Methods for Estimating Change from NSCAW I and NSCAW II

Paul Biemer
Sara Wheeless
Keith Smith
Course Outline

- Review of NSCAW I and NSCAW II Designs
- Issues in Estimating Between-Cohort Differences
- Calibration Weighting
- Cautions in Using Calibration Weights
- Illustrations and Examples
- Questions and Answers

National Survey of Child and Adolescent Well-Being
Overview of the NSCAW I Design

- National representative stratified, two-stage sample
  - 100 PSUs (counties or groups of counties)
  - Secondaries are children with counties selected by a stratified sample using 8 strata (domains)
  - Age restricted to 0 to 14 years
- Four states (representing 8 PSUs) refused to participate (referred to as “agency first contact” states)
NSCAW II Design

NSCAW II was designed to facilitate comparisons with NSCAW I

- an equivalent target population (with exceptions to be noted),
- same PSUs were used as for NSCAW I
- statistically equivalent sampling methodology,
- same interview protocols, respondent selection rules, and nonresponse conversion mechanisms,
- similar questions or characteristics, and
- comparable weighting, post-survey weighting and estimation methods
The NSCAW II Sample Design

Very similar to NSCAW I except:

- Age range expanded from 14 to 17.5
- 5 within PSU sampling domains instead of 8
- Four new agency first contact states (representing 9 additional PSUs)

Target populations for NSCAW I and II are not identical
### NSCAW I and NSCAW II Target Populations

<table>
<thead>
<tr>
<th>NSCAW I</th>
<th>NSCAW II</th>
</tr>
</thead>
<tbody>
<tr>
<td>All children <strong>age 0 – 14 years</strong> who are subjects of investigations of child abuse/neglect during the 15-month time period from <strong>October, 1999</strong> through <strong>December, 2000</strong>.</td>
<td>All children <strong>age 0 – 17.5 years</strong> who are subjects of investigations of child abuse/neglect during the 15-month time period from <strong>February, 2008</strong> through <strong>May, 2009</strong>.</td>
</tr>
<tr>
<td>Excludes children in 8 “agency first contact” PSUs representing about <strong>5%</strong> of the US child welfare population.</td>
<td>Excludes children in the NSCAW I 8 plus <strong>9 additional</strong> “agency first contact” representing about <strong>10%</strong> of the US child welfare population.</td>
</tr>
</tbody>
</table>
Coverage Error

Children 14-17.5

NSCAW I population

NSCAW II population

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Coverage Error

Agencies who opted out of NCSAW II citing “first contact” reasons

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Coverage Error

Children age 14 to 17.5 who were not in-scope for NSCAW I

NSCAW I population

NSCAW II population

Children 14-17.5

Agencies who opted out of NCSAW II citing “first contact” reasons

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Coverage Error and Remedies

Remove from NSCAW II for comparisons with NSCAW I

Either:
- a. Remove from NSCAW I for comparisons, or
- b. Use calibration to adjust NSCAW II weights

Children 14-17.5

NSCAW I population

NSCAW II population

Agency “first contact” in NCSAW II only
Option A – Infer to the “Intersection” Population Only

- A simple approach is to analyze the “intersection” population only
- This approach requires that the population of inference for the comparison be restricted to the intersection of NSCAW I and NSCAW II populations; viz.,
  - Children 0-14
  - Areas represented by NSCAW II cooperating agencies
Inferential Population Using “Intersection” Approach

Agency “first contact” in NCSAW II only

NSCAW I – NSCAW II intersection population

Inferential population using “intersection” approach

Children 14-17.5

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Option B – Expand Inference to the Entire NSCAW Population Using “Calibration” Weights

- To expand the inferential population to the entire NSCAW I population, RTI developed the “calibration” weights.

- These weights still restricted the population of inference for the comparison to children 0-14.

- However, it includes a sophisticated coverage adjustment that expands inference to include agencies that cooperated in NSCAW I but were first contact agencies in NSCAW II.

