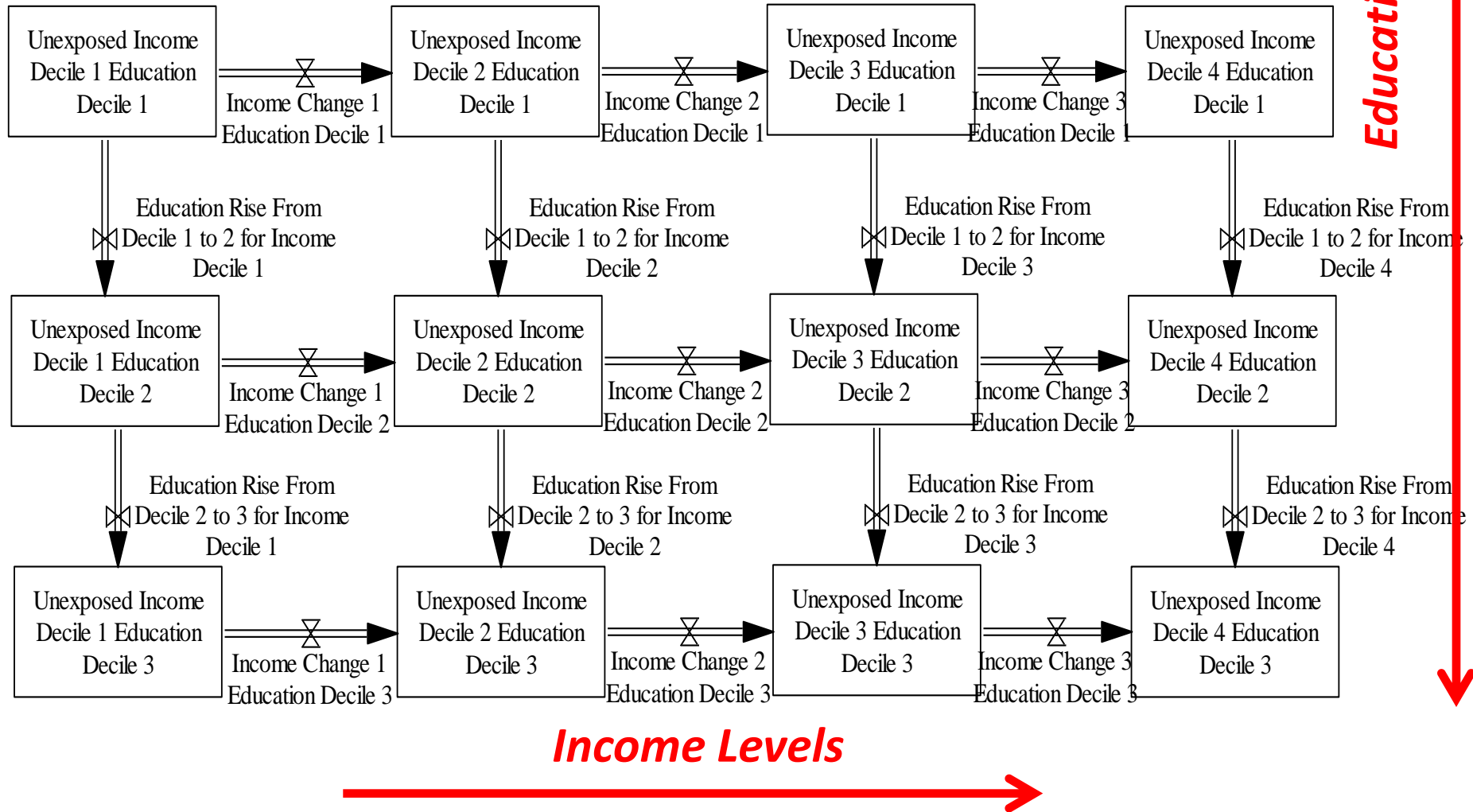# Subscripting in Vensim 2: Subscript Introduction, Selection, Progression & Mapping, Subranging

Nathaniel Osgood

CMPT 858

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# A Common Pattern in Aggregate Models: Lattice Structure

