TECHNICAL NOTES

This section contains details for many of the technical procedures used in the Health Indicators Project. The topics addressed in this section are listed below:

Population Estimates

Peer Comparison Groups

Trend Analysis

Overview of Adequacy of the Kotelchuck

Determination of Elevated Blood Lead Levels

Sampling and Analysis for Childhood Immunization Survey

Sampling and Analysis for Percentage of Children who were Overweight or Obese

Population Estimates

Data for all indicators was analyzed in three year periods. In most cases the rates/percentages were exact representations. However, because census data is only collected every ten years, teen and adolescent birth rates, and child and adolescent death rates, are estimated. *Linear interpolation* was used to estimate the total population in each category (e.g. the number of females aged 10-14) for each year being analyzed.

The formula used was:

$$\text{Average Annual Change} = \left(\frac{\frac{\text{Final Value} - \text{First Value}}{\text{First Value}}}{n-1} \right) \times 100$$

$$= \left(\frac{\frac{\text{Final Value}}{\text{First Value}} - \frac{\text{First Value}}{\text{First Value}}}{n-1} \right) \times 100$$

$$= \left(\frac{\frac{\text{Final Value}}{\text{First Value}} - 1}{n-1} \right) \times 100$$

Where n = the number of years, inclusive of the first and final years

The average annual change was then added to the value for 1990, to estimate the population for 1991. Then the average annual change was added to the 1991 estimate to get the 1992 estimate. This was done for all years through 2000. This is a common method for obtaining estimates in the absence of actual counts of a given year.

Peer Comparison Groups:

Four factors were taken into account in creating the peer groups. These four factors were: the median income, the average poverty rate, the percentage of population that was black, and the percentage of the population that was under 18 for each neighborhood/ municipality. The information on these factors at the neighborhood/ municipality level were obtained from the *Cleveland Area Network for Data & Organizing (CAN DO)* at the Center on Urban Poverty and Social Change at Case Western Reserve University's Mandel School of Applied Social Sciences. These data were downloaded into a Microsoft Excel table and imported into SPSS v12.0 for creation of the peer groups.

SPSS was used to assign a decile rank to each of the factors for each neighborhood/ municipality. Ties were assigned to the higher rank. Once the rankings were done, a Two Step Cluster Analysis was performed based upon the four decile ranks. Log-likelihood was the distance measure and the number of groups was specified to be eight. Although arbitrary, eight was specified in attempt to create a feasible and manageable number of peer groups given that there are 94 neighborhoods and municipalities in Cuyahoga County. Deciles were used in order to reduce the variability and assure that the number of cities in each peer group was not extremely different. Data was sorted by median income, average poverty rate, percent black, and percent less than 18 in order to force the importance of these variables in the grouping.

The neighborhoods and/or municipalities within each peer group were divided into quartiles to create the **peer group rank**. Ties were assigned to the higher quartile rank. This created standard ranks that enabled comparisons across peer groups.

The following tables provide details for each Peer Comparison Group.

Peer Group Number 1:

Municipality/ Neighborhood	Pop Count	% Black	% Pop < 18	Poverty Rate	Median Income
Central	12,107	93	41	65	$8,657
Kinsman	5,842	97	44	57	$12,093
Hough	16,359	97	31	41	$13,305
University	9,469	31	9	42	$14,725
Fairfax	7,352	97	29	33	$16,549
Woodland Hills	11,574	97	36	43	$17,081
Goodrich –Kirtland Park	4,295	18	22	30	$17,703
St.Clair-Superior	11,410	77	37	41	$18,362
Ohio City	9,308	27	27	38	$20,340
East Cleveland	27,217	94	30	32	$20,542
Stockyards	8,616	11	34	35	$21,057
Detroit-Shoreway	17,382	19	31	36	$21,138
North Broadway	9,049	40	35	37	$21,140
Glenville	23,559	98	33	31	$21,471
Tremont	8,163	20	29	38	$21,496
Union-