Representing Interventions

CMPT 858

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4-7-2011

Representing Interventions in AnyLogic & Vensim

- Interventions disturb the baseline operation of the system
- Interventions can be represented by several types of changes, namely modifications to:
  - Parameter/initial state values
  - Model structure
  - Incentives represented in model
  - System state at one or more particular points in time

Running Interventions

- Typical: Run Baseline and alternatives each in series
  - Compare results (as if sensitivity analysis)
- Radical but effective (e.g. for cost-effectiveness arguments)
  - Vensim: Subscripting Vensim Model by intervention (Baseline/Intervention A/Intervention B), and having run in parallel
  - AnyLogic: Run several populations in parallel (each associated with a different intervention)

Model Granularity can Limit Options in Representing Interventions

- Model specificity provides limits our ability to investigate targeted interventions
- Model granularity may force us to represent more detail with respect to an intervention

Model Granularity & Intervention specificity

- All other things being equal, the more detailed the model, the greater detail with which we can – and sometimes must! – specify interventions
- Examples
  - A model stratified by age&sex permits vaccinations to be rolled out at different times according to these factors
  - A model incorporating network structure allows us to target our interventions at network “hubs”
  - A model in which contacts emerge from agents moving between locations to would allow us to examine how changing those locations would affect contact patterns
  - Capturing history supports history-specific interventions

Fine Grained Models Oblige Specifying Added Intervention Details

- More detail in a model generally requires making more specific statements about intervention effects
- Contrast changes to mixing assumptions
  - Unstratified aggregate model: Changing *c*
  - Stratified aggregate model: Changing mixing matrix (abstracting over exactly how this is accomplished)
  - Individual-based model with Network: Change certain areas of network (e.g. add/delete/modify connections)
  - Individual-based model where contacts emerge from move: Change something about specific factors driving mobility patterns

Common Phrasing of Interventions What would be Impact of….

- “Reducing uptake rate by 10%”?
- “Increasing cessation rate by 10%”
- “Lowering mortality rate by 2%”
- “Reducing mixing levels by 7%”
- “Increasing emergency room staff by 20%”
- “Reducing the rate of progression of diabetes by 10%”

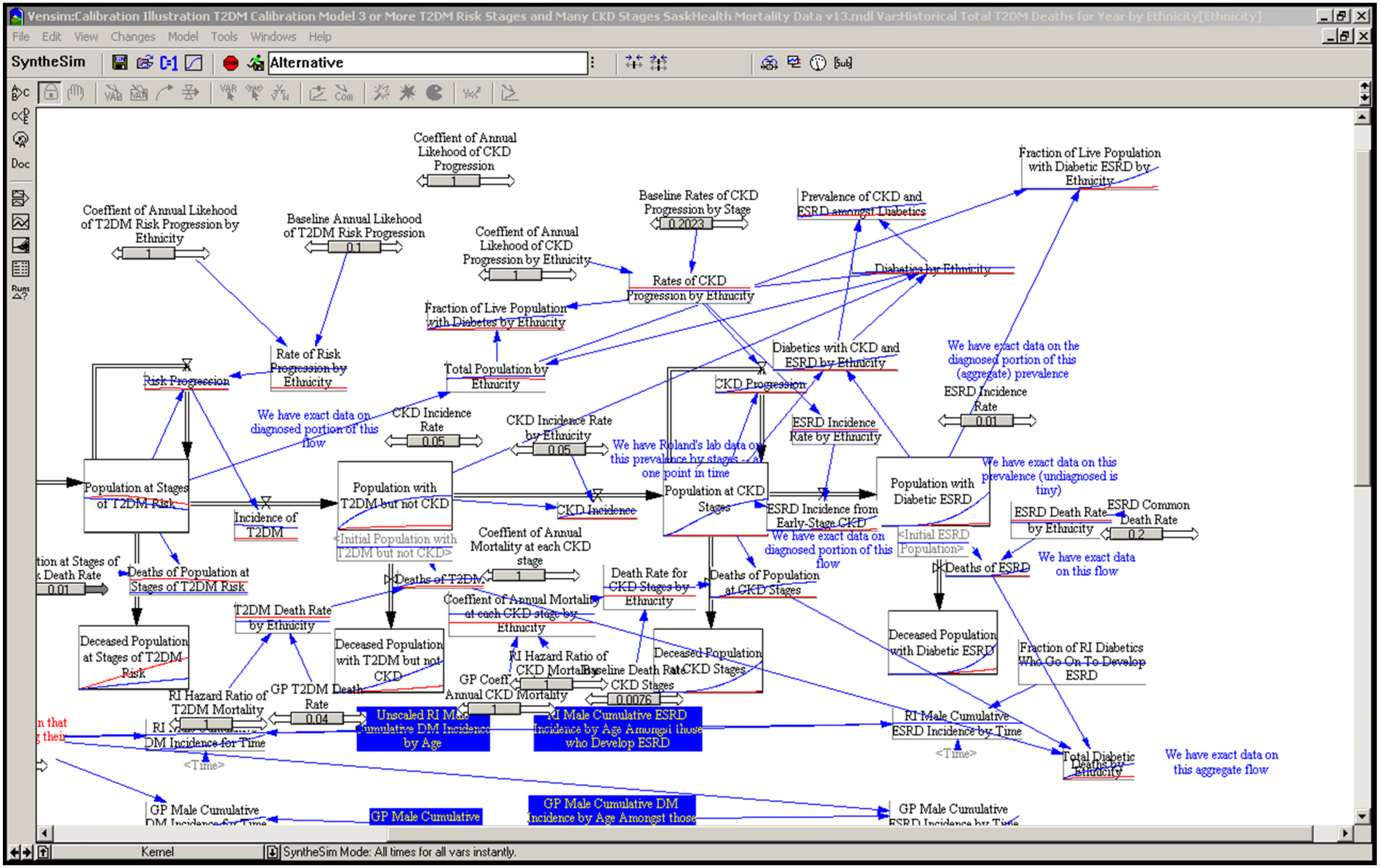
Changing Parameter Values

- Frequently we can approximate an intervention's impact by changing behaviors already represented in the model
  - This is abstracting over the issue of the exact nature of how this is caused
- This might affect parameters or initial values
- Often several parameters may need to be changed together, e.g.
  - Higher smoking cessation rate, lower smoking relapse rate
  - Lower value of c & lower value of β
- Be sure to restore parameters to their baseline values after experiments!

Changing Parameters in Vensim

- In Synthesim
  - No worries that saving away the model will disturb baseline functioning!
  - Easy setting of values
    - (left click on variable to set exact value)
- Via “Gaming” variables (can adjust over time!)
- Via “changes” files (to remember *exact* changes across multiple parameters)
  - These can let you systematically save away parameter sets, each associated with a particular intervention scenario
- By modifying value of parameter within the model specification (to constant, formula, or time series)
  - Remember to restore (Indicate change with color eg red)

Synthesim



Vensim:Calibration Illustration T2DM Calibration Model 3 or More T2DM Risk Stages and Many CKD Stages SaskHealth Mortality Data v13.mdl Var:Historical Total T2DM Deaths for Year by Ethnicity[Ethnicity]

SyntheSim Mode: All times for all vars instantly.

File Edit View Changes Model Tools Windows Help
SyntheSim
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Coeffient of Annual Likehood of CKD Progression
1
Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity
1
Baseline Annual Likehood of T2DM Risk Progression
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Coeffient of Annual Likehood of CKD Progression by Ethnicity
1
Baseline Rates of CKD Progression by Stage
0.2023
Rates of CKD Progression by Ethnicity
Prevalence of CKD and ESRD amongst Diabetics
Fraction of Live Population with Diabetic ESRD by Ethnicity
Diabetics by Ethnicity
Fraction of Live Population with Diabetes by Ethnicity
Rate of Risk Progression by Ethnicity
Risk Progression
Total Population by Ethnicity
Diabetics with CKD and ESRD by Ethnicity
CKD Progression
We have exact data on the diagnosed portion of this (aggregate) prevalence
ESRD Incidence Rate
0.01
We have exact data on diagnosed portion of this flow
CKD Incidence Rate
0.05
CKD Incidence Rate by Ethnicity
0.05
We have Roland's lab data on this prevalence by stages - at one point in time
ESRD Incidence Rate by Ethnicity
Population at Stages of T2DM Risk
Incidence of T2DM
Population with T2DM but not CKD
CKD Incidence
Population at CKD Stages
ESRD Incidence from Early-Stage CKD
Population with Diabetic ESRD
We have exact data on this prevalence (undiagnosed is tiny)
ESRD Death Rate by Ethnicity
ESRD Common Death Rate
0.2
<Initial Population with T2DM but not CKD>
Coeffient of Annual Mortality at each CKD stage
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We have exact data on diagnosed portion of this flow
<Initial ESRD Population>
We have exact data on this flow
tion at Stages of k Death Rate
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Deaths of Population at Stages of T2DM Risk
Deaths of T2DM
Death Rate for CKD Stages by Ethnicity
Deaths of Population at CKD Stages
Deaths of ESRD
T2DM Death Rate by Ethnicity
Coeffient of Annual Mortality at each CKD stage by Ethnicity
Deceased Population at Stages of T2DM Risk
Deceased Population with T2DM but not CKD
RI Hazard Ratio of CKD Mortality
1
Baseline Death Rate CKD Stages
0.0076
Deceased Population at CKD Stages
Deceased Population with Diabetic ESRD
Fraction of RI Diabetics Who Go On To Develop ESRD
RI Hazard Ratio of T2DM Mortality
1
GP T2DM Death Rate
0.04
GP Coeff Annual CKD Mortality
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Unscaled RI Male Cumulative DM Incidence by Age
RI Male Cumulative ESRD Incidence by Age Amongst those who Develop ESRD
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Total Diabetic Deaths by Ethnicity
We have exact data on this aggregate flow
GP Male Cumulative DM Incidence for Time
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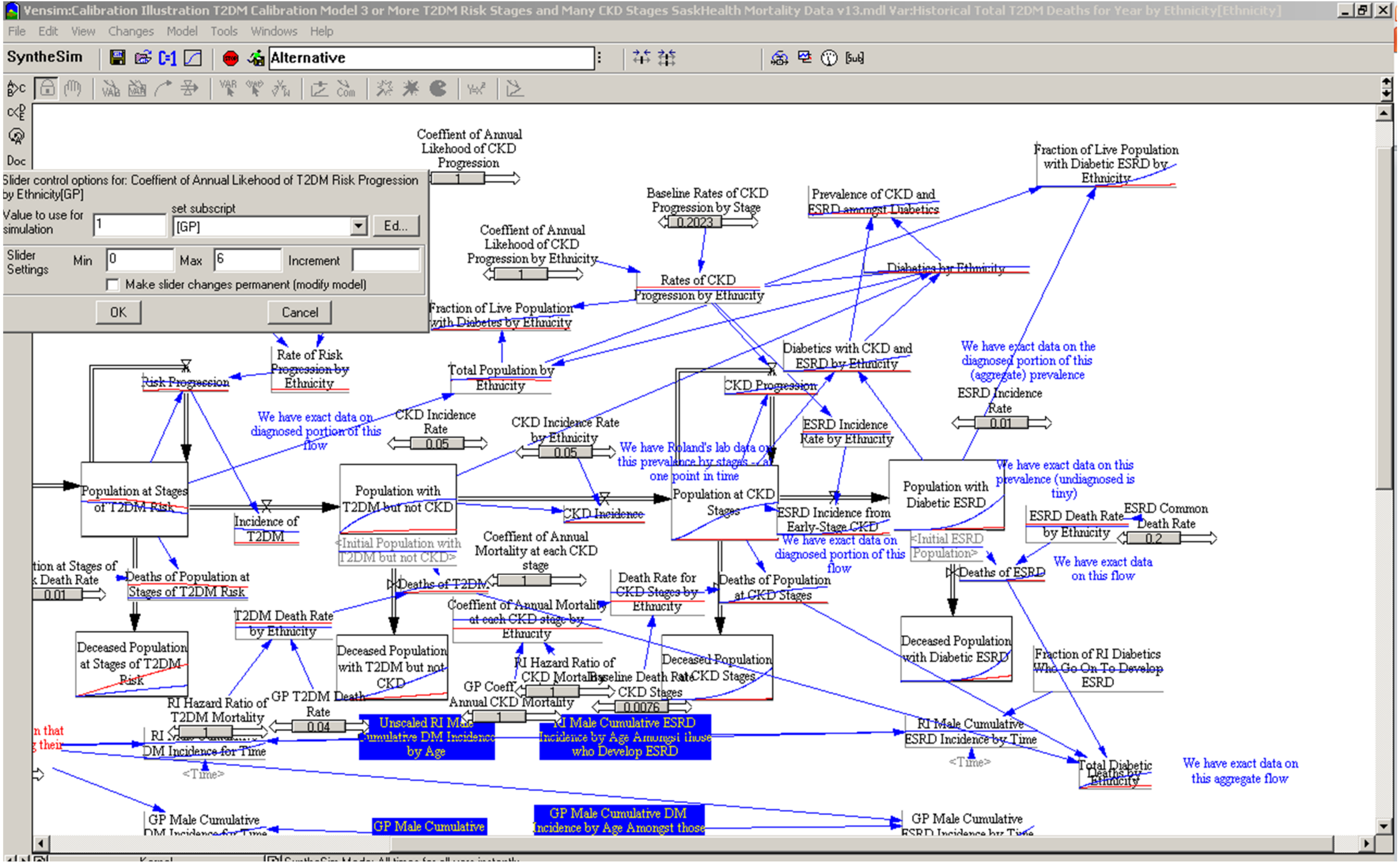
GP Male Cumulative ESRD Incidence by Time