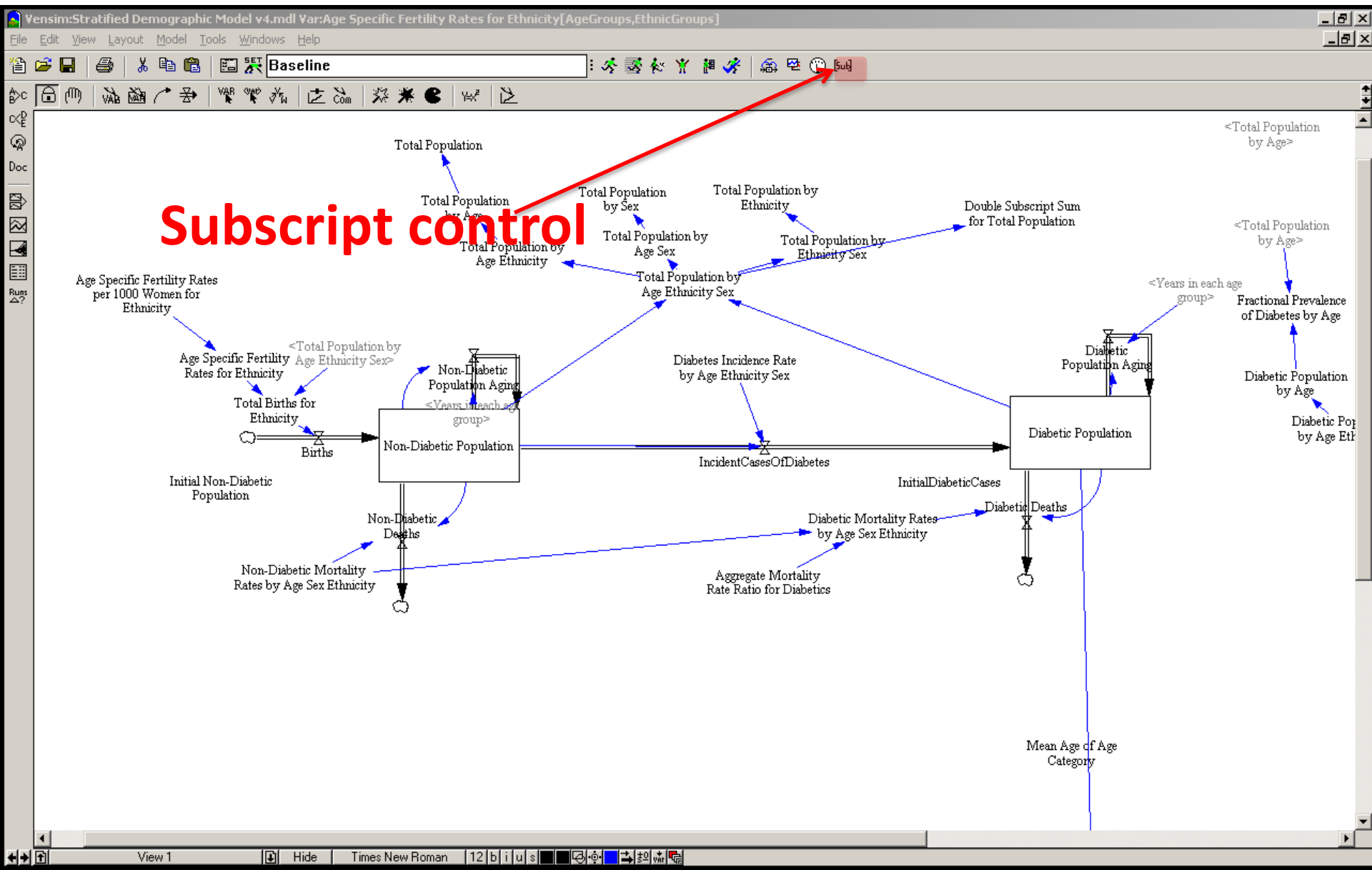# Recall: A Means to Simplification: Subscripting

- We can simplify "lattice structure" by "subscripting" the structure by (discrete) properties

- This structure is then replicated for every subscript combination

- We can perform operations to create aggregate totals from this disaggregated data

# Recall: Reading a Subscripted Equation

Suggestion: Read as follows "variable Total Population for a specific age group (member of AgeGroups), ethnic group (member of EthnicGroups) and sex (member of Sex) is just the