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Inferential Population Using “Calibration” Weights

NSCAW I population
Agency “first contact” in NCSAW II only

Children 14-17.5

Inferential population using “comparison weights”
The Calibration Weighting Process in a Nutshell

The NSCAW I population can be divided into two parts:

- **P1** = intersection of the NSCAW I and NSCAW II populations
- **P2** = subpopulation in NSCAW I not in NSCAW II (i.e., AFC states omitted from NSCAW II only)

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**Children 14-17.5**

<table>
<thead>
<tr>
<th>NSCAW I population not in intersection</th>
<th>NSCAW I population in the intersection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agency “first contact” in NCSAW II only</td>
<td></td>
</tr>
</tbody>
</table>

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Step 1. Identify a set of domains, $D$, to be used in the calibration.

These domains should be defined identically for both the NSCAW I and NSCAW II populations.

E.g., $D$ includes the 5 NSCAW II domains x NSCAW I PSUs
The Calibration Weighting Process in a Nutshell (cont’d)

Step 2. Compute weight adjustment factors, $f_D$, so that

$$\sum_{D \cap P1} f_D w_D^I z_D = \sum_{D \cap (P1 \cup P2)} w_D^I z_D$$

where $w_D^I = \text{sum NSCAW I weight in domain } D$

and $z_D = \text{sum of } z \text{ in domain } D$.

Children 14-17.5

NSCAW I population not in intersection

NSCAW I population in the intersection

Agency “first contact” in NCSAW II only

P2

P1

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Step 3. Now, apply these adjustment factors to the weights corresponding to the same domains in NSCAW II.

\[ f_D w_i^{II} \text{ for } i \in D \]

for the NSCAW II sample

\[ w_i^{II} = \text{NSCAW II weight} \]
The Calibration Weighting Process in a Nutshell (cont’d)

Step 4. For the final step, these weights are further adjusted so that their totals add to 2006 NCANDS marginal control totals

\[
\text{final NSCAW II weight} = a_i f_i w_{II}^{II}
\]

- Original NSCAW II weight
- Calibration adjustment weight
- NCANDS adjustment weight
Advantage of Intersection Approach over Calibration Weights

- Consistent with current NSCAW II weights
- NSCAW II target population is the population of inference (excluding 14+ aged children)
- Provide unbiased estimators of the NSCAW II population (excluding 14+ aged children)
- Easy to explain and understand
Disadvantage of Intersection Approach over Calibration Weights

- Limits inference to 90% of the child welfare population (compare to 95% using calibration weights)
- Sample sizes for comparisons are smaller (since part of NSCAW I sample must be discarded)
- Current NSCAW II weights have not been post-stratified to the intersection population – slightly reduces estimate stability
Advantage of Calibration Weights over Intersection Method

- Expands inference to a larger population, viz., the NSCAW I population
- Uses all the NSCAW I data in estimating change, not just data in the intersection
- Residual coverage bias is small. Bias is 0 if we can assume that the adjustments that solve the calibration equations for NSCAW I would solve similar calibration equations for NSCAW II.
Disadvantage of Calibration Weights over Intersection Method

- Weights are 0 for children aged 14+ in NSCAW II – this may limit their utility for uses other than NSCAW I to NSCAW II comparisons
- Complicated to explain (but not necessarily to use)
- Using NSCAW II standard weights vs NSCAW II calibration weights may produce differences for the same NSCAW II estimates.

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When to Use NSCAW II Calibration Weights

- Calibration weights apply only to NSCAW II and are wave specific.
  - So far, we have developed calibration weights for Waves 1 and 2 of NSCAW II
  - Wave 3 weights are currently being developed
When to Use NSCAW II Calibration Weights (cont’d)

- Calibration weights can be used for NSCAW II, Wave 1 analysis instead of the current NSCAW II Wave 1 weights.
  - The advantage is that inference can be expanded to the essentially the entire child welfare population (aged 0-14)
  - Disadvantage is that children aged 14+ must be dropped from the analysis when calibration weights are used
When to Use NSCAW II Calibration Weights (cont’d)

- When using Wave 1 calibration weights, NSCAW II estimates are directly comparable to corresponding estimates from NSCAW I with standard NSCAW I weights.