Setting the Value of a Parameter in Synthesim



Vensim:Calibration Illustration T2DM Calibration Model 3 or More T2DM Risk Stages and Many CKD Stages SaskHealth Mortality Data v13.mdl Var:Historical Total T2DM Deaths for Year by Ethnicity[Ethnicity]

Slider control options for: Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity[GP]

Value to use for simulation: 1

set subscript: [GP]

Slider Settings: Min 0, Max 6, Increment

□ Make slider changes permanent (modify model)

File
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Coeffient of Annual Likehood of CKD Progression
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Baseline Rates of CKD Progression by Stage
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Prevalence of CKD and ESRD amongst Diabetics
Fraction of Live Population with Diabetic ESRD by Ethnicity
Coeffient of Annual Likehood of CKD Progression by Ethnicity
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Rates of CKD Progression by Ethnicity
Diabetics by Ethnicity
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GP Male Cumulative DM Incidence for Time
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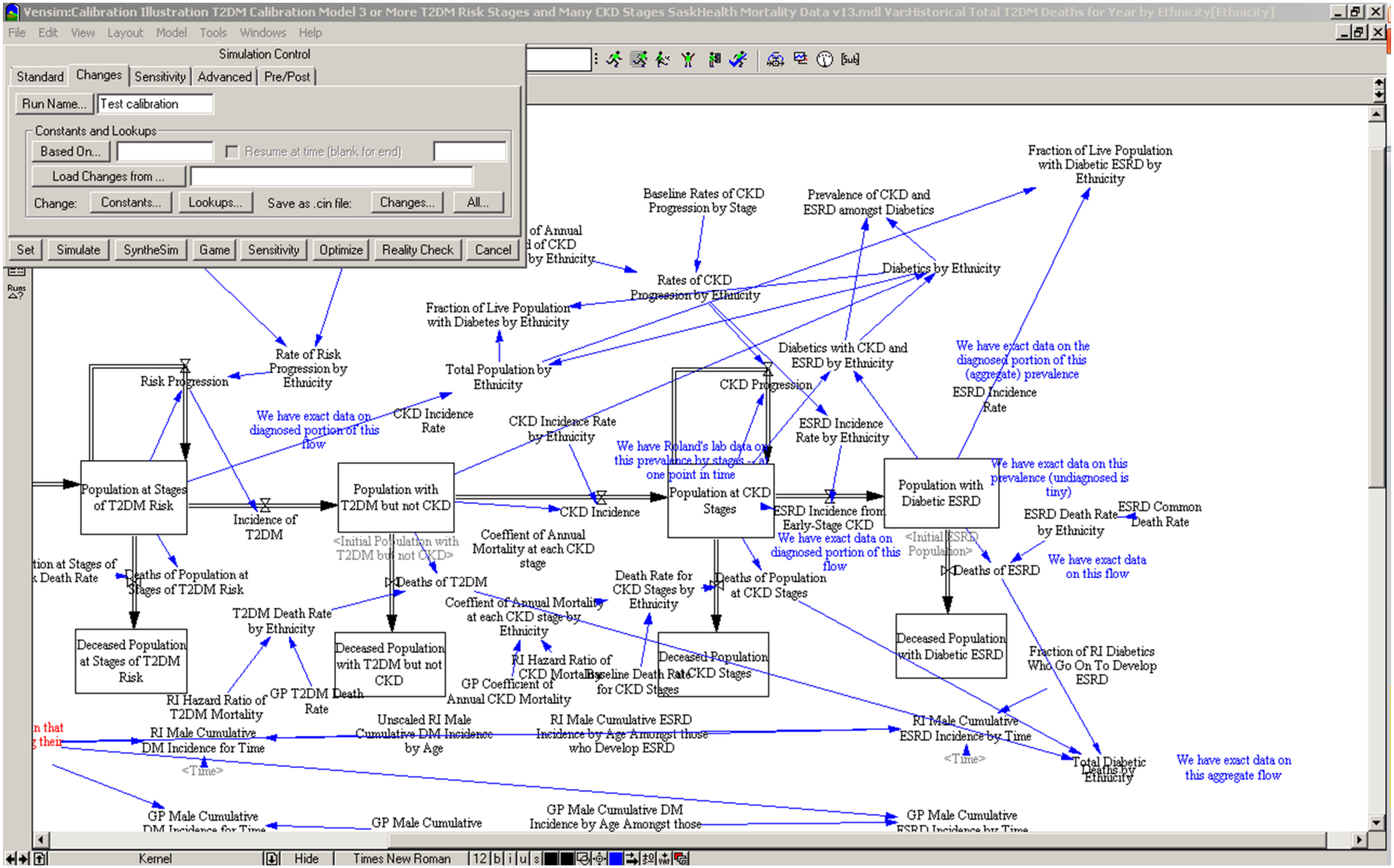
GP Male Cumulative DM Incidence by Age Amongst those
GP Male Cumulative ESRD Incidence by Time
Kernel
SyntheSim Mode: All times for all uses instantly

Loading Changes File



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Simulation Control

Run Name... Test calibration

☐ Resume at time (blank for end)

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ESRD Incidence Rate by Ethnicity
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Population at CKD Stages
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CKD Incidence
ESRD Incidence from Early-Stage CKD
ESRD Death Rate by Ethnicity
ESRD Common Death Rate
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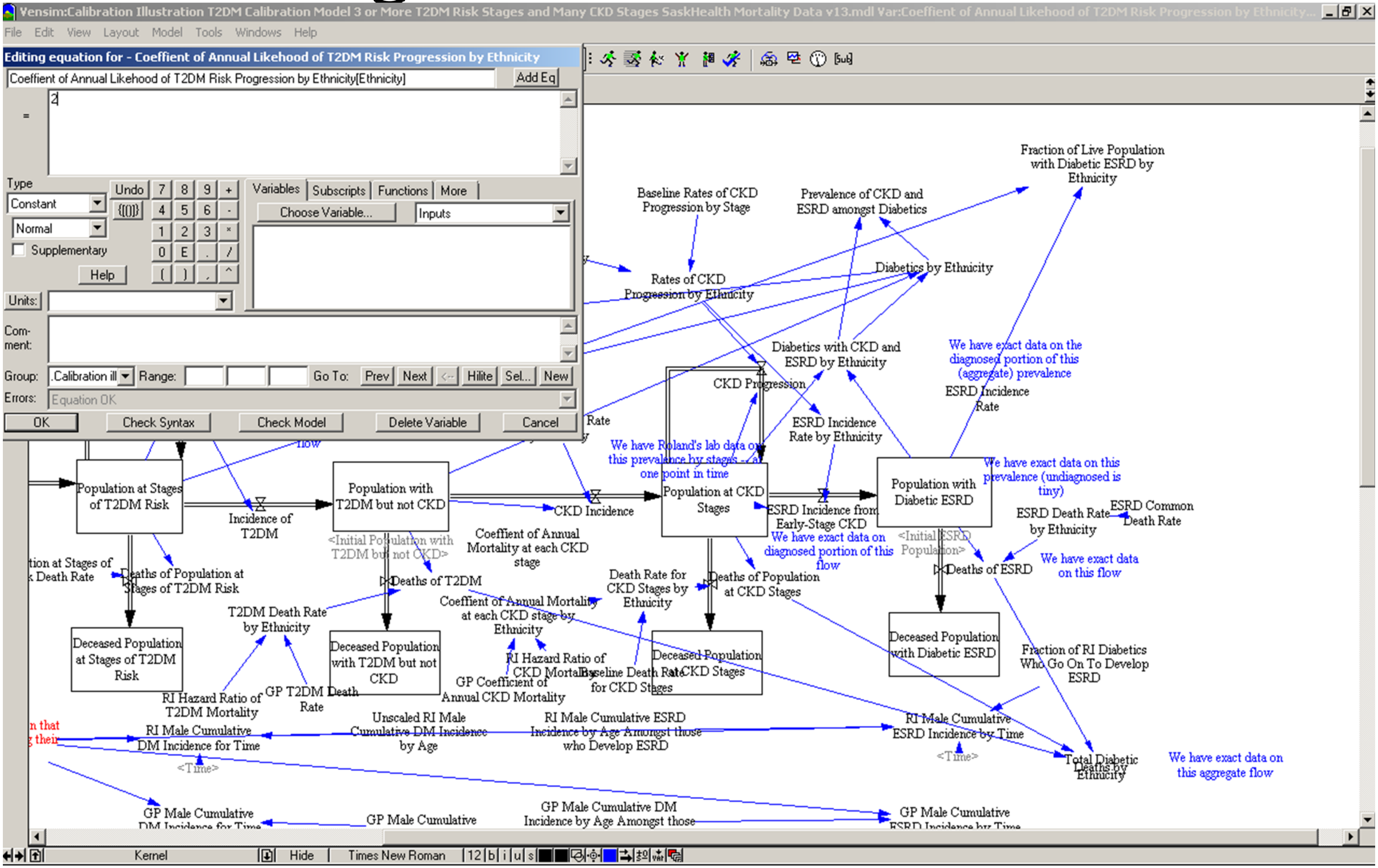
Altering Variable Value in Model



Vensim:Calibration Illustration T2DM Calibration Model 3 or More T2DM Risk Stages and Many CKD Stages SaskHealth Mortality Data v13.mdl Var:Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity...

Editing equation for - Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity

Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity[Ethnicity]

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Total Diabetic Deaths by Ethnicity
We have exact data on this aggregate flow
GP Male Cumulative DM Incidence for Time
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GP Male Cumulative ESRD Incidence by Time
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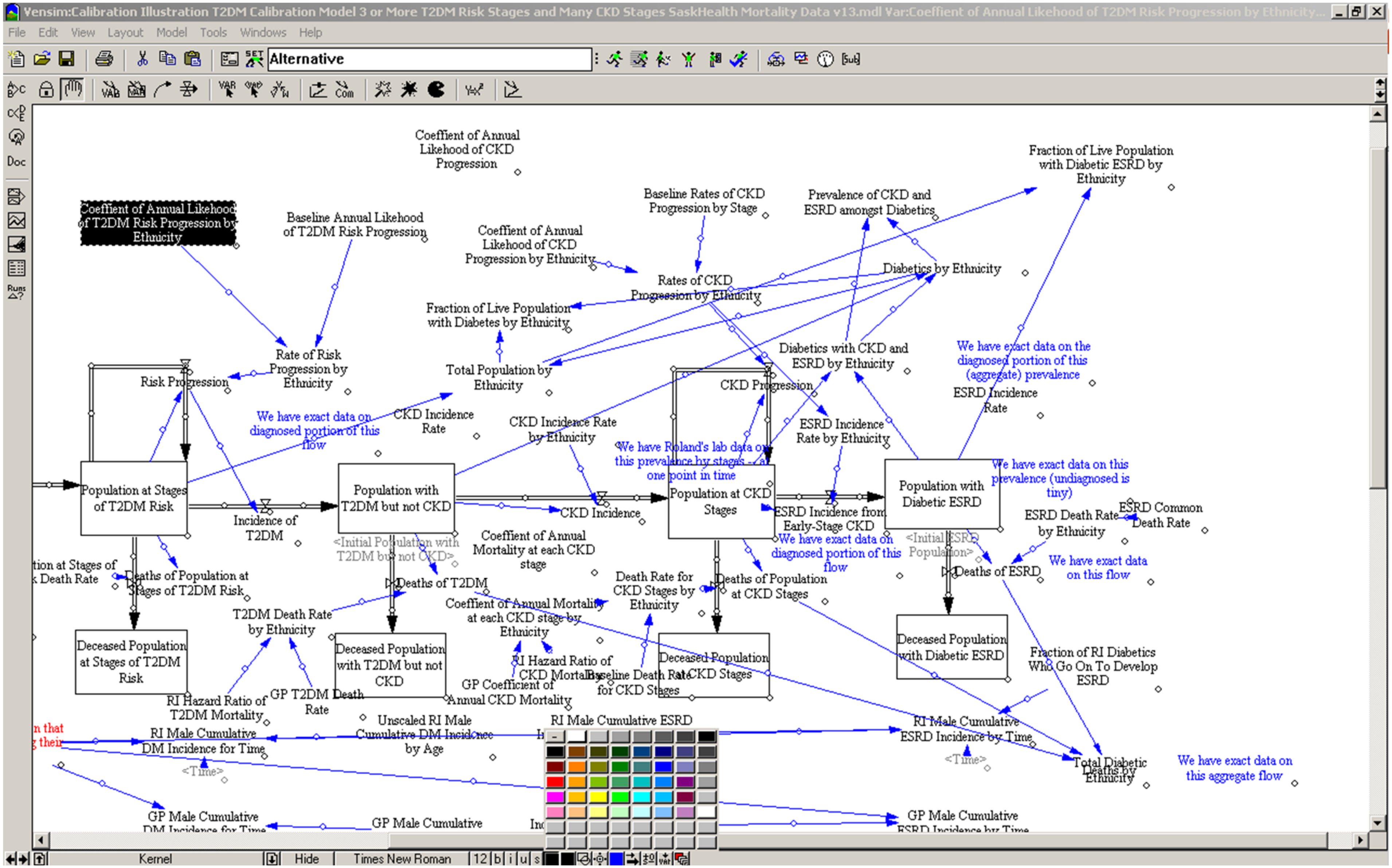
Setting the Color of Parameter to Remind Us that it is Changed