sum of the non-diabetic population for that same age, ethnic & sex group and of the diabetic population for that same age, ethnic & sex group
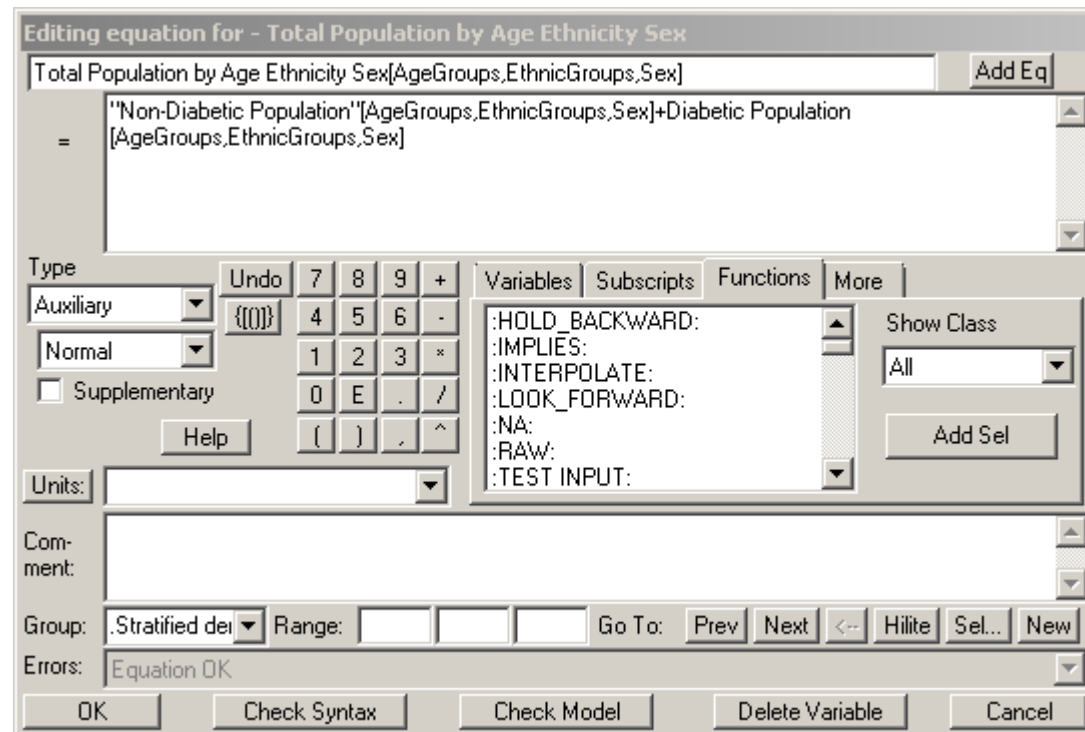
# Recall: Vensim Model