- Caution: Questions and scales being compared should be identical.
  - Question items: the same question text, response categories, and reference periods
  - Scales: same version of scale calculated the same way
Illustration - Estimating the Change in Child CBCL for Some Age Group

Let

\[ \bar{y}_I \] denote the Child CBCL score for NSCAW I, Wave 1 weighted

\[ \bar{y}_{II} \] denote the Child CBCL score for NSCAW II, Wave 1 calibration weighted

Want to test \( H_0: E(\bar{y}_I - \bar{y}_{II}) = 0 \)

Two sample t-test is a biased test since

\[ Cov(\bar{y}_I, \bar{y}_{II}) \neq 0 \]
Proper Way to Proceed

Concatenate the NSCAW I and NSCAW II data sets.

Use SUDAAN to fit the ANACOV model

\[ y_{ijk} = \beta_0 + \beta x_{ijk} + S_i + \varepsilon_{ijk} \]

- Cohort
- PSU
- Person

\[ E(\bar{y}_I - \bar{y}_{II}) = 0 \Leftrightarrow S_1 = S_2 \]
Weight Variables

- **N1N2CWT1** – baseline (Wave 1) comparisons
- **N1N2CWT18MO** – 18 month followup comparisons (using NSCAW I Wave 3 and NSCAW II Wave 2)
- **N1N2CWT36MO** – 36 month followup comparisons (using NSCAW I Wave 4 and NSCAW II Wave 3) (coming soon)
### Variance Estimation

**STRATUM and PSU Variables**

- **COMP_STR** and **COMP_PSU** are variables that denote the variance estimation strata and PSU (or cluster).

- **COMP_PSU** is defined so that PSUs that are the same in the two surveys take the same values, so that the covariance is estimated correctly.
Analysts should use the same software currently being used with NSCAW I or NSCAW II data

Software needs to account for the stratification, clustering, and unequal weighting

Examples of software: SUDAAN, SPSS Complex Samples, Stata with svyset, SAS survey procedures

Documentation provided with the calibration weights gives some examples
Analysis Techniques

- Concatenate/stack the data from the two surveys
- Need an indicator variable to denote the survey or cohort (COHORT: 1=NSCAW I, 2=NSCAW II)
- Analysis variables from the two surveys should be named identically
- Tell the software the name of the weight variable
- Tell the software the names of the variables for variance estimation (COMP_STR and COMP_PSU)
SUDAAN Code

```sas
proc regress design=wr;
   nest COMP_STR COMP_PSU;
   weight N1N2CWT1;
   model Y = X $ S
run;
```

COMP_STR, COMP_PSU = combined NSCAW I and NSCAW II Stratum and PSU indicator vectors,

N1N2CWT1 = concatenated NSCAW I and NSCAW II calibrated weight vector for wave 1 (baseline)

\[
Y = [y_{ijk}]
\]

\[
X = [x_{ijk}]
\]

S = cohort indicator variable.

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Other Examples

- Testing $H_0 : E(\bar{y}_{II,d1} - \bar{y}_{II,d2}) = 0$ for two NSCAW II domains, $d_1$ and $d_2$, using calibration weights.

- Testing $H_0 : E(\bar{y}_{I,d1} - \bar{y}_{II,d1}) = 0$ for domain $d_1$ in NSCAW I and domain and $d_1$ in NSCAW II.

- Others
Example Code

Examples of SAS/SUDAAN Code and Output
libname cps 'C:\Documents and Settings\kesmith\My Documents\Data Delivery\final w5 data';
libname nscaw2 'C:\Documents and Settings\kesmith\My Documents\NSCAW II\Freq review';
libname calwgt "L:\Sampling\NSCAW_II\Calibration Weights\delivery";
option nofmterr;

/* Sort NSCAW I Survey data by child ID */
PROC SORT DATA= cps.cps OUT=NSCAW1_SURVEY (KEEP = NSCAWID SERVC YYB_TPT CRA13A CHDGENDR);
BY NSCAWID;
RUN;

/* Sort NSCAW I Wave 1 Weights and Sample Variables by child ID */
PROC SORT DATA= calwgt.N1_W1Calib OUT=NSCAW1_Calib;
BY NSCAWID;
RUN;