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File Edit View Layout Model Tools Windows Help
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Coeffient of Annual Likehood of CKD Progression
Fraction of Live Population with Diabetic ESRD by Ethnicity
Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity
Baseline Annual Likehood of T2DM Risk Progression
Coeffient of Annual Likehood of CKD Progression by Ethnicity
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Deaths of Population at Stages of T2DM Risk
Deaths of T2DM
Death Rate for CKD Stages by Ethnicity
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We have exact data on this flow
T2DM Death Rate by Ethnicity
Coeffient of Annual Mortality at each CKD stage by Ethnicity
Deceased Population at Stages of T2DM Risk
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We have exact data on this aggregate flow
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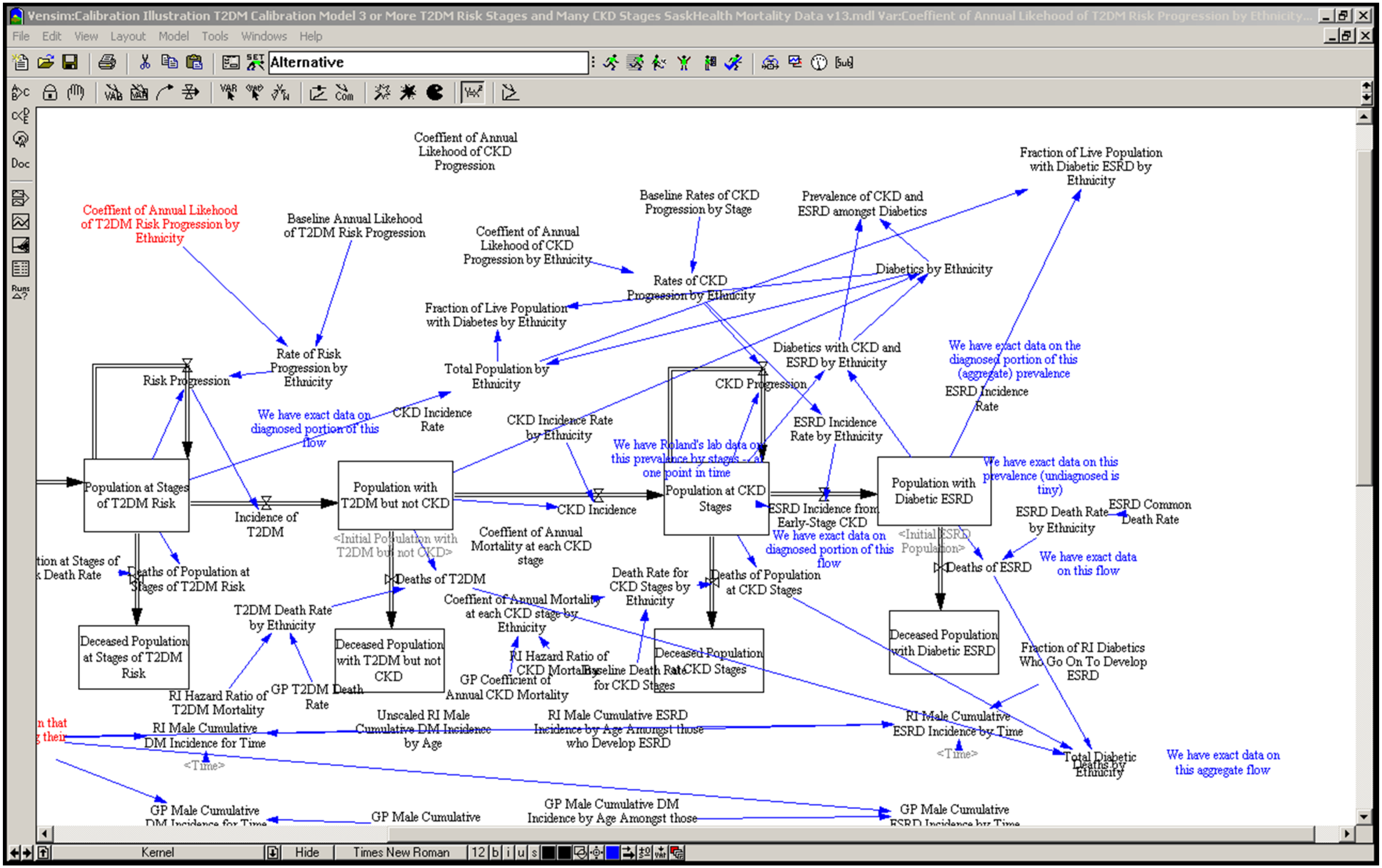
Following Color Change



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File Edit View Layout Model Tools Windows Help
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Runs
Coeffient of Annual Likehood of CKD Progression
Fraction of Live Population with Diabetic ESRD by Ethnicity
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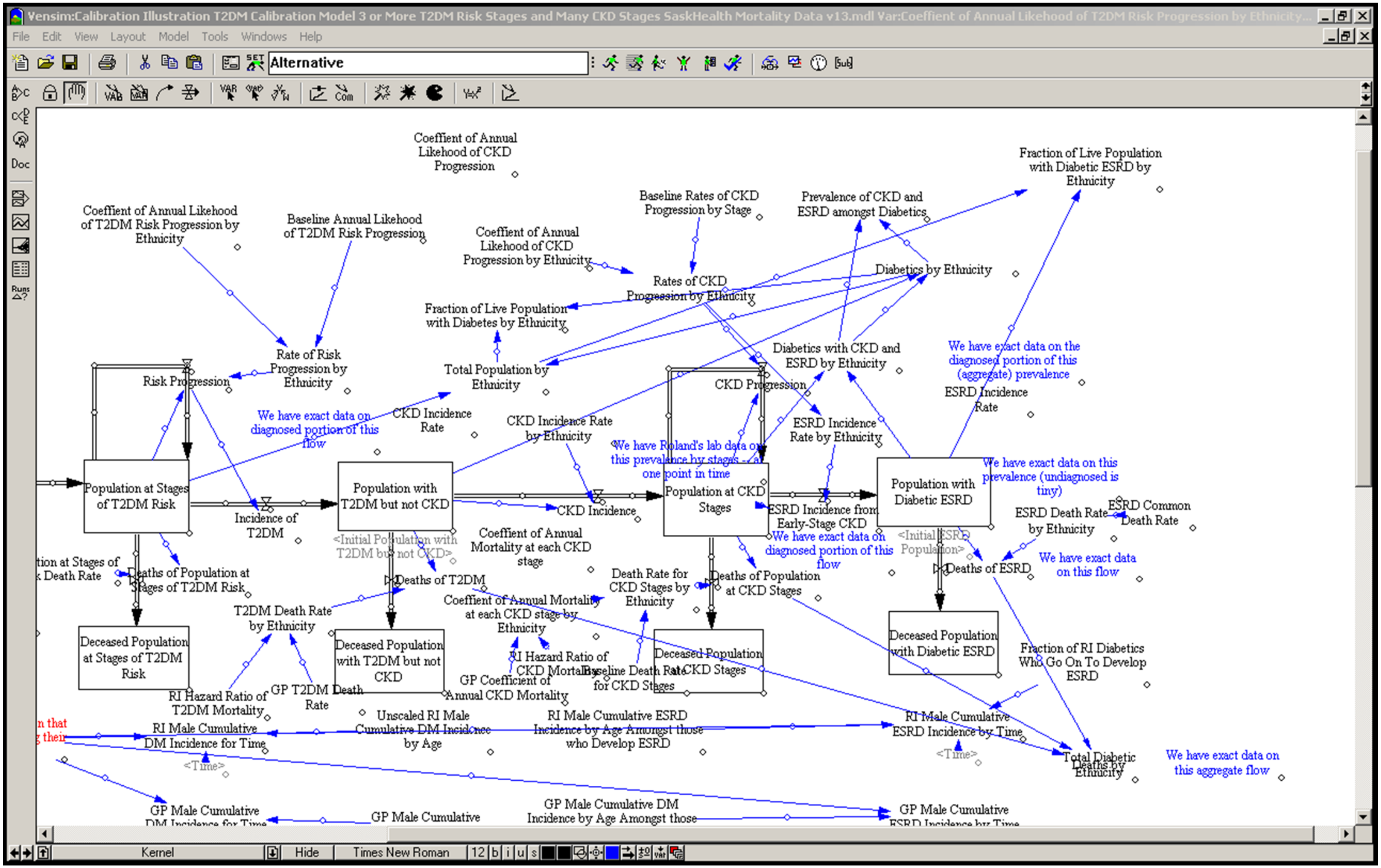
Restore Color once Restore Value



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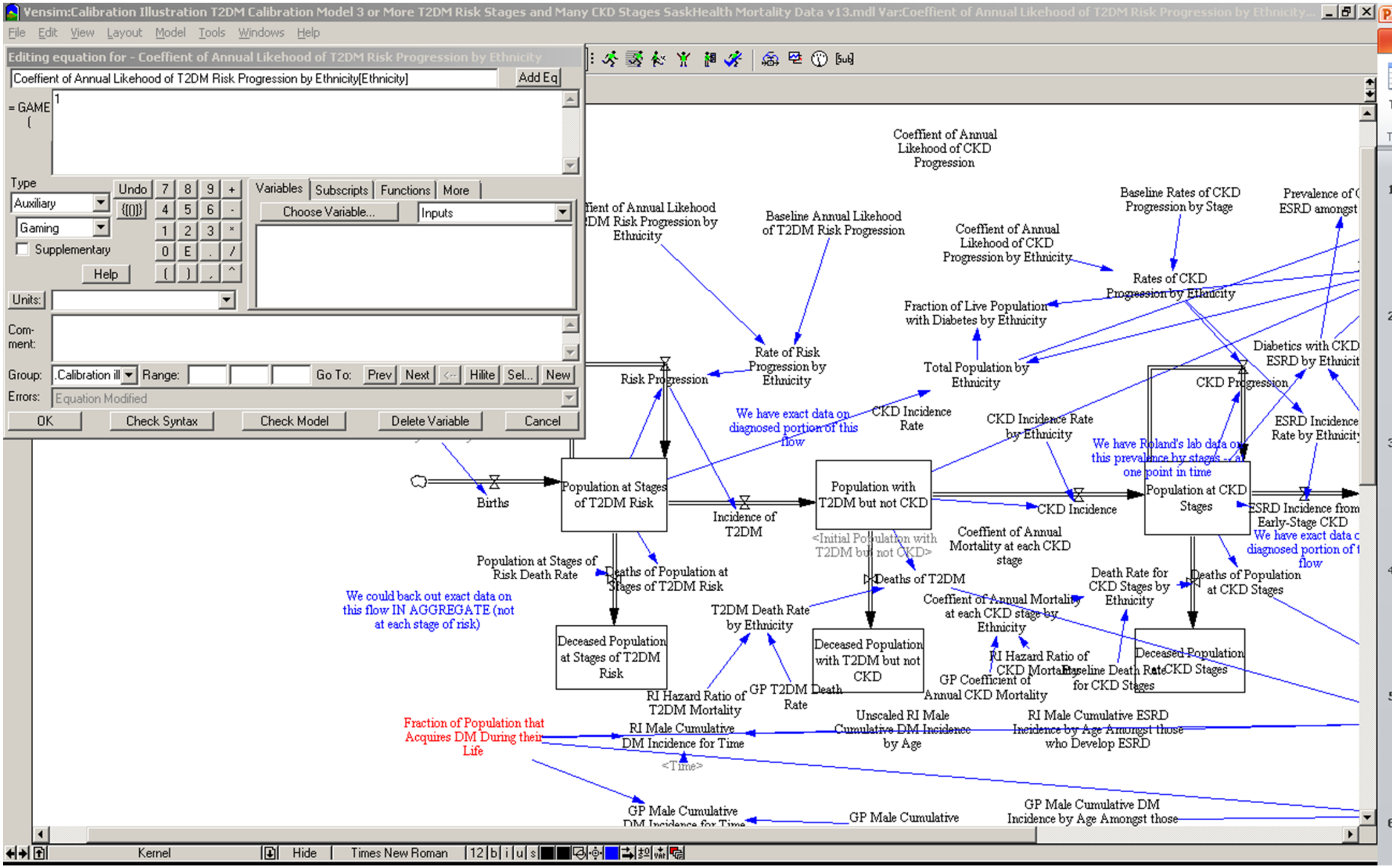
“Gaming” Variables



Vensim:Calibration Illustration T2DM Calibration Model 3 or More T2DM Risk Stages and Many CKD Stages SaskHealth Mortality Data v13.mdl Var:Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity...