# Subscript Control Interface

# Subscript Control Interface



**The elements in this pane are those that will be shown in graphs & tables**

# Subscript Control Interface



**These controls add or remove elements whose values should be displayed**

# A Key Piece of Functionality: "Subscript" Control



**The selected subset of subscripts are shown (here, All)**

# Subscript Control Interface



**Maximum length subset of those selected are shown**
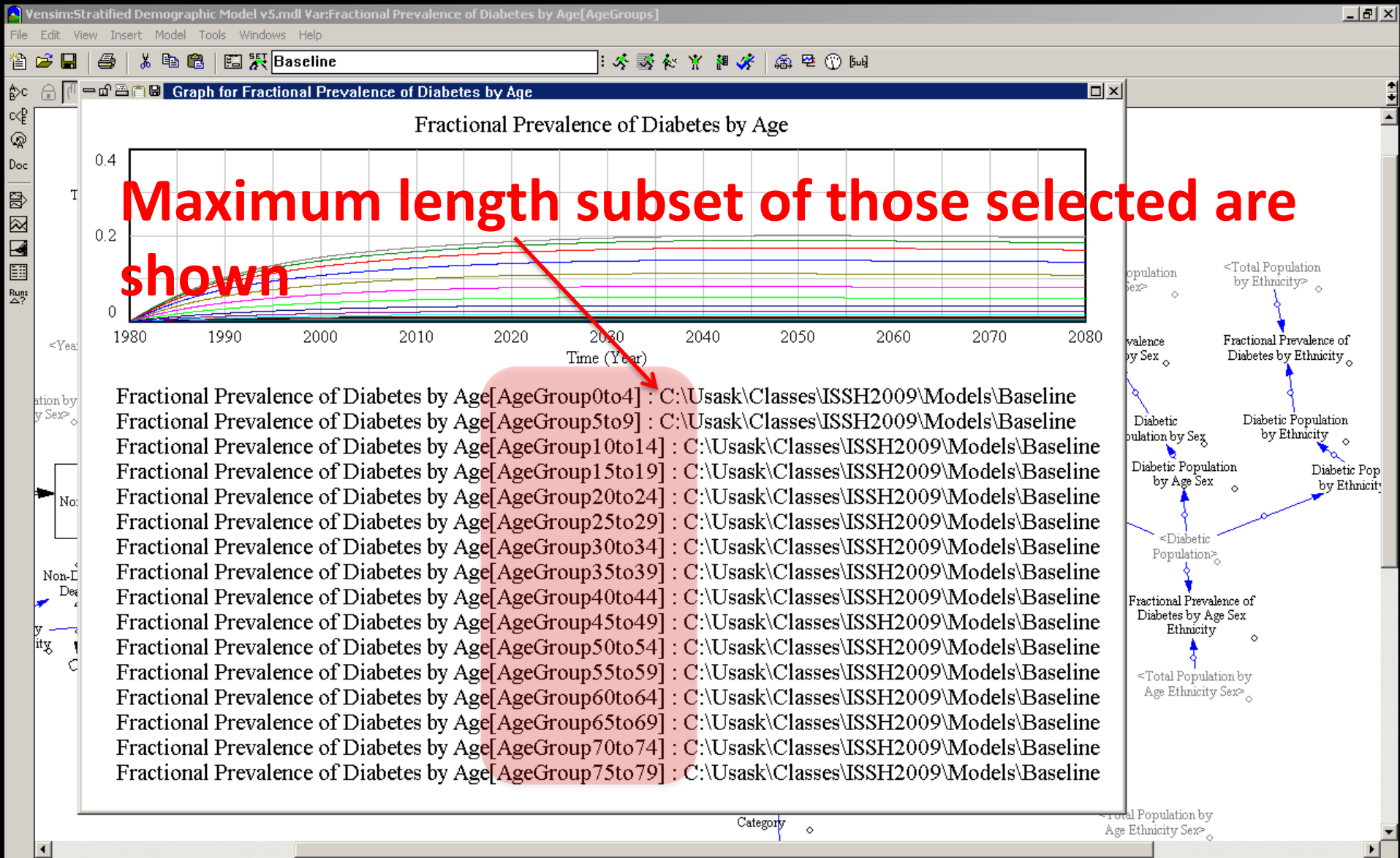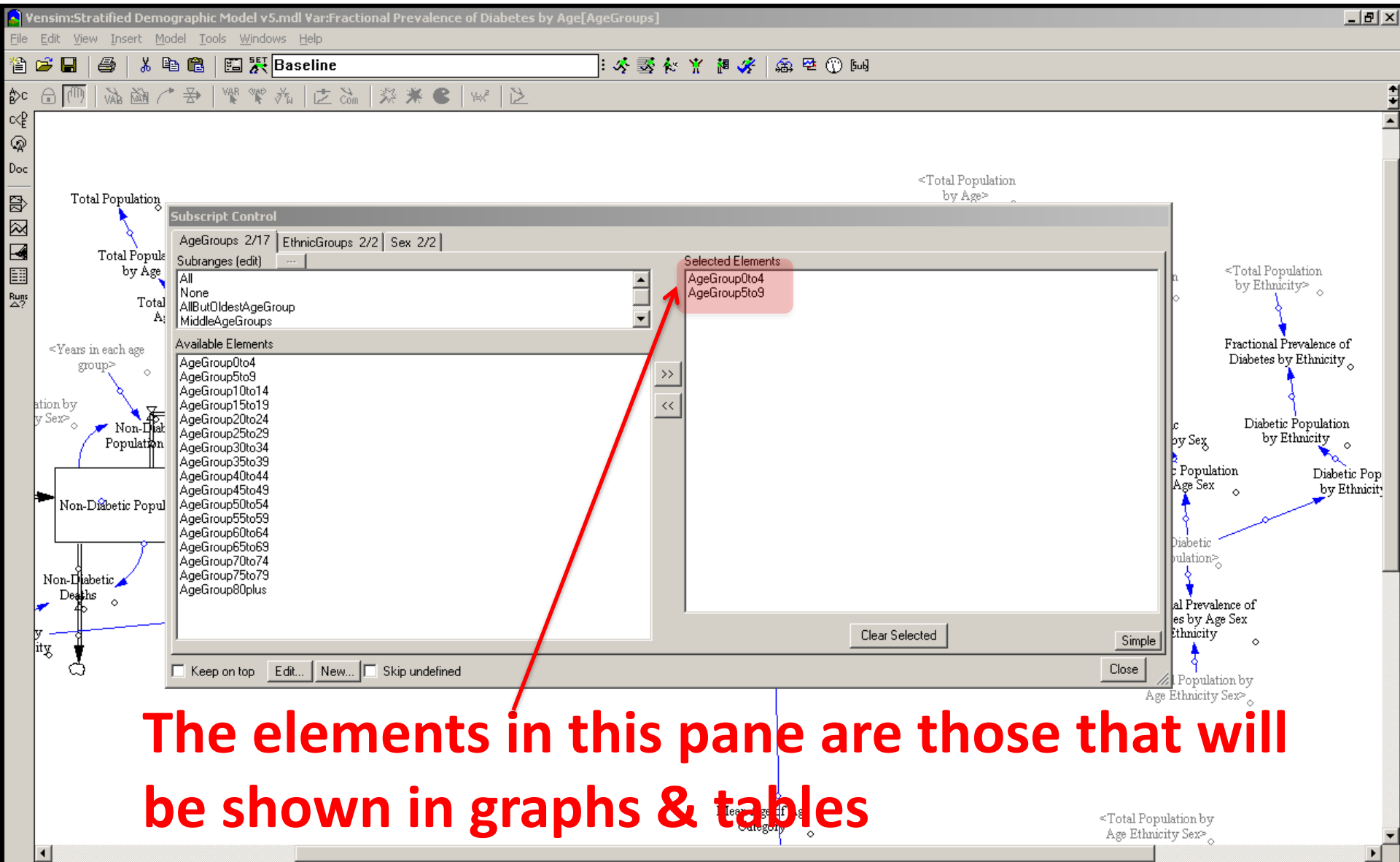
**The elements in this pane are those that will be shown in graphs & tables**