/* Sort NSCAW II Survey data by child ID */
PROC SORT DATA= nscaw2.CPS_N2 OUT=NSCAW2_SURVEY (KEEP = NSCAWID SERVC YYB_TPT CRA13A CHDGENDR);
BY NSCAWID;
RUN;

/* Sort NSCAW II Wave 1 Calibrated Weights and Sample Variables by child ID */
PROC SORT DATA=calwgt.N2_W1Calib OUT=NSCAW2_Calib;
BY NSCAWID;
RUN;

/* Next the comparison variables are merged with the survey variables, separately for each year */
/* Merge survey data with calibrated weights file */
DATA NSCAWI;
MERGE NSCAW1_SURVEY NSCAW1_Calib;
BY NSCAWID;
RUN;

DATA NSCAWII;
    MERGE NSCAW2_SURVEY NSCAW2_Calib;
    BY NSCAWID;
    RUN;

/* After the variables are merged on, the resulting NSCAW I and NSCAW II data sets should be
concatenated or stacked. */

/* Stack the datasets */
DATA COMPARISON;
SET NSCAWI NSCAWII ;

/* recode SERVC to 1-0 instead of 1-2 */
RSERVC=SERVC;
if SERVC=2 then RSERVC=0; else
if SERVC<0 then RSERVC=.;
/* Set negative values of CRA13A to missing */
if CRA13A < 0 then CRA13A=.;
run;

/* QC check on the SERVC recode */
proc freq; tables RSERVC*SERVC/list missprint;
run;

/* Once the datasets are stacked the data is ready for analysis using a survey software package such as SUDAAN. To run the analysis, the stacked dataset must first be sorted by the variables on the NEST statement, specifically COMP_PSU and COMP_STR. */

/* Begin SUDAAN Analysis */
PROC SORT DATA=COMPARISON;
BY COMP_STR COMP_PSU;
RUN;

/* EXAMPLE ANALYSIS OUTPUT IN SUDAAN */
PROC CROSSTAB DESIGN=WR DATA=COMPARISON;
WEIGHT N1N2CWT1;
NEST COMP_STR COMP_PSU;
class
NCOHORT
RSERVC
/nofreq;
tables
NCOHORT*RSERVC
;
test chisq;
print nsum wsum totper setot rowper serow colper secol / stest=default;
run;

/* Generate another crosstab and chi-square of the cohort by categorical variable CW Risk Assessment (CRA13A) Active alcohol abuse by primary CG */
PROC CROSSTAB DESIGN=WR DATA=COMPARISÓN;
WEIGHT N1N2CWT1;
NEST COMP_STR COMP_PSU;
class
NCOHORT
CRA13A
/nofreq;
tables
NCOHORT*CRA13A
;
test chisq;
print nsum wsum totper setot rowper serow colper secol / stest=default;
run;

/* Test whether the estimated mean of a variable (for example SERVC) is the same in both survey years. */
The PROC DESCRIPT procedure is used to conduct this test. */
PROC DESCRIPT DESIGN=WR DATA=COMPARISON;
WEIGHT N1N2CWT1;
NEST COMP_STR COMP_PSU;
VAR RSERVC;
CLASS NCOHORT;
DIFFVAR NCOHORT = (1 2);
rtitle "Difference in proportion receiving services (according to frame) in NSCAW I versus NSCAW II";
run;

/* Also, use SUDAAN to obtain the estimated mean of a variable (for example SERVC) for each cohort. */
PROC DESCRIPT DESIGN=WR DATA=COMPARISON;
WEIGHT N1N2CWT1;
NEST COMP_STR COMP_PSU;
VAR RSERVC;
CLASS NCOHORT;
Tables NCOHORT;
rtitle "Proportion receiving services (according to frame) in NSCAW I and NSCAW II";
RUN;