Editing equation for - Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity

Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity[Ethnicity]

= GAME (1

Type: Auxiliary

Gaming

□ Supplementary

Units:

Com- ment:

Group: Calibration ill

Range:

Errors: Equation Modified

Inputs

We have exact data on diagnosed portion of this flow

We have Roland's lab data on this prevalence by stage - at one point in time

We have exact data on diagnosed portion of this flow

We could back out exact data on this flow IN AGGREGATE (not at each stage of risk)

Fraction of Population that Acquires DM During their Life

File
Edit
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Tools
Windows
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Help
Variables
Subscripts
Functions
More
Choose Variable...
Go To:
Prev
Next
Hilite
Sel...
New
OK
Check Syntax
Check Model
Delete Variable
Cancel
Coeffient of Annual Likehood of CKD Progression
...fient of Annual Likehood ...DM Risk Progression by Ethnicity
Baseline Annual Likehood of T2DM Risk Progression
Coeffient of Annual Likehood of CKD Progression by Ethnicity
Baseline Rates of CKD Progression by Stage
Prevalence of ... ESRD amongst
Rates of CKD Progression by Ethnicity
Fraction of Live Population with Diabetes by Ethnicity
Total Population by Ethnicity
Rate of Risk Progression by Ethnicity
Risk Progression
CKD Incidence Rate
CKD Incidence Rate by Ethnicity
CKD Progression
Diabetics with CKD ESRD by Ethnicit...
ESRD Incidence Rate by Ethnicity
Births
Population at Stages of T2DM Risk
Incidence of T2DM
Population with T2DM but not CKD
CKD Incidence
Population at CKD Stages
ESRD Incidence from Early-Stage CKD
<Initial Population with T2DM but not CKD>
Coefficient of Annual Mortality at each CKD stage
Population at Stages of Risk Death Rate
Deaths of Population at Stages of T2DM Risk
Deaths of T2DM
Death Rate for CKD Stages by Ethnicity
Deaths of Population at CKD Stages
Coeffient of Annual Mortality at each CKD stage by Ethnicity
T2DM Death Rate by Ethnicity
Deceased Population at Stages of T2DM Risk
Deceased Population with T2DM but not CKD
Deceased Population CKD Stages
RI Hazard Ratio of CKD Mortality
Baseline Death Rate for CKD Stages
GP Coefficient of Annual CKD Mortality
RI Hazard Ratio of T2DM Mortality
GP T2DM Death Rate
RI Male Cumulative DM Incidence for Time
Unscaled RI Male Cumulative DM Incidence by Age
RI Male Cumulative ESRD Incidence by Age Amongst those who Develop ESRD
<Time>
GP Male Cumulative DM Incidence for Time
GP Male Cumulative
GP Male Cumulative DM Incidence by Age Amongst those
Kernel
Hide
Times New Roman
12
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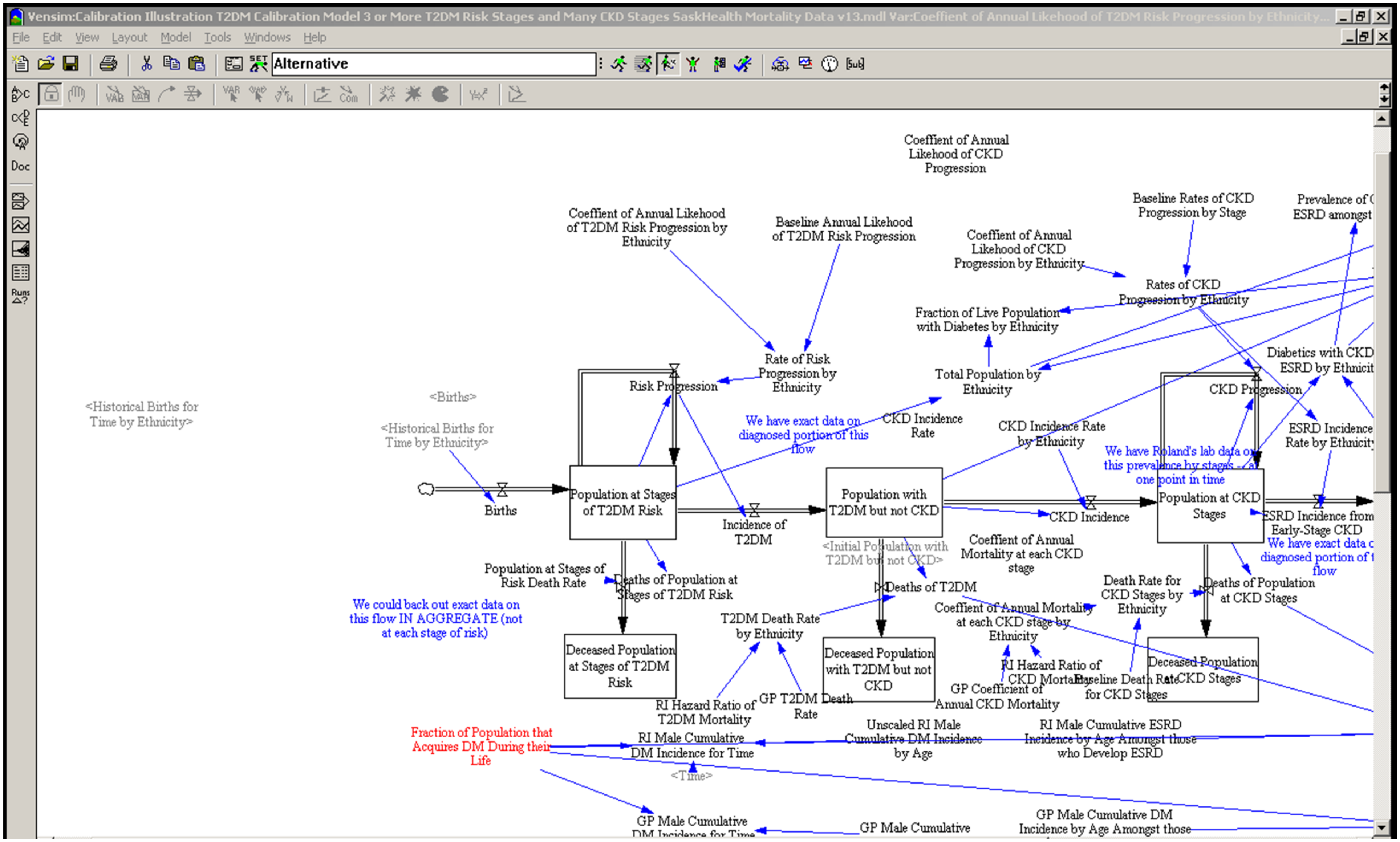
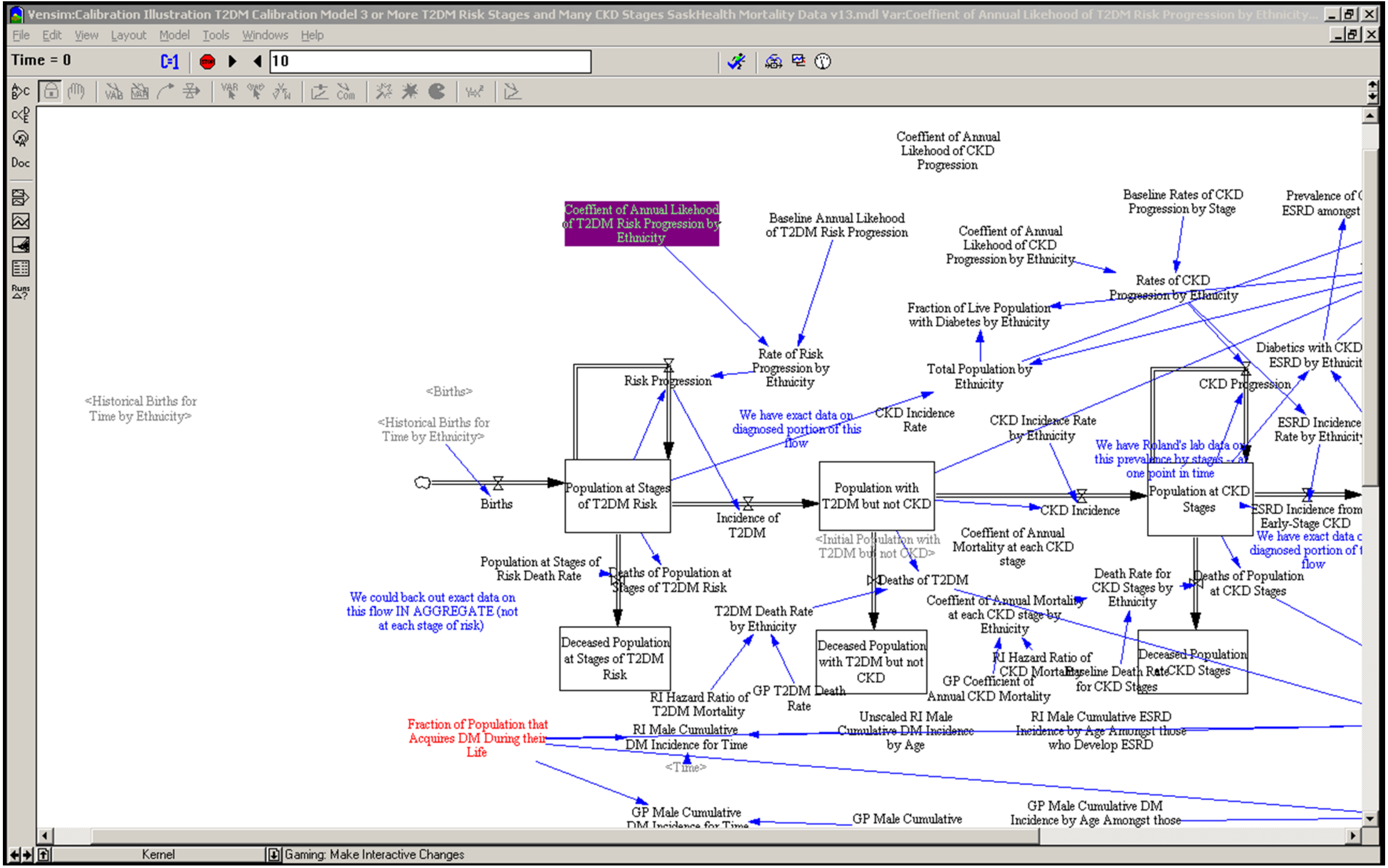
Gaming


Vensim:Calibration Illustration T2DM Calibration Model 3 or More T2DM Risk Stages and Many CKD Stages SaskHealth Mortality Data v13.mdl Var:Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity...
File Edit View Layout Model Tools Windows Help
Alternative
Doc
Runs
Coeffient of Annual Likehood of CKD Progression
Baseline Rates of CKD Progression by Stage
Prevalence of ESRD amongst
Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity
Baseline Annual Likehood of T2DM Risk Progression
Coeffient of Annual Likehood of CKD Progression by Ethnicity
Rates of CKD Progression by Ethnicity
Fraction of Live Population with Diabetes by Ethnicity
Diabetics with CKD ESRD by Ethnicit
Rate of Risk Progression by Ethnicity
Total Population by Ethnicity
Risk Progression
CKD Progression
<Historical Births for Time by Ethnicity>
<Births>
<Historical Births for Time by Ethnicity>
We have exact data on diagnosed portion of this flow
CKD Incidence Rate
CKD Incidence Rate by Ethnicity
ESRD Incidence Rate by Ethnicit
We have Roland's lab data on this prevalence by stages - at one point in time
Births
Population at Stages of T2DM Risk
Population with T2DM but not CKD
CKD Incidence
Population at CKD Stages
ESRD Incidence from Early-Stage CKD
We have exact data c diagnosed portion of t flow
Incidence of T2DM
<Initial Population with T2DM but not CKD>
Coeffient of Annual Mortality at each CKD stage
Population at Stages of Risk Death Rate
Deaths of Population at Stages of T2DM Risk
Deaths of T2DM
Death Rate for CKD Stages by Ethnicity
Deaths of Population at CKD Stages
We could back out exact data on this flow IN AGGREGATE (not at each stage of risk)
T2DM Death Rate by Ethnicity
Coeffient of Annual Mortality at each CKD stage by Ethnicity
Deceased Population at Stages of T2DM Risk
Deceased Population with T2DM but not CKD
RI Hazard Ratio of CKD Mortality
Baseline Death Rate for CKD Stages
Deceased Population CKD Stages
GP Coefficient of Annual CKD Mortality
RI Hazard Ratio of T2DM Mortality
GP T2DM Death Rate
Fraction of Population that Acquires DM During their Life
RI Male Cumulative DM Incidence for Time
Unscaled RI Male Cumulative DM Incidence by Age
RI Male Cumulative ESRD Incidence by Age Amongst those who Develop ESRD
<Time>
GP Male Cumulative DM Incidence for Time
GP Male Cumulative
GP Male Cumulative DM Incidence by Age Amongst those

Gaming Interface



Vensim:Calibration Illustration T2DM Calibration Model 3 or More T2DM Risk Stages and Many CKD Stages SaskHealth Mortality Data v13.mdl Var:Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity...

Time = 0

10

We have exact data on diagnosed portion of this flow

We have Roland's lab data on this prevalence by stages -- at one point in time

We have exact data c diagnosed portion of t flow

We could back out exact data on this flow IN AGGREGATE (not at each stage of risk)