# Subscripts: Tables



**The selected subset of subscripts are shown**

# Subscripts: Graphs

# Choosing Additional Tools (from Tools/Analysis Menu)
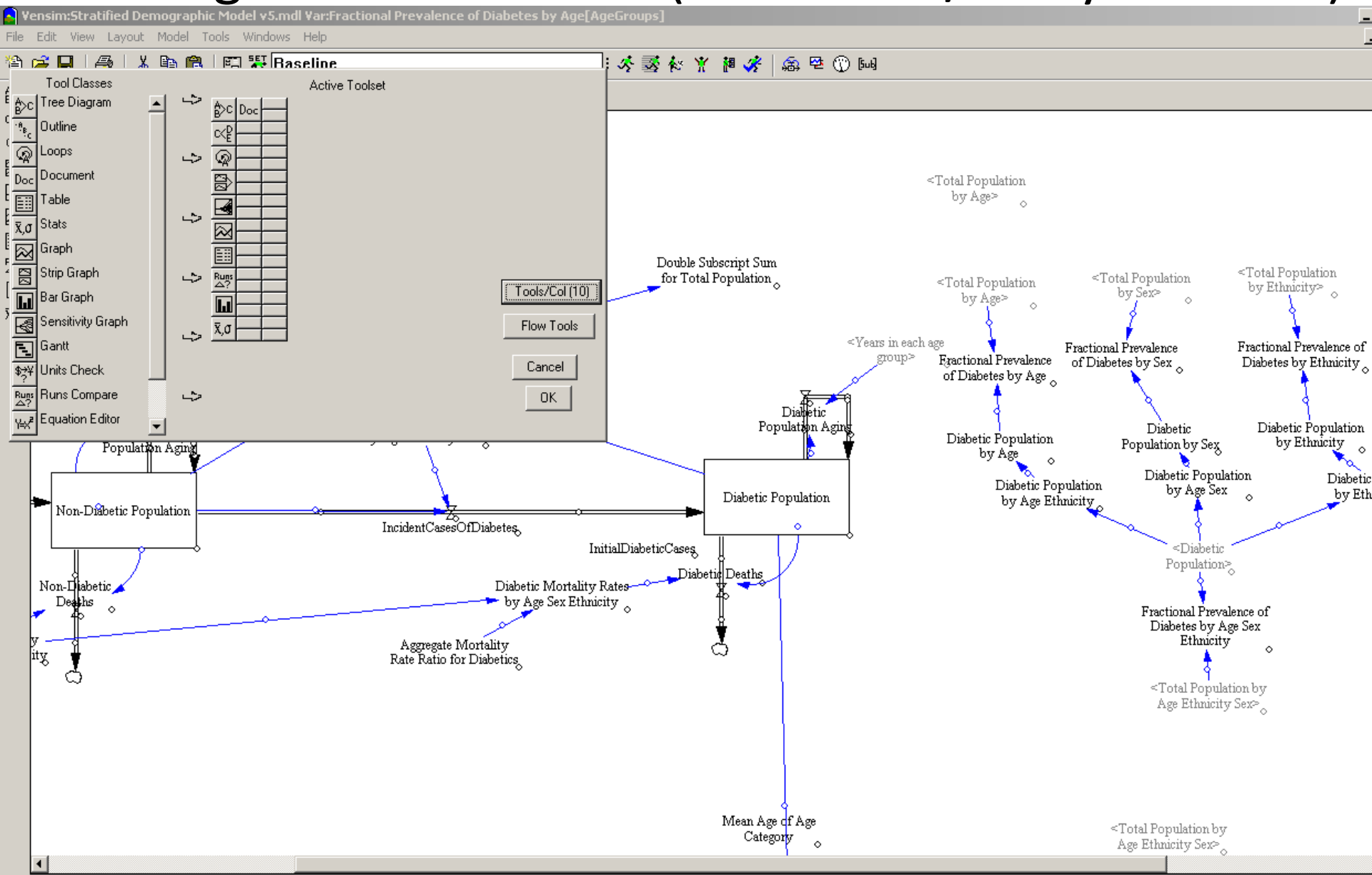
# Histogram Tool
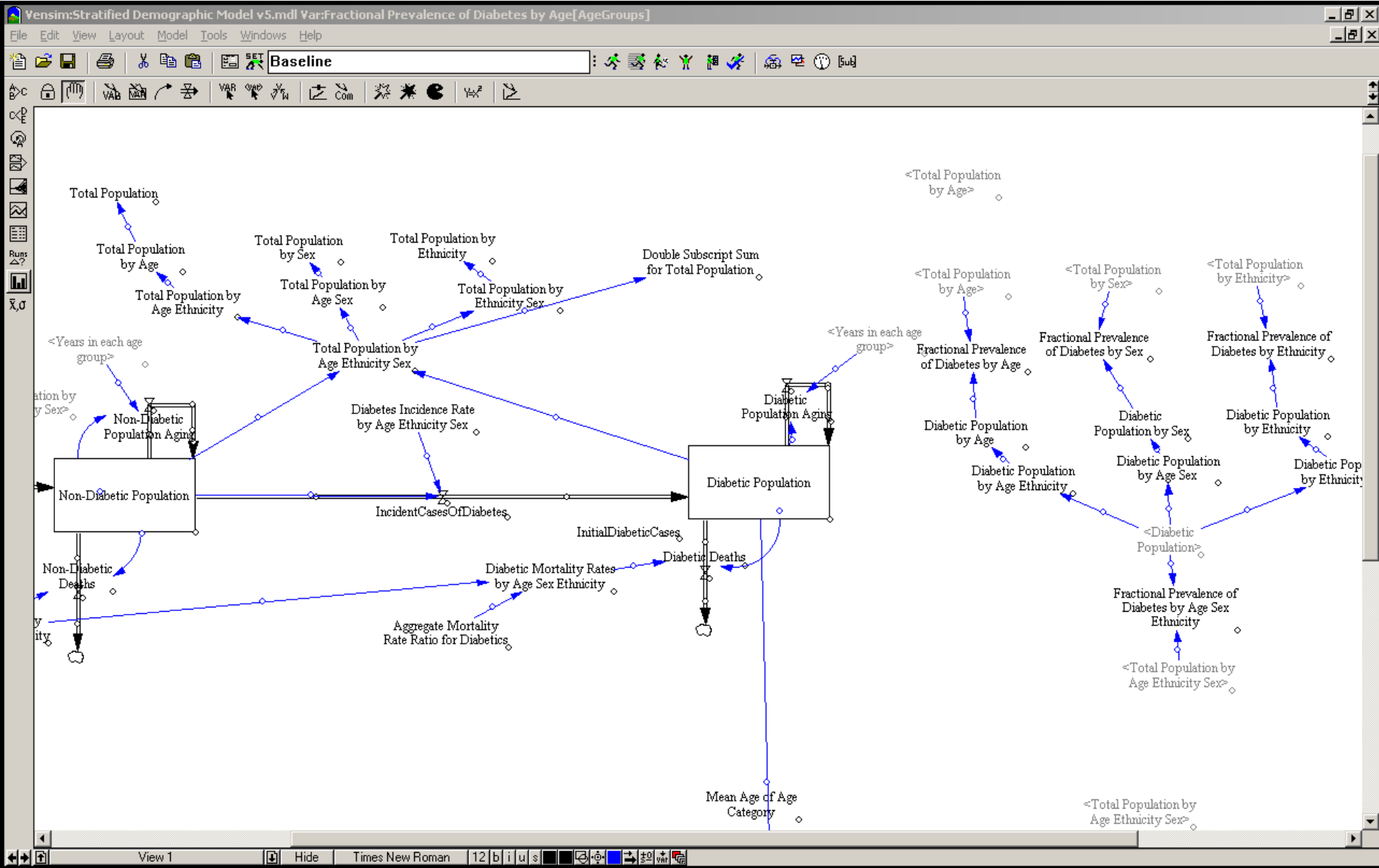
# Displaying over Subscripts at the End

# In Control Panel, Select "All"

# Select all

# Displaying Histogram Across Subscript Values

# Setting Subscript

# Displaying Statistics Across Subscripts

# Subscript Control Interface



**Can use this button to introduce a new Subscript (i.e. stratification dimension)**

# Creating a New Subscript

# Defining a New Subscript's Elements

**Editing equation for - Income**

Income | Add Eq

: | HighestQuartileIncome,SecondHighestQuartile,ThirdHighestQuartile,FourthHighestQuartile

