COV Programs

1. Launch the xxx_M program
   - The list of macro variables: see manual

2. Follow the steps in the xxx_S program and run them on the computer
   - Prepare the data set
   - Estimate the prevalence
   - Estimate the transition rates
   - Estimate the HE and save the output

3. Back to the xxx_M program – the bootstrap part

1. How to Prepare the Data Set

Format: One observation per line of record

ID	Yr of obs.	Age at obs.	Strata	PSU	Health Measure	Sex	Race	Edu
1	2000	67	37298	765	2	1	2	2
1	2001	68	37298	765	1	1	2	2
1	2002	69	37298	765	1	1	2	2
1	2003	70	37298	765	2	1	2	2
…	…	…	…	…	…	…	…	…
870	2002	81	87493	897	1	2	2	1
870	2003	82	87493	897	1	2	2	1
870	2004	83	87493	897	1	2	2	1
870	2005	84	87493	897	3	2	2	1

How Missing Obs. Is Handled (1)

If the gap is an even #, then event is assumed to occur in the second half of the gap

Original

ID	Yr. of obs.	Age	Health
1	2000	67	1
1	2001	68	1
1	2003	70	2

Recreated

ID	Yr. of obs.	Age	Health
1	2000	67	1
1	2001	68	1
1	2002	69	1
1	2003	70	2

How Missing Obs. Is Handled (2)

If the gap is an odd #, then event is assumed to occur in the middle of the gap

Original

ID	Yr. of obs.	Age	Health
1	2000	67	1
1	2001	68	1
1	2004	71	2

Recreated

ID	Yr. of obs.	Age	Health
1	2000	67	1
1	2001	68	1
1	2002	69	1
1	2003	70	2
1	2004	71	2

The Analysis Sample

Format: One consecutive pair of obs. per line of record

ID	Yr of obs.	Age	Strata	PSU	Sex	Race	Edu.	Beg. State	End State
1	2000	67	37298	765	1	2	2	2	1
1	2001	68	37298	765	1	2	2	1	1
1	2002	69	37298	765	1	2	2	1	2
…	…	…	…	…	…	…	…	…	…

2. How to Estimate the Prevalence

```
PROC LOGISTIC DATA=PSBACK DESCENDING NOPRINT;
    CLASS &COV;
    MODEL &VAR=AGE &COV AGE*AGE / L=GLOGIT;
    WEIGHT &WGT;
    OUTPUT OUT=PREV PREDPROBS=I;
RUN;
```

- The purpose of this section is to estimate the age-specific prevalence of initial states to average status-based HE estimates
- The model should be modified to find best fit
- Be careful if some ages are not present in the data set

3. How to Estimate the Transition Rates

%MACRO *MODEL_hazard*;

Discrete-time hazard model is applied to each type of events – nonevents and other types of events are both censored

Form of model can be modified

- MODEL EXPOS*EV&J(**0**) = &COV AGE / DIST=EXPONENTIAL

4. How to Estimate HE

Radix population of 100,000

L(x,n) calculated using the linear method:

```
Lx[&X+1,]=Lx[&X,]*(I-M&X/2)*INV(I+M&X/2);
nLx[&X,]=(Lx[&X,]+Lx[&X+1,])/2;
```

All HE estimates are stored in a small data set

The Bootstrap Procedure

Resample the PSUs with replacement within each stratum

NU (# of PSU resampled) = PS (# of PSU) - 1 or 1, whichever is greater

- Each resampled PSU appears only once in the bootstrap sample

All persons in the resampled PSU are included in the bootstrap sample; their weight recalculated as

&WGT=&WGT*NU*(PS/(PS-**1**)) if PS>1

Example 2. Use The SIM2COV Programs

1. Launch the xxx_M program
   - The list of macro variables: see manual

2. Follow the steps in the xxx_S program and run them on the computer
   - Prepare the data set
   - Estimate the prevalence
   - Estimate the transition rates
   - Estimate the HE and save the output

3. Back to the xxx_M program – the bootstrap part

3. How to Estimate the Transition Probs.

```
PROC LOGISTIC DATA=MODEL DESCENDING NOPRINT;
   BY BEGST;
   CLASS &COV;
   MODEL ENDST=AGE &COV / L=GLOGIT;
   WEIGHT &WGT;
   OUTPUT OUT=PROBS PREDPROBS=I;
RUN;
```

- Model regress state at time t on age and covariates measured at t-1
- Model's form can be modified

4. How to Estimate HE

HE estimated via microsimulation

Use estimated prevalence to distribute initial health states (IHS) and average status-based HE

Allocation of years lived

- In the event of death, the entire last year is given to the last state
- In other events, evenly split between the adjacent states

Conclusion

Limitations

- Assumption of complete event history
- Simulation is computationally intensive

Future enhancements

- SMP-EM method
- Multi-session version for computers with multiple CPUs
- No embedded version

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