Fraction of Population that Acquires DM During their Life

Kernel

Gaming: Make Interactive Changes

File
Edit
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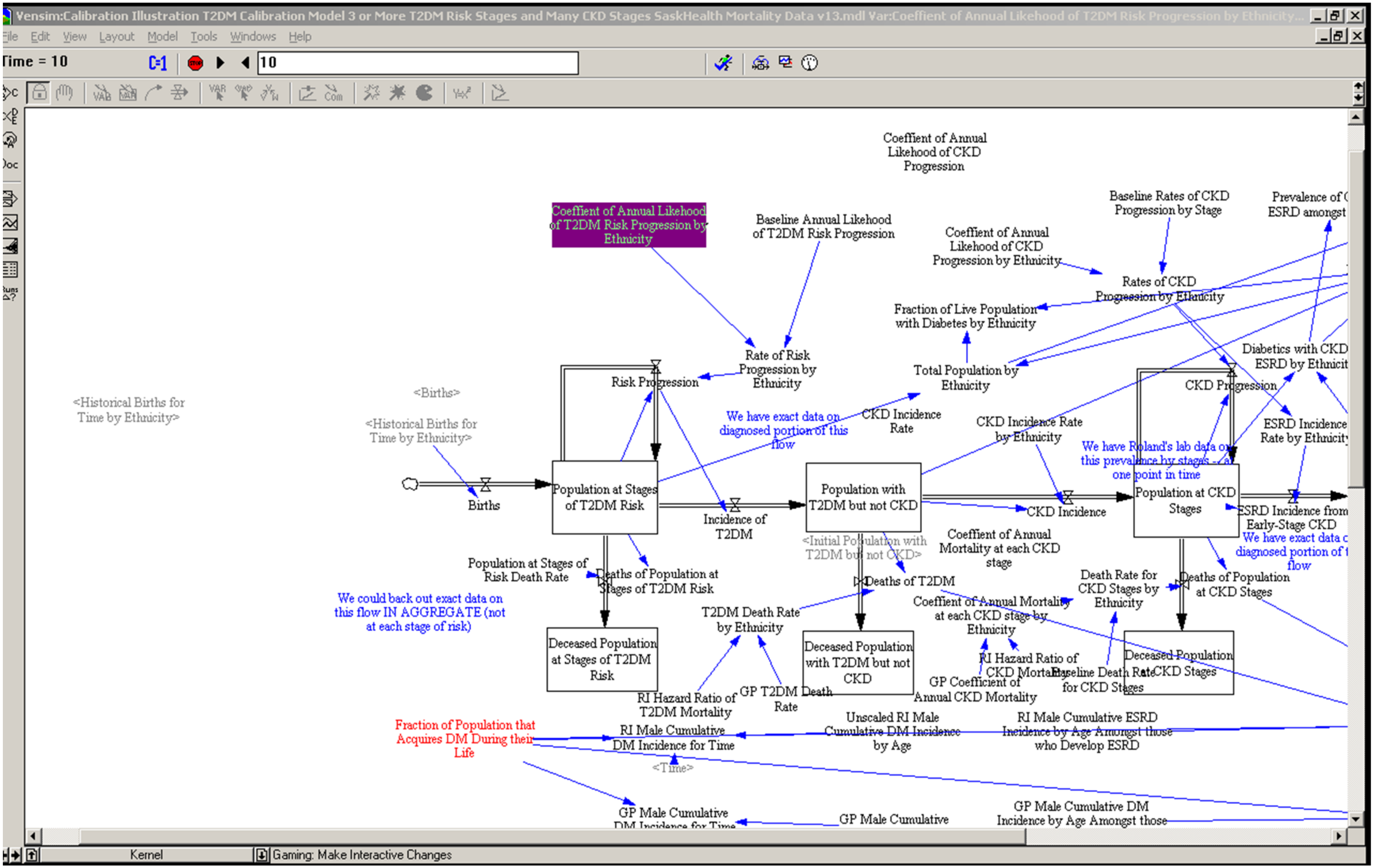
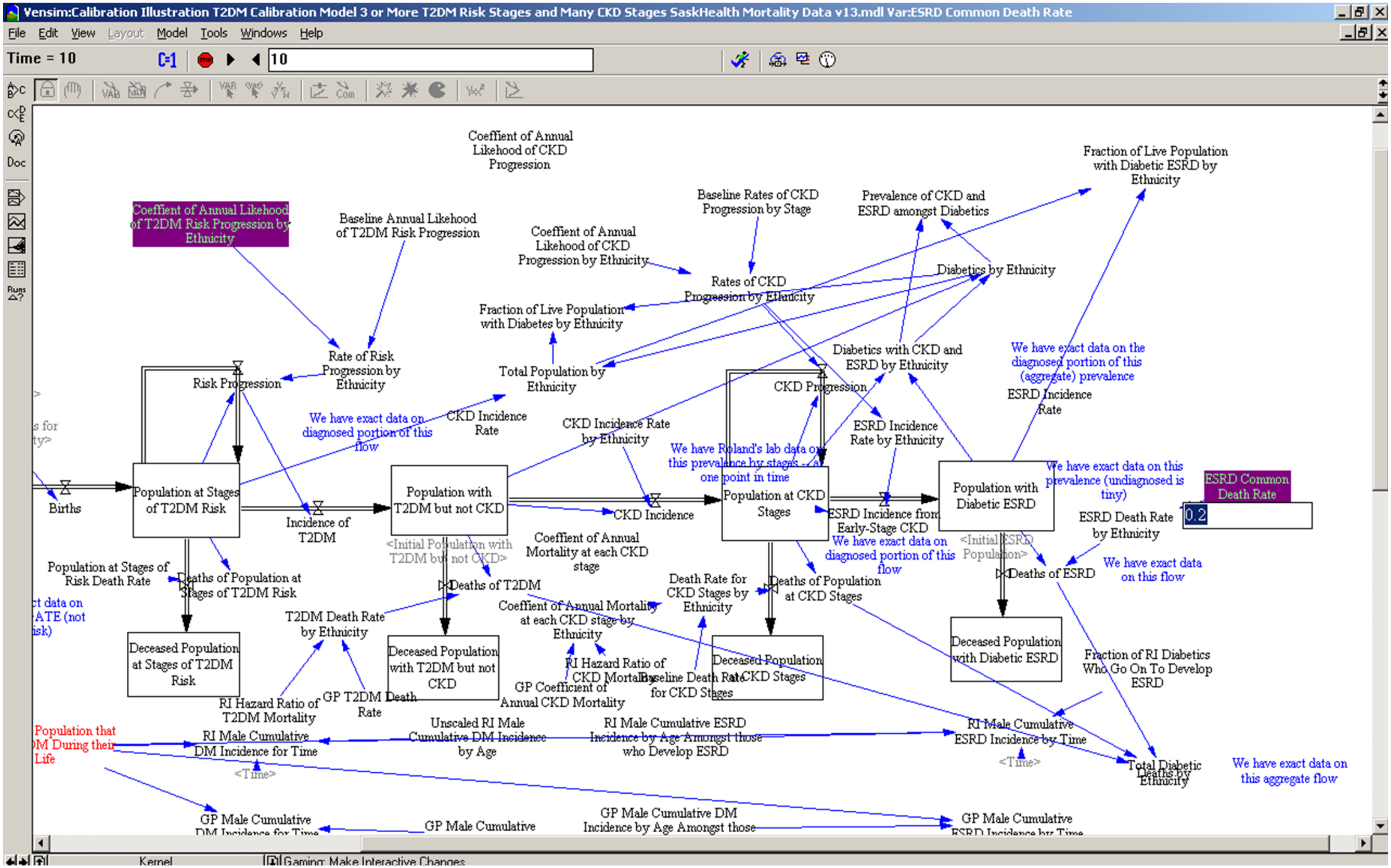
Tools
Windows
Help
VAR
Com
Doc
Runs
Coeffient of Annual Likehood of CKD Progression
Baseline Rates of CKD Progression by Stage
Prevalence of (ESRD amongst
Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity
Baseline Annual Likehood of T2DM Risk Progression
Coeffient of Annual Likehood of CKD Progression by Ethnicity
Rates of CKD Progression by Ethnicity
Fraction of Live Population with Diabetes by Ethnicity
Rate of Risk Progression by Ethnicity
Total Population by Ethnicity
Diabetics with CKD ESRD by Ethnicit
Risk Progression
CKD Progression
<Historical Births for Time by Ethnicity>
<Births>
<Historical Births for Time by Ethnicity>
CKD Incidence Rate
CKD Incidence Rate by Ethnicity
ESRD Incidence Rate by Ethnicity
Births
Population at Stages of T2DM Risk
Incidence of T2DM
Population with T2DM but not CKD
CKD Incidence
Population at CKD Stages
ESRD Incidence from Early-Stage CKD
<Initial Population with T2DM but not CKD>
Coeffient of Annual Mortality at each CKD stage
Population at Stages of Risk Death Rate
Deaths of Population at Stages of T2DM Risk
Deaths of T2DM
Death Rate for CKD Stages by Ethnicity
Deaths of Population at CKD Stages
T2DM Death Rate by Ethnicity
Coeffient of Annual Mortality at each CKD stage by Ethnicity
Deceased Population at Stages of T2DM Risk
Deceased Population with T2DM but not CKD
Deceased Population at CKD Stages
RI Hazard Ratio of CKD Mortality
Baseline Death Rate for CKD Stages
GP Coefficient of Annual CKD Mortality
RI Hazard Ratio of T2DM Mortality
GP T2DM Death Rate
Unscaled RI Male Cumulative DM Incidence by Age
RI Male Cumulative ESRD Incidence by Age Amongst those who Develop ESRD
RI Male Cumulative DM Incidence for Time
<Time>
GP Male Cumulative DM Incidence for Time
GP Male Cumulative
GP Male Cumulative DM Incidence by Age Amongst those

Advancing time w/"Move Forward" Button


Vensim:Calibration Illustration T2DM Calibration Model 3 or More T2DM Risk Stages and Many CKD Stages SaskHealth Mortality Data v13.mdl Var:Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity...
File Edit View Layout Model Tools Windows Help
Time = 10
C=1
10
VAR
Com
Kernel
Gaming: Make Interactive Changes
Coeffient of Annual Likehood of CKD Progression
Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity
Baseline Annual Likehood of T2DM Risk Progression
Coeffient of Annual Likehood of CKD Progression by Ethnicity
Baseline Rates of CKD Progression by Stage
Prevalence of (ESRD amongst
Rates of CKD Progression by Ethnicity
Fraction of Live Population with Diabetes by Ethnicity
Diabetics with CKD ESRD by Ethnicit
Rate of Risk Progression by Ethnicity
Total Population by Ethnicity
Risk Progression
CKD Progression
<Historical Births for Time by Ethnicity>
<Births>
<Historical Births for Time by Ethnicity>
We have exact data on diagnosed portion of this flow
CKD Incidence Rate
CKD Incidence Rate by Ethnicity
ESRD Incidence Rate by Ethnicity
We have Roland's lab data on this prevalence by stages -- at one point in time
Births
Population at Stages of T2DM Risk
Incidence of T2DM
Population with T2DM but not CKD
CKD Incidence
Population at CKD Stages
ESRD Incidence from Early-Stage CKD
We have exact data o diagnosed portion of t flow
<Initial Population with T2DM but not CKD>
Coeffient of Annual Mortality at each CKD stage
Population at Stages of Risk Death Rate
Deaths of Population at Stages of T2DM Risk
Deaths of T2DM
Death Rate for CKD Stages by Ethnicity
Deaths of Population at CKD Stages
We could back out exact data on this flow IN AGGREGATE (not at each stage of risk)
T2DM Death Rate by Ethnicity
Coeffient of Annual Mortality at each CKD stage by Ethnicity
Deceased Population at Stages of T2DM Risk
Deceased Population with T2DM but not CKD
Deceased Population at CKD Stages
RI Hazard Ratio of CKD Mortality
Baseline Death Rate for CKD Stages
RI Hazard Ratio of T2DM Mortality
GP T2DM Death Rate
GP Coefficient of Annual CKD Mortality
Fraction of Population that Acquires DM During their Life
RI Male Cumulative DM Incidence for Time
Unscaled RI Male Cumulative DM Incidence by Age
RI Male Cumulative ESRD Incidence by Age Amongst those who Develop ESRD
<Time>
GP Male Cumulative DM Incidence for Time
GP Male Cumulative
GP Male Cumulative DM Incidence by Age Amongst those

Click to Change a Gaming Variable (Interface for a Non-Subscripted Variable)



Vensim:Calibration Illustration T2DM Calibration Model 3 or More T2DM Risk Stages and Many CKD Stages SaskHealth Mortality Data v13.mdl Var:ESRD Common Death Rate

Time = 10

10

ESRD Common Death Rate: 0.2

Kernel

Gaming: Make Interactive Changes

We have exact data on diagnosed portion of this flow

We have Roland's lab data on this prevalence by stages -- at one point in time

We have exact data on diagnosed portion of this flow

We have exact data on the diagnosed portion of this (aggregate) prevalence

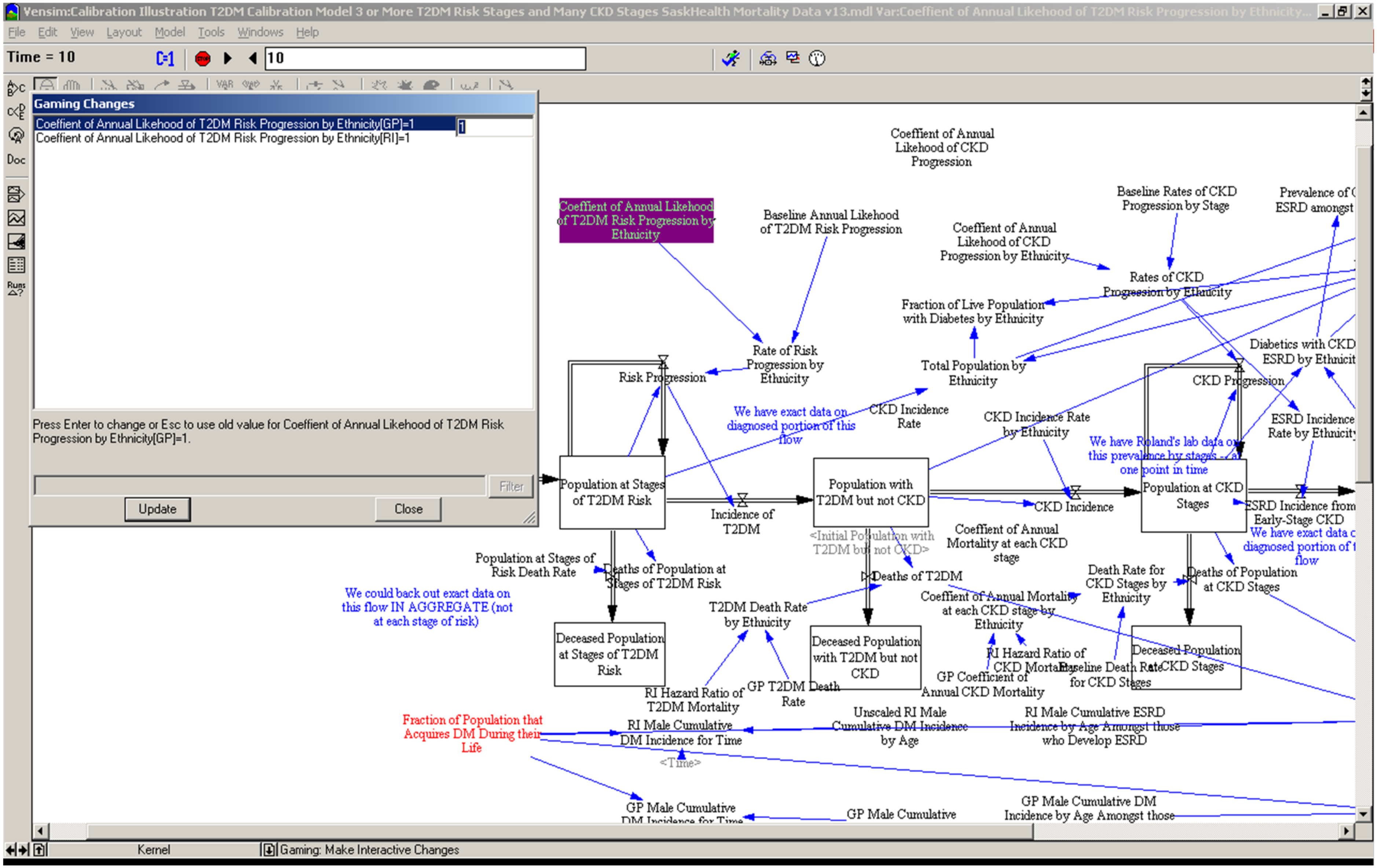
We have exact data on this prevalence (undiagnosed is tiny)