/* Child CBCL Comparison */
PROC DESCRIPT DESIGN=WR DATA=COMPARISON;
WEIGHT N1N2CWT1;
NEST COMP_STR COMP_PSU;
VAR YYB_TPT;
CLASS NCOHORT;
DIFFVAR NCOHORT = (1 2);
rtitle "Difference in the Child CBCL in NSCAW I and NSCAW II";
run;
PROC DESCRIPT DESIGN=WR DATA=COMPARISON;
WEIGHT N1N2CWT1;
NEST COMP_STR COMP_PSU;
VAR YYB_TPT;
CLASS NCOHORT;
Tables NCOHORT;
rtitle "Comparison of the Child CBCL in NSCAW I and NSCAW II";
RUN;

proc regress data=COMPARISON;
NEST COMP_STR COMP_PSU;
WEIGHT N1N2CWT1;
MODEL YYB_TPT = CHDGENDR NCOHORT;
SUBGROUP CHDGENDR NCOHORT;
LEVELS 2 2 ;
rtitle "Regression model: CBCL = Gender Cohort";
run;
libname nscaw2 'C:\Documents and Settings\kesmith\My Documents\NSCAW II\Freq review';
libname cps 'C:\Documents and Settings\kesmith\My Documents\Data Delivery\final w5 data';
libname library "L:\NSCAW_II\Master\Data";
libname calwgt18 'L:\Sampling\NSCAW_II\Calibration Weights\18months';

option nofmterr;

/* Sort NSCAW I Wave 3 Survey data by Child ID*/
PROC SORT DATA= cps.cps_w3 OUT=NSCAW1_SURVEY_W3 (KEEP = NSCAWID YB3_TPT);
   BY NSCAWID;
RUN;

/* Sort NSCAW I Wave 3 Weights by Child ID */
PROC SORT DATA= calwgt18.N1_compwts OUT=NSCAW1_Calib_W3;
   BY NSCAWID;
RUN;

/* Sort NSCAW II Wave 2 Survey data by Child ID*/
PROC SORT DATA= nscaw2.cps_n2_w2 OUT=NSCAW2_SURVEY_W2 (keep = NSCAWID YB2_TPT);
   BY NSCAWID;
RUN;

/* Sort NSCAW II Wave 2 Calibrated Weights and Sample Variables by Child ID */
PROC SORT DATA=calwgt18.N2_compwts OUT=NSCAW2_Calib_W2;
   BY NSCAWID;
RUN;

/* Next the comparison variables are merged with the survey variables, separately for each year */
/* Merge survey data with calibrated weights file */
DATA NSCAW1_W3;
   MERGE NSCAW1_SURVEY_W3 NSCAW1_Calib_W3;
   BY NSCAWID;
RUN;

DATA NSCAWII_W2;
   MERGE NSCAW2_SURVEY_W2 NSCAW2_Calib_W2;
   BY NSCAWID;
RUN;

/* Added Step for Making 18-Month Comparisons */
/* Prior to stacking the datasets,
rename NSCAW I W3 variables so they have the same name
as the NSCAW II W2 variables */
DATA NSCAW1_W3 (RENAME = (YB3_TPT = YB2_TPT)); SET NSCAW1_W3; RUN;

/* Stack the datasets */
DATA COMPARISON_W3_W2;
   SET NSCAW1_W3 NSCAWII_W2 ;
/* Once the datasets are stacked the data is ready for analysis using a survey software package such as SUDAAN. To use SUDAAN, the stacked dataset must first be sorted by the variables on the NEST statement, specifically COMP_PSU and COMP_STR. */

PROC SORT DATA=COMPARISON_W3_W2;
BY COMP_STR COMP_PSU;
RUN;

/* SUDAAN ANALYSIS */

/* Child CBCL Comparison */
PROC DESCRIPT DESIGN=WR DATA=COMPARISON_W3_W2;
WEIGHT N1N2Cwt18mo;
NEST COMP_STR COMP_PSU;
VAR YB2_TPT;
CLASS NCOHORT;
DIFFVAR NCOHORT = (1 2);
rtitle "Comparison of the Child CBCL in NSCAW I and NSCAW II";
run;

PROC DESCRIPT DESIGN=WR DATA=COMPARISON_W3_W2;
WEIGHT N1N2Cwt18mo;
NEST COMP_STR COMP_PSU;
VAR YB2_TPT;
CLASS NCOHORT;
Tables NCOHORT;
rtitle "Comparison of the Child CBCL in NSCAW I and NSCAW II";
RUN;