Definition of demography

Demography is “the study of the size, territorial distribution, and composition of population, changes therein, and the components of such changes.” Hauser and Duncan (1959:2)
What is interesting about composition?
It depends on who is asking

a) Policy
   e.g., SS eligible, LFP at older ages, poverty, marital status/SPF, etc.

b) Local govt.
   e.g., school age, poverty, language, etc.

c) Demographers
   e.g., age, sex, race, family structure, marital status, etc.

d) Marketers
   e.g., profiles (multivariate)
Change in relationship between characteristics

Interest not only in change in composition with respect to characteristic x but also in change in composition with respect to intersection of x and y (and z and so on)

e.g., race and marriage, gender and occupational status, gender and educational background, age and employment status.

Simple description or multivariate modeling
Measures of composition

a) simple descriptives

b) Indices
   a. e.g., dissimilarity, isolation, interaction, redistribution, concentration, diversity (Theil), Gini, etc.
   c) straightforward for past and present
   d) what about the future?
Characteristic-specific projections: Projected population composition

1. What will the population look like with respect to things like school enrollment, labor force participation, housing tenure, etc.

2. Typically based on projected age and sex-specific populations from cohort component method
Alternative methods

1. Participation ratio method
   a. Apply prevailing participation rates (or other characteristics) to projected population by age, sex
   b. Can also make assumptions about future trajectories of participation rates

2. Cohort progression method
   a. Calculate observed net progression ratios between two points in time for a given age
   b. Apply these progression ratios sequentially – assume temporal stability in progression ratios (or not)
Example – population in assisted living

1. Calculate age-specific proportions in assisted living facilities for most recently observed year(s)

2. Assume stability in proportions into future (or make assumptions about change)

3. Apply proportions to projected population by age (and perhaps sex, marital status, race, etc.)

4. Calculate projected numbers at points in future (can do at national/local levels)
Example – HIV/AIDS prevalence

- HIV negative
- HIV positive
- AIDS
- Dead
1. Calculate progression ratio

\[
\frac{P^{z,t+n}_{x+n}}{P^{t+n}_x} \div \frac{P^{z,t}_x}{P^{t}_{x-n}}
\]

2. Multiply observed population in a given state (z) in base year by progression ratio for corresponding age

3. Multiply projected population in a given state (z) from initial iteration (2) by progression ratio for corresponding age
Household headship method

1. What is the projected number of households $x$ years into the future?

2. Use variant(s) of participation ratio method

3. Calculate age-sex specific proportions who are classified as household heads (e.g., in the census) $HR = \frac{H_x}{P_x}$

4. Apply these proportions to projected populations in households (by sex and age) $x$ years into the future

5. Sum estimated number of household heads across age and sex.
6. Can do by any observable characteristic of the household – by marital status, by number of families, by size, by race(?), by employment status, etc.
Living arrangements method

1. What will the composition of households look like x years into the future?
2. Calculate age and sex-specific living arrangement distributions (e.g., from the census)
3. Apply these proportions to projected populations (by sex and age) x years into the future
4. Sum estimated number of families (see text for derivation)
5. Multiply estimated number of families by observed ratio of families to households to estimate # of hh.
Analysis of Housing Unit Information

Prince William County Real Estate Assessment Information

Extract of Parcel Data

Classify parcels by Land Use:
- Residential / Non-Residential / Vacant
Type of Housing Unit if Residential:
- Single Family
- Townhouse
- Multi-Family

Residential Information Geodatabase in GIS

Prince William County Geographic Information System

Prince William County Planning Office
Residential Development Plans

PWCS Staff convert information into geographic data

Outside data vendors provide additional information on pace of development

Current and 10-Year Projection of Housing Units by Unit Type and Planning Zone
Preparation of Student Enrollment Forecasts

PWCS - GIS Geodatabase

Current and 10-Year Projection of Housing Units by Unit Type and Planning Zone

Calculate Transfer Rates (percentage of students attending school other than their geographically assigned school)

Calculate Student Generation Factors - SGF (students per housing unit, by Unit Type and Planning Zone and grade)

Progress student generation factor cohorts and transfer rates 5-years forward

Calculate new grade enrollments for each Planning Zone

* By Planning Zone:
  Students (Grade X, Year Y) =
  SGF (Grade X-1 by Unit Type * Units Year 0
  + SGF Grade X by Unit Type * Add'l Units Year 0 to Y * Transfer Rate Grade X

Allocate Planning Zones to Schools to create Enrollment Projections by School and Grade
Use of Cohort Progression Ratio in Enrollment Projections

<table>
<thead>
<tr>
<th>Grade</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>Cohort Ratio</th>
<th>Forecasted 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>6th</td>
<td>3.888</td>
<td>4.066</td>
<td>4.348</td>
<td>4.581</td>
<td></td>
<td></td>
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<tr>
<td>7th</td>
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<td>4.024</td>
<td>4.184</td>
<td>4.525</td>
<td>1.0350</td>
<td>4.741</td>
</tr>
</tbody>
</table>

1. **Cohort Ratio** = \( \frac{7^{\text{th}}_{2003} + 7^{\text{th}}_{2006} + 7^{\text{th}}_{2007}}{6^{\text{th}}_{2004} + 6^{\text{th}}_{2003} + 6^{\text{th}}_{2006}} \)
   
   \( 7^{\text{th}}_{2007} \) indicates the 7th grade cohort of 2007.

2. **Cohort Ratio** = \( \frac{4.024 + 4.184 + 4.525}{3.888 + 4.066 + 4.348} = 1.0350 \)

3. **Forecasted 2008 7th Grade Cohort** = 4.581 \times 1.0350 = 4.741