We have exact data on this flow

We have exact data on this aggregate flow

File
Edit
View
Layout
Model
Tools
Windows
Help
Doc
Runs
Coeffient of Annual Likehood of CKD Progression
Fraction of Live Population with Diabetic ESRD by Ethnicity
Coefficent of Annual Likehood of T2DM Risk Progression by Ethnicity
Baseline Annual Likehood of T2DM Risk Progression
Coefficent of Annual Likehood of CKD Progression by Ethnicity
Baseline Rates of CKD Progression by Stage
Prevalence of CKD and ESRD amongst Diabetics
Rates of CKD Progression by Ethnicity
Diabetics by Ethnicity
Fraction of Live Population with Diabetes by Ethnicity
Rate of Risk Progression by Ethnicity
Total Population by Ethnicity
Diabetics with CKD and ESRD by Ethnicity
Risk Progression
CKD Progression
CKD Incidence Rate
CKD Incidence Rate by Ethnicity
ESRD Incidence Rate by Ethnicity
ESRD Incidence Rate
Births
Population at Stages of T2DM Risk
Incidence of T2DM
Population with T2DM but not CKD
CKD Incidence
Population at CKD Stages
ESRD Incidence from Early-Stage CKD
Population with Diabetic ESRD
ESRD Common Death Rate
ESRD Death Rate by Ethnicity
<Initial Population with T2DM but not CKD>
<Initial ESRD Population>
Coefficent of Annual Mortality at each CKD stage
Population at Stages of Risk Death Rate
Deaths of Population at Stages of T2DM Risk
Deaths of T2DM
T2DM Death Rate by Ethnicity
Coefficent of Annual Mortality at each CKD stage by Ethnicity
Death Rate for CKD Stages by Ethnicity
Deaths of Population at CKD Stages
Deaths of ESRD
Deceased Population at Stages of T2DM Risk
Deceased Population with T2DM but not CKD
Deceased Population at CKD Stages
Deceased Population with Diabetic ESRD
RI Hazard Ratio of CKD Mortality
Baseline Death Rate for CKD Stages
GP Coefficient of Annual CKD Mortality
Fraction of RI Diabetics Who Go On To Develop ESRD
RI Hazard Ratio of T2DM Mortality
GP T2DM Death Rate
Population that DM During their Life
RI Male Cumulative DM Incidence for Time
Unscaled RI Male Cumulative DM Incidence by Age
RI Male Cumulative ESRD Incidence by Age Amongst those who Develop ESRD
RI Male Cumulative ESRD Incidence by Time
Total Diabetic Deaths by Ethnicity
<Time>
<Time>
GP Male Cumulative DM Incidence for Time
GP Male Cumulative
GP Male Cumulative DM Incidence by Age Amongst those
GP Male Cumulative ESRD Incidence by Time

Click to Change a Gaming Variable (Interface for a Subscripted Variable)



Vensim:Calibration Illustration T2DM Calibration Model 3 or More T2DM Risk Stages and Many CKD Stages SaskHealth Mortality Data v13.mdl Var:Coefficent of Annual Likehood of T2DM Risk Progression by Ethnicity...

Time = 10

Gaming Changes

Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity[GP]=1 | 1

Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity[RI]=1

Press Enter to change or Esc to use old value for Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity[GP]=1.

Kernel

Gaming: Make Interactive Changes

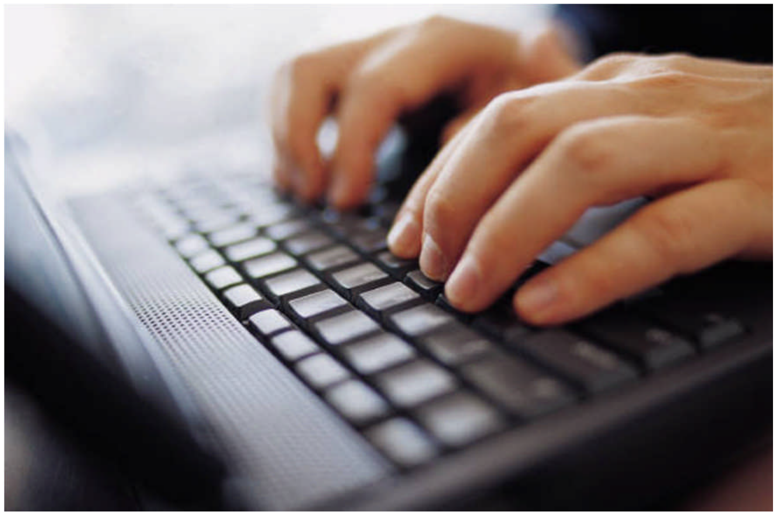
File
Edit
View
Layout
Model
Tools
Windows
Help
10
Doc
Runs
Filter
Update
Close
Coeffient of Annual Likehood of CKD Progression
Coeffient of Annual Likehood of T2DM Risk Progression by Ethnicity
Baseline Annual Likehood of T2DM Risk Progression
Baseline Rates of CKD Progression by Stage
Prevalence of ESRD amongst
Coeffient of Annual Likehood of CKD Progression by Ethnicity
Rates of CKD Progression by Ethnicity
Fraction of Live Population with Diabetes by Ethnicity
Rate of Risk Progression by Ethnicity
Risk Progression
Total Population by Ethnicity
Diabetics with CKD ESRD by Ethnicit
CKD Progression
We have exact data on diagnosed portion of this flow
CKD Incidence Rate
CKD Incidence Rate by Ethnicity
ESRD Incidence Rate by Ethnicit
We have Roland's lab data on this prevalence by stages - at one point in time
Population at Stages of T2DM Risk
Population with T2DM but not CKD
Population at CKD Stages
Incidence of T2DM
CKD Incidence
ESRD Incidence from Early-Stage CKD
<Initial Population with T2DM but not CKD>
Coeffient of Annual Mortality at each CKD stage
We have exact data c diagnosed portion of t flow
Population at Stages of Risk Death Rate
Deaths of Population at Stages of T2DM Risk
Deaths of T2DM
Death Rate for CKD Stages by Ethnicity
Deaths of Population at CKD Stages
We could back out exact data on this flow IN AGGREGATE (not at each stage of risk)
T2DM Death Rate by Ethnicity
Coeffient of Annual Mortality at each CKD stage by Ethnicity
Deceased Population at Stages of T2DM Risk
Deceased Population with T2DM but not CKD
Deceased Population CKD Stages
RI Hazard Ratio of CKD Mortality
Baseline Death Rate for CKD Stages
GP Coefficient of Annual CKD Mortality
RI Hazard Ratio of T2DM Mortality
GP T2DM Death Rate
Unscaled RI Male Cumulative DM Incidence by Age
RI Male Cumulative ESRD Incidence by Age Amongst those who Develop ESRD
Fraction of Population that Acquires DM During their Life
RI Male Cumulative DM Incidence for Time
<Time>
GP Male Cumulative DM Incidence for Time
GP Male Cumulative
GP Male Cumulative DM Incidence by Age Amongst those

Accomplishing “Live” Changes in AnyLogic via User Interface Elements

- Experiment User Interface normally just provides parameter values for starting up model
- Modifying an AnyLogic model’s operation during simulation itself can most easily be accomplished via a UI based in the Main object

⚠

Hands on Model Use Ahead

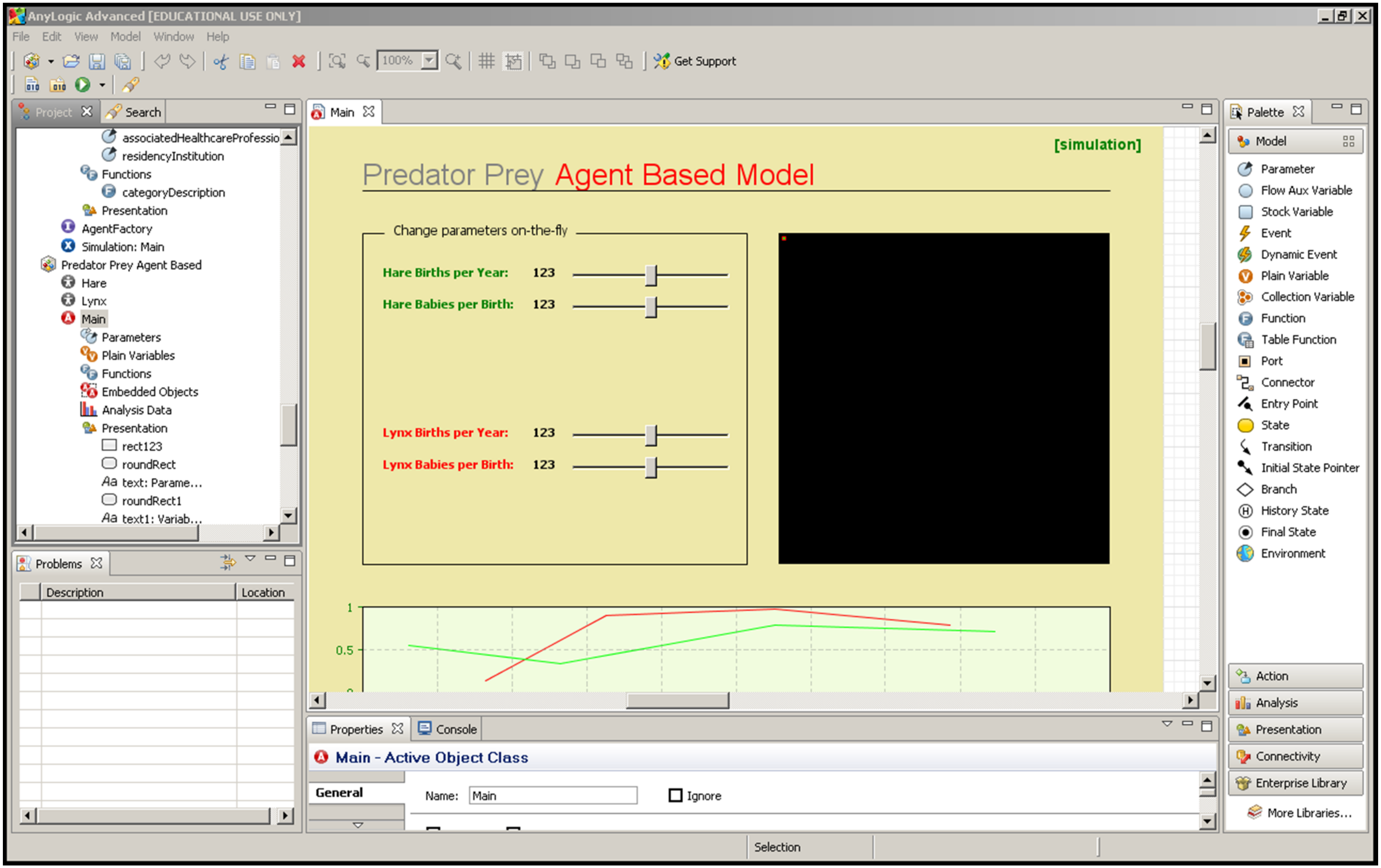


Load Sample Model:

Predatory Prey Agent Based

(Via “Sample Models” under “Help” Menu)