Type
Subscript
Normal
☐ Supplementary

Undo | 7 | 8 | 9 | +
{[()]} | 4 | 5 | 6 | -
| 1 | 2 | 3 | ×
Help | 0 | E | . | /
| [ | ] | , | ^

Variables | Subscripts | Functions | More
Choose Variable... | Inputs

Units:

Com-ment:

Group: .Stratified de▼ | Range: | Go To: | Prev | Next | <-- | Hilite | Sel... | New

Errors: Equation Modified

OK | Check Syntax | Check Model | Delete Variable | Cancel

# New Subscript Appears in Subscript Control

# Edit Subscript



**Can use this button to edit the a subscript (e.g. to add or remove elements)**

# Example Subscripted Stock: Youngest



Editing equation for – Non-Diabetic Population (1/3)

"Non-Diabetic Population"[AgeGroup0to4,EthnicGroups,Sex]       1 ▼   Del

=
INTEG (
Births[EthnicGroups,Sex]-IncidentCasesOfDiabetes[AgeGroup0to4,EthnicGroups,Sex] - "Non-Diabetic Deaths"[AgeGroup0to4,EthnicGroups,Sex]  -
  "Non-Diabetic Population Aging"[AgeGroup0to4,EthnicGroups

Initial Value: "Initial Non-Diabetic Population"[AgeGroup0to4,EthnicGroups,Sex]

Type: Level / Normal / Supplementary

Undo   7 8 9 +
{[()]}  4 5 6 -
        1 2 3 ×
        0 E . /
        ( ) . ^
Help

Variables | Subscripts | Functions | More
Choose Variable...     Inputs ▼
Non-Diabetic Population
Births
IncidentCasesOfDiabetes
Non-Diabetic Deaths
Non-Diabetic Population Aging

Units:

Comment:

**Must consider birth flow in and aging to next higher age group**

Group: .Stratified der ▼   Range: [  ] [  ] [  ]   Go To: Prev | Next | <- | Hilite | Sel... | New

Errors: Equation OK

OK | Check Syntax | Check Model | Delete Variable | Cancel

# For Middle Age Categories



**Uses "subscript mapping" to find previous age Category to this**

**Must Consider both aging in (from previous category & aging out)**

# For Oldest Age Category

''Non-Diabetic Population''[AgeGroup80plus,EthnicGroups,Sex]     3 ▼   Del

=
INTEG (
-IncidentCasesOfDiabetes[AgeGroup80plus,EthnicGroups,Sex]
- ''Non-Diabetic Deaths''[AgeGroup80plus,EthnicGroups,Sex] + ''Non-Diabetic Population Aging''
[AgeGroup75to79,EthnicGroups,Sex]

Initial Value   ''Initial Non-Diabetic Population''[AgeGroup80plus,EthnicGroups,Sex]

Type

| Undo | 7 | 8 | 9 | + |
| {[()]} | 4 | 5 | 6 | - |
| | 1 | 2 | 3 | x |
| | 0 | E | . | / |
| Help | [ | ] | , | ^ |

Level ▼
Normal ▼
☐ Supplementary

| Variables | Subscripts | Functions | More |

Choose Variable...     Inputs ▼

Non-Diabetic Population
Births
IncidentCasesOfDiabetes
Non-Diabetic Deaths
Non-Diabetic Population Aging

Units: ▼

Com-ment:   **Must consider aging in , but there is no aging out**

Group: .Stratified dei ▼   Range: [   ][   ][   ]   Go To: Prev | Next | <-- | Hilite | Sel... | New

Errors: Equation Modified ▼

| OK | Check Syntax | Check Model | Delete Variable | Cancel |

**Previous age category is hard-coded**

# Finding the  Mapping

# Finding among Variables

# MiddleAgeGroup Subranges
# (In Subscript Control)

# Finding Middle Age Group Subrange Definition

# Subrange Definitions

# Mapping Definition



Editing equation for - PreviousAgeGroup

| PreviousAgeGroup | Add Eq |

:
AgeGroup0to4,AgeGroup5to9,AgeGroup10to14,AgeGroup15to19,AgeGroup20to24,AgeGroup25to29
,AgeGroup30to34,AgeGroup35to39,AgeGroup40to44,AgeGroup45to49,AgeGroup50to54,AgeGroup5
5to59, AgeGroup60to64, AgeGroup65to69,AgeGroup70to74 ->  MiddleAgeGroups

Type

Subscript

Normal

☑ Supplementary

Help

Units:

| Undo | 7 | 8 | 9 | + |
| {[()]} | 4 | 5 | 6 | - |
| | 1 | 2 | 3 | × |
| | 0 | E | . | / |
| | [ | ] | . | ^ |