“Main” interface with Sliders



Hare Births per Year: 123

Hare Babies per Birth: 123

Lynx Births per Year: 123

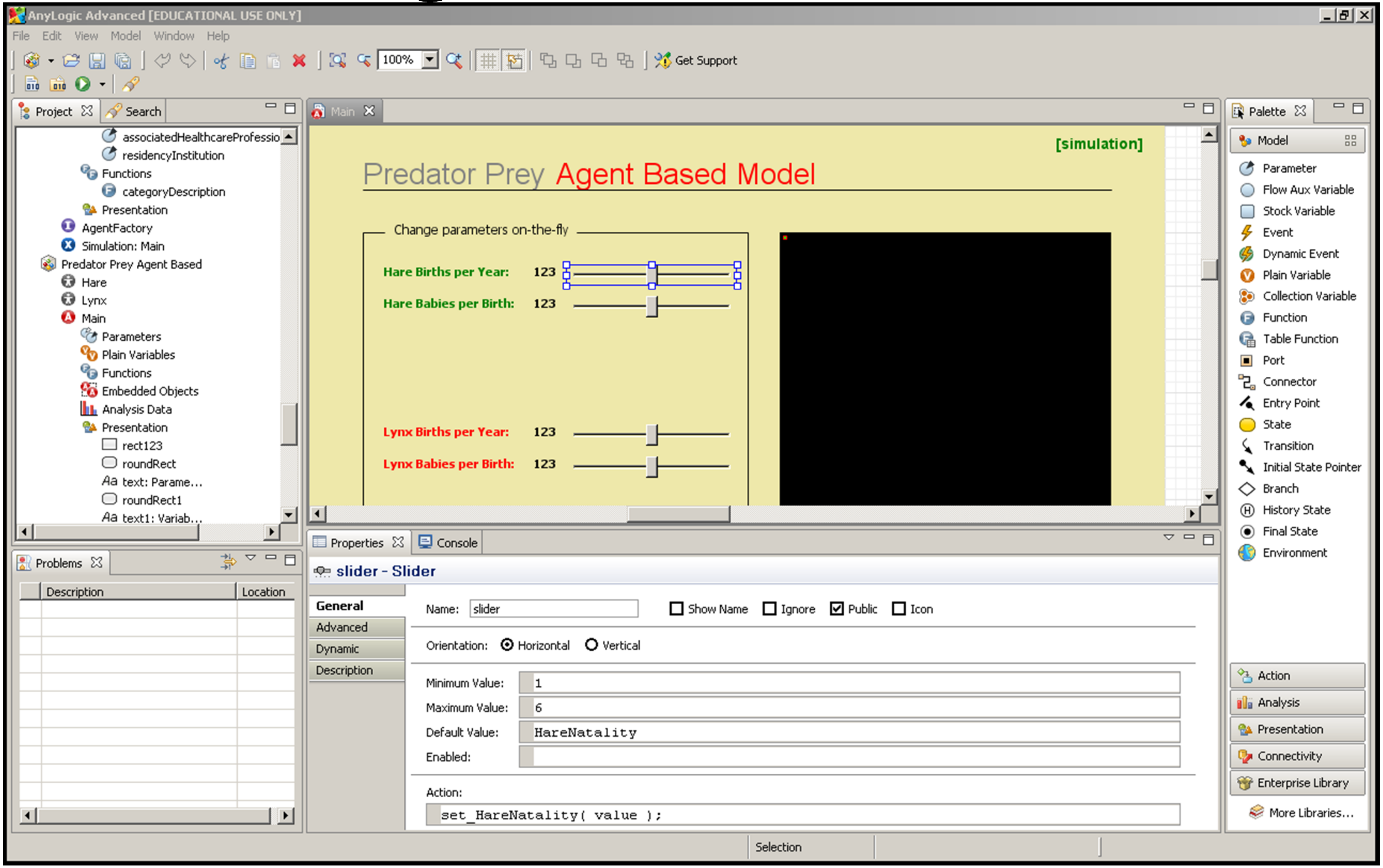
Lynx Babies per Birth: 123

Main - Active Object Class

Name: Main

□ Ignore

Slider Logic – Modifies Parameter



slider - Slider

Name: slider ☐ Show Name ☐ Ignore ☑ Public ☐ Icon

Orientation: ● Horizontal ○ Vertical

Minimum Value: 1

Maximum Value: 6

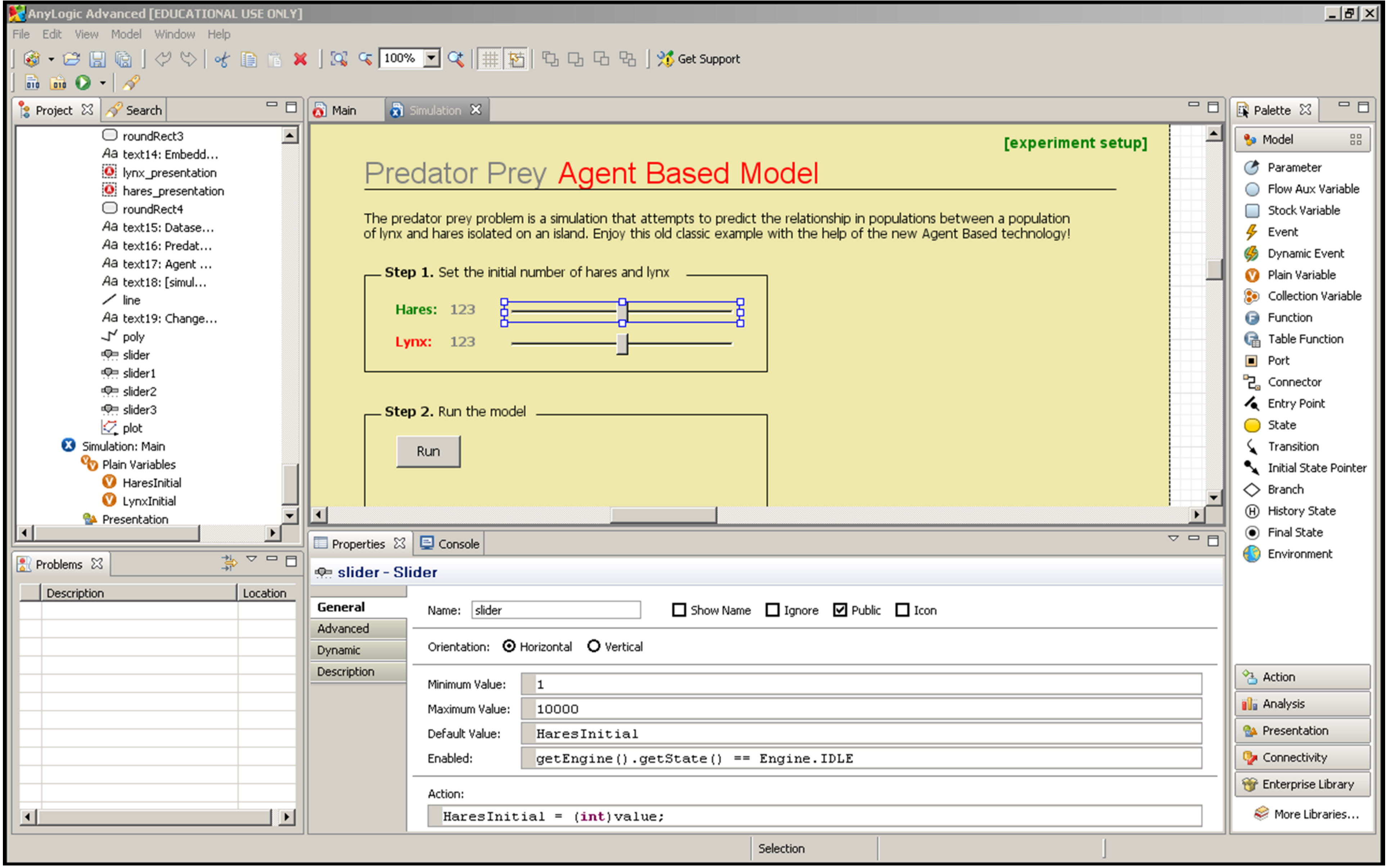
Default Value: HareNatality

Enabled:

Action:

```
set_HareNatality( value );
```

Logic for Initial Values



[experiment setup]

Predator Prey Agent Based Model

The predator prey problem is a simulation that attempts to predict the relationship in populations between a population of lynx and hares isolated on an island. Enjoy this old classic example with the help of the new Agent Based technology!

Step 1. Set the initial number of hares and lynx

Hares: 123

Lynx: 123

Step 2. Run the model

Run

slider - Slider

Name: slider   ☐ Show Name   ☐ Ignore   ☑ Public   ☐ Icon

Orientation: ● Horizontal   ○ Vertical

Minimum Value: 1

Maximum Value: 10000

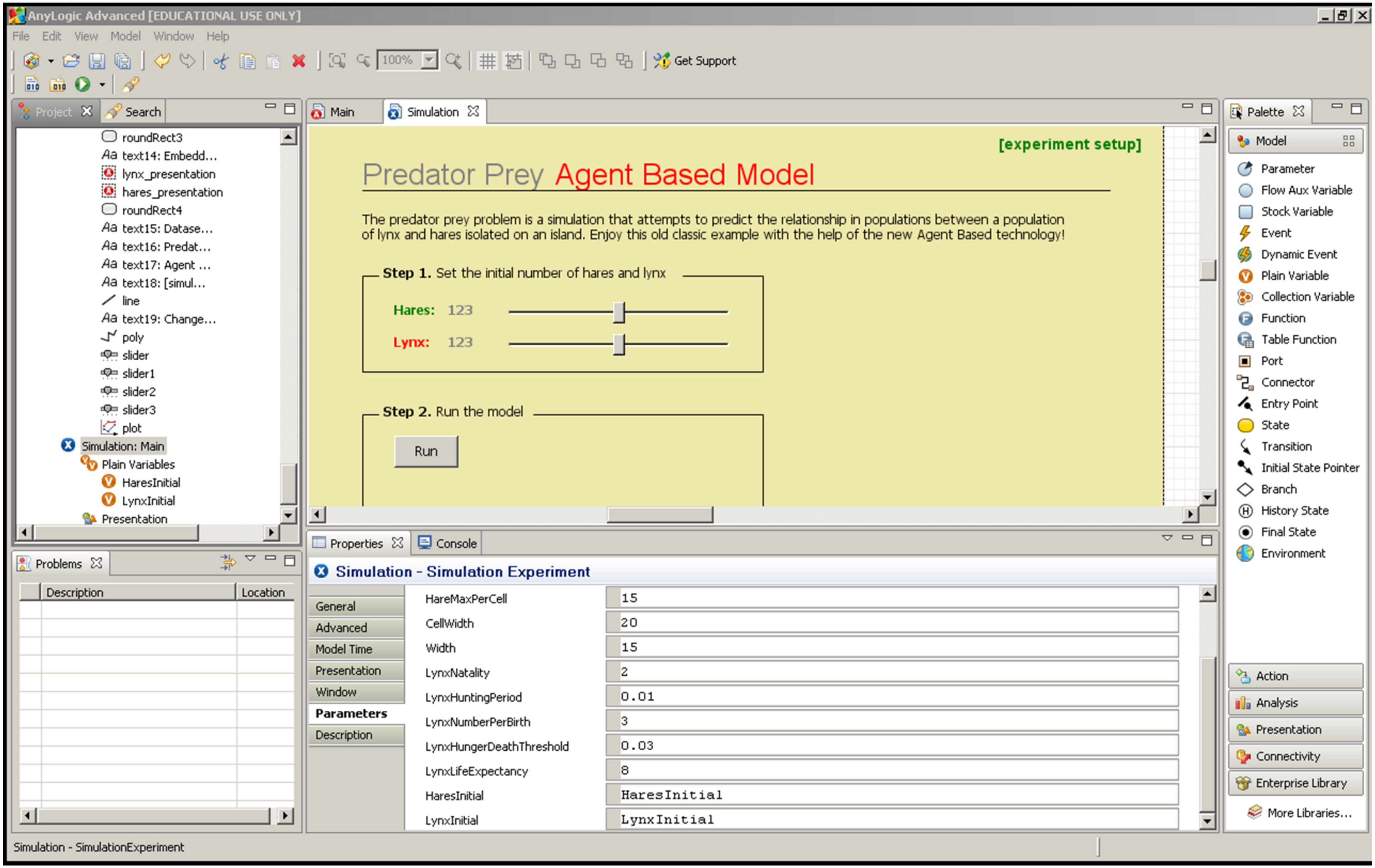
Default Value: HaresInitial

Enabled: getEngine().getState() == Engine.IDLE

Action:

```
HaresInitial = (int)value;
```

Passing on Modified Parameter Values to the Simulation



[experiment setup]

Predator Prey Agent Based Model

The predator prey problem is a simulation that attempts to predict the relationship in populations between a population of lynx and hares isolated on an island. Enjoy this old classic example with the help of the new Agent Based technology!

Step 1. Set the initial number of hares and lynx

Hares: 123

Lynx: 123

Step 2. Run the model

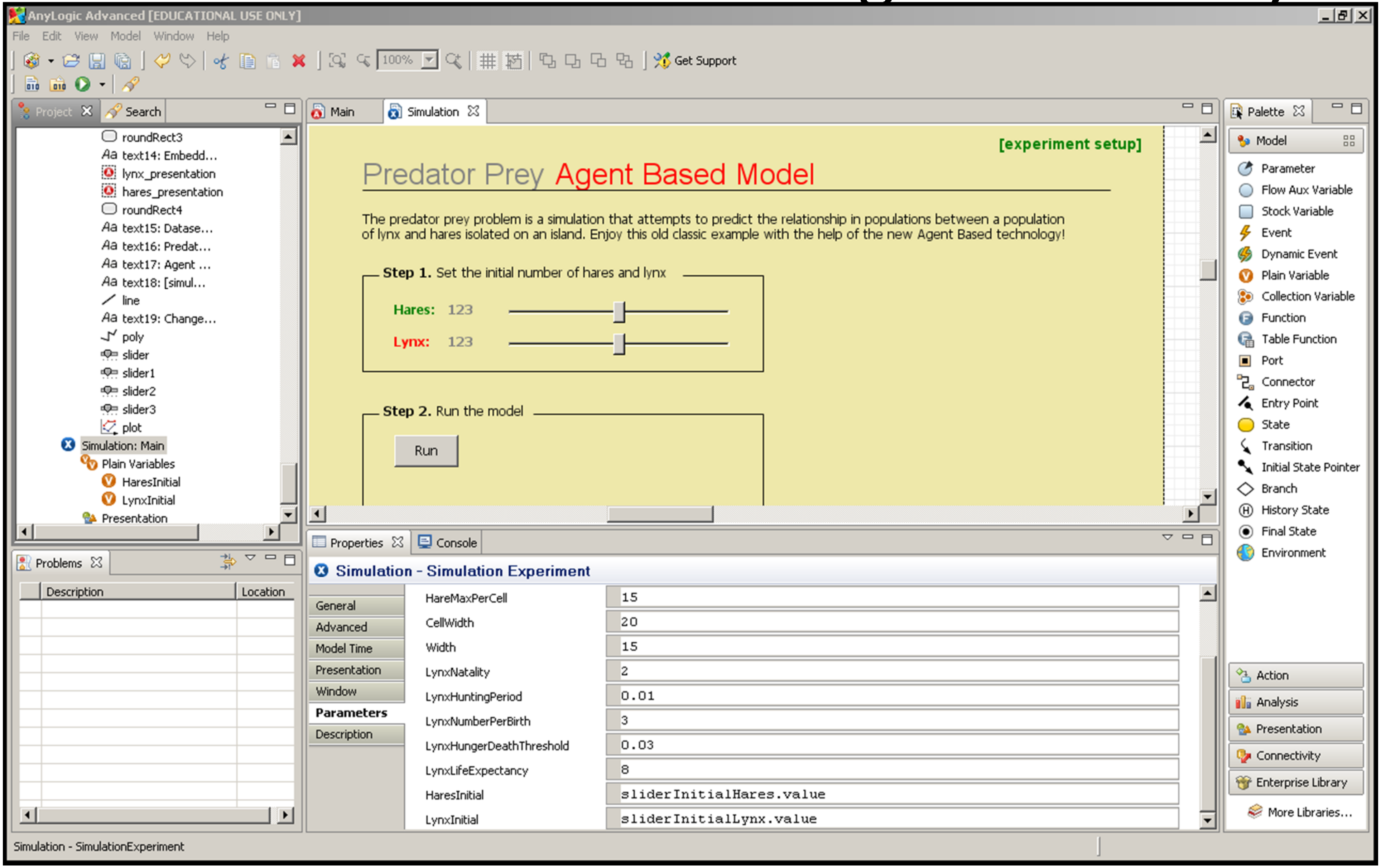
Run

Simulation - Simulation Experiment

HareMaxPerCell	15
CellWidth	20
Width	15
LynxNatality	2
LynxHuntingPeriod	0.01
LynxNumberPerBirth	3
LynxHungerDeathThreshold	0.03
LynxLifeExpectancy	8
HaresInitial	HaresInitial
LynxInitial	LynxInitial

Simulation - SimulationExperiment

Another Option
Note: Slider Names Changed for Clarity



[experiment setup]

Predator Prey Agent Based Model

The predator prey problem is a simulation that attempts to predict the relationship in populations between a population of lynx and hares isolated on an island. Enjoy this old classic example with the help of the new Agent Based technology!

Step 1. Set the initial number of hares and lynx

Hares: 123

Lynx: 123

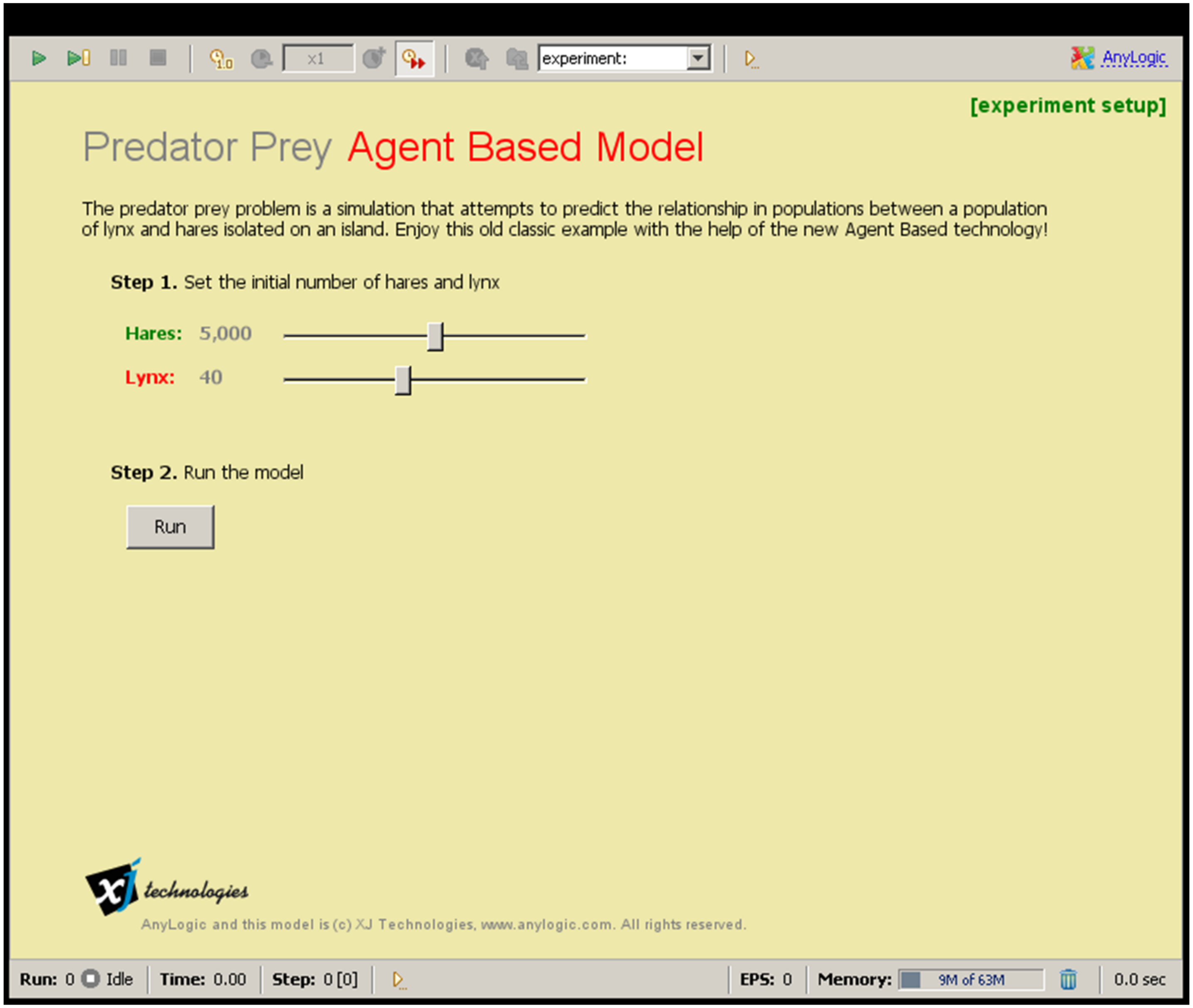
Step 2. Run the model

Run

Simulation - Simulation Experiment

HareMaxPerCell	15
CellWidth	20
Width	15
LynxNatality	2
LynxHuntingPeriod	0.01
LynxNumberPerBirth	3
LynxHungerDeathThreshold	0.03
LynxLifeExpectancy	8
HaresInitial	sliderInitialHares.value
LynxInitial	sliderInitialLynx.value

Setting Initial Values



[experiment setup]

Predator Prey Agent Based Model

The predator prey problem is a simulation that attempts to predict the relationship in populations between a population of lynx and hares isolated on an island. Enjoy this old classic example with the help of the new Agent Based technology!

Step 1. Set the initial number of hares and lynx

Hares: 5,000

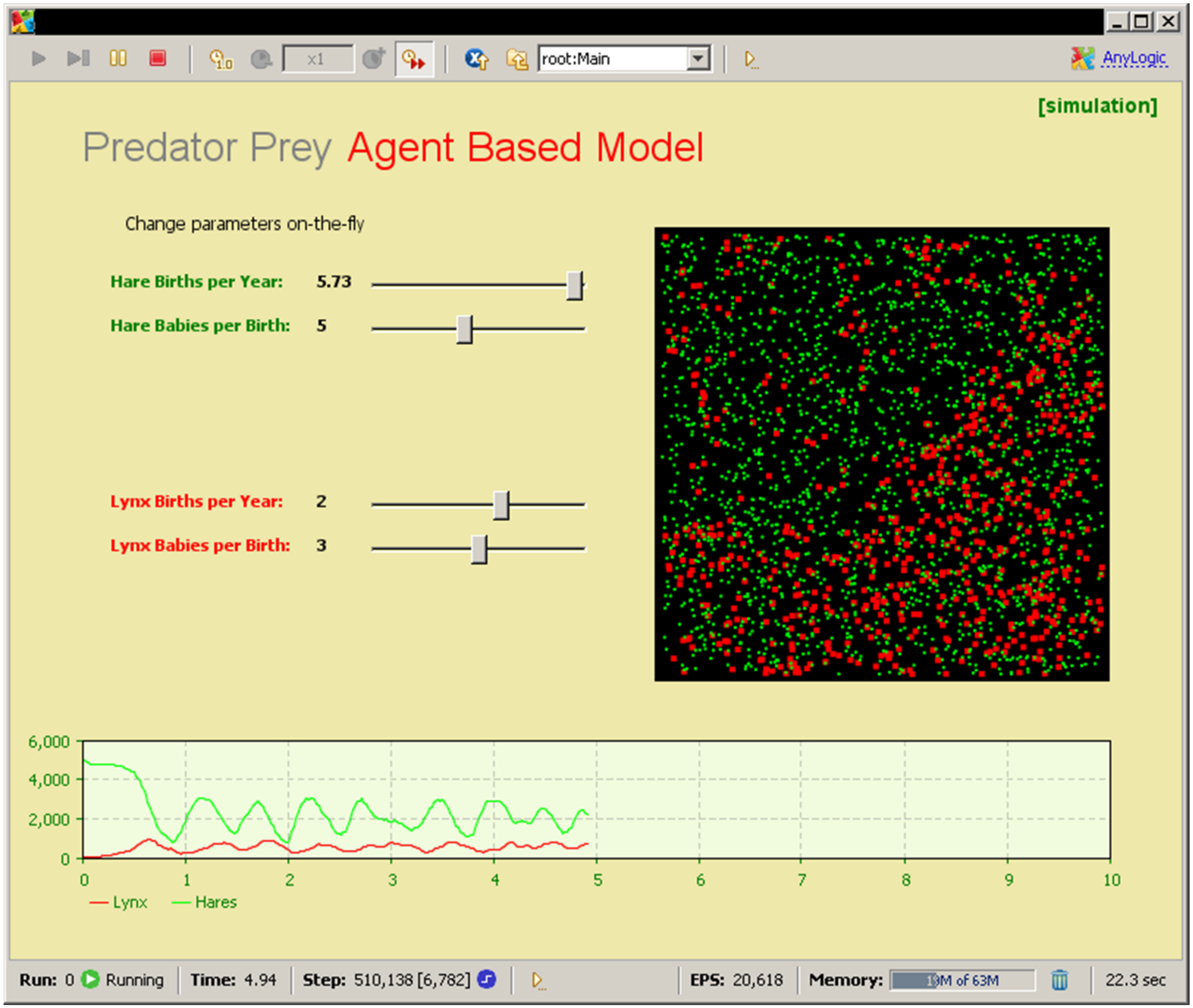
Lynx: 40

Step 2. Run the model

AnyLogic and this model is (c) XJ Technologies, www.anylogic.com. All rights reserved.

Run: 0 Idle | Time: 0.00 | Step: 0 [0] | EPS: 0 | Memory: 9M of 63M | 0.0 sec

Run-Time Parameter Modifications



Predator Prey Agent Based Model

Change parameters on-the-fly

Hare Births per Year: 5.73

Hare Babies per Birth: 5

Lynx Births per Year: 2

Lynx Babies per Birth: 3

Run: 0 Running | Time: 4.94 | Step: 510,138 [6,782] | EPS: 20,618 | Memory: 19M of 63M | 22.3 sec

Changing Parameters in AnyLogic

- Changing value of parameter explicitly in model
  - Avoid if possible -- could forget to restore
- Create a new experiment
  - Set the parameter value as a parameter for Main
  - Here, easiest if the operational parameter in Main!
  - If parameter is not located in “Main”, Main should “pass on” parameter value to e.g. the agent class
- Via an interface in the main class or agent class itself

Structural Modifications

- Sometimes, capturing the effects of an intervention requires representing a different processes than are present in the baseline model
- e.g.
  - Vaccination
  - Quarantine
  - Intervention group
    - Educated
    - Given a treatment
  - Genetically immune mosquitoes

Capturing Structural Modifications in Vensim

- Adding
  - Stocks (e.g. Vaccinated people, quarantined people)
  - Flows (e.g. to vaccinated stock, or quarantined stock)
  - Subscripts
    - e.g. Intervention group (may run in parallel with other group, subject to the same forces)
- Modifying existing flows
  - E.g. disabling smoking relapse when intervention is enabled

Capturing Structural Modifications in AnyLogic

- Statechart based: Adding
  - States (e.g. Vaccinated, quarantined)
  - Transitions (e.g. to vaccinated state, or quarantined state, or to a new “cured” state)
- System Dynamics: flows
- Modifying an existing transition so that it is contingent on an intervention being disabled
- For targeted intervention, may wish to capture people as having been affected by the intervention

Representing Intervention Mechanisms: Two Choices

- Some interventions are representing in a stylized fashion that abstracts away from *dynamics of intervention implementation*
  - Here, we just examine proximal & distal effects of certain modifications to baseline model assumptions, ignoring the issue of how these modifications would be achieved
- Some intervention representations include characterizing both the intervention effects & its dynamics e.g.
  - Dynamics of training teachers to deliver anti-smoking lessons in the classroom
  - Dynamics of vaccine production

Endogenous Intervention Impacts on Behaviour: Current Practice

- Behaviour is exogenous to many models
- Models link behavior to distal impacts
- Modelers impose assumptions of how interventions affect behaviour
- Models offer value in understanding emergent, distal implications of behaviour change
- We gain little insight into the counter-intuitive behavioral impacts of intervention

Example Behavioral Feedbacks Underlying Much Policy Resistance

– Cutting cigarette tar levels reduces cessation

– Cutting cigarette nicotine levels leads to compensatory smoking

– ARVs prolong lives of HIV carriers, but lower risk perception

– Availability of reduced-fat/calorie varieties undercuts changes to eating habits

– Antilock brakes lead to more risky driving

Endogenous Intervention Impacts on Behaviour: Vision

- Modelers characterize intervention impacts on environment (e.g. prices, tax burden, $ incentives, laws)
- Capture indiv preferences&mental models, learning

- Model endogenously compute individual, localized behavioural responses (cf discrete choice theory, psych. models)
- Models provide insight into both
  - Distal implications of interventions
  - Behavioral impacts of intervention (individual&collective)

Additional Factors

- Accumulating costs for interventions
- Accumulating costs for other factors (so can see what intervention eliminates)