Variables | Subscripts | Functions | More

Choose Variable... | Inputs

Com-
ment:
AgeGroup0to4,AgeGroup5to9,AgeGroup10to14,AgeGroup15to19,AgeGroup20to24,AgeGroup25to2
9,AgeGroup30to34,AgeGroup35to39,AgeGroup40to44,AgeGroup45to49,AgeGroup50to54,AgeGrou
p55to59, AgeGroup60to64, AgeGroup65to69, AgeGroup70to74

Group: | .Stratified der | Range: | | | | Go To: | Prev | Next | <-- | Hilite | Sel... | New |

Errors: | Equation OK.

| OK | Check Syntax | Check Model | Delete Variable | Cancel |

# Finding the Other Sex for a Given Sex

# Using the "Opposite Sex" In an Equation

**Editing equation for - Mixing Matrix Elements rho**

Mixing Matrix Elements rho[Sex,ActivityGroup,MixingMatrixActivityGroup,HostGroup,MixingMatri    [Add Eq]

= ((1-Mixing Parameter Epsilon)*Activity and Host Group Discrepency small delta
[ActivityGroup,MixingMatrixActivityGroup]+Mixing Parameter Epsilon*Fraction of Total Partnership
Changes for Activity Group[OtherSex,MixingMatrixActivityGroup,MixingMatrixHostGroup])*Fraction of
Partnership Changes for Sex and Activity Group Represented in Host Group
[OtherSex,MixingMatrixActivityGroup,MixingMatrixHostGroup]

Type: Auxiliary

Normal

☐ Supplementary

| Undo | 7 | 8 | 9 | + |
| {[()]} | 4 | 5 | 6 | - |
| | 1 | 2 | 3 | * |
| | 0 | E | . | / |
| Help | ( | ) | , | ^ |

Variables | Subscripts | Functions | More

Range

ActivityGroup
HostGroup
MixingMatrixActivityGroup
MixingMatrixHostGroup
OtherSex
Sex

Units:

Comment:

Group: .Garnett 200 ▼   Range: [ ] [ ] [ ]   Go To: Prev | Next | <-- | Hilite | Sel... | New

Errors: Equation OK

OK | Check Syntax | Check Model | Delete Variable | Cancel

# Clever Ways of Defining Flows can lead to Fewer Equations



**Editing equation for - Uninfected People**

Uninfected People[AgeGroup,Ethnicity]   [Add Eq]

= INTEG (

if then else(AgeGroup=AgeGroup0to4,+New Births[Ethnicity],0)+Aging of Uninfected People [PreviousAgeGroup,Ethnicity]-Aging of Uninfected People [AgeGroup,Ethnicity]+Uninfected Immigrants[AgeGroup,Ethnicity]-Latent Infection [AgeGroup,Ethnicity]-"Non-TB Death of Uninfected"[AgeGroup,Ethnicity]-Vaccination [AgeGroup,Ethnicity]+Waning of Immunity[AgeGroup,Ethnicity]

Initial Value: Initial Uninfected Population by Age and Ethnicity[AgeGroup,Ethnicity]

Type: Level / Normal / ☐ Supplementary

Variables | Subscripts | Functions | More

Choose Variable...   Inputs

Uninfected People
Aging of Uninfected People
Latent Infection
New Births
Non-TB Death of Uninfected
Uninfected Immigrants

Units:

Comment:

Group: .Age structur   Range:   Go To: Prev | Next | <-- | Hilite | Sel... | New

Errors: Equation OK

OK | Check Syntax | Check Model | Delete Variable | Cancel

# Definition of Aging

Aging of Uninfected People[AgeGroup,Ethnicity]        | Add Eq |

= Uninfected People[AgeGroup,Ethnicity]*Fraction of Age Category Leaving by Aging every Year
[AgeGroup]

**Type**

Auxiliary ▼

Normal ▼

☐ Supplementary

| Undo | 7 | 8 | 9 | + |
| {[()]} | 4 | 5 | 6 | - |
| | 1 | 2 | 3 | × |
| | 0 | E | . | / |
| Help | ( | ) | , | ^ |

**Variables** | Subscripts | Functions | More

Choose Variable...        | Inputs ▼

Fraction of Age Category Leaving by Aging every Year
Uninfected People

**Units:** [                    ] ▼

**Com-ment:**

**Group:** .Age structur ▼ **Range:** [    ] [    ] [    ]   **Go To:** | Prev | Next | <-- | Hilite | Sel... | New |

**Errors:** Equation OK

| OK | Check Syntax | Check Model | Delete Variable | Cancel |

# Fraction Leaving Each Year is Set to 0 for Oldest Age Group

# "Previous Age Group" for Youngest Age Group is Oldest – So no Aging into Youngest Age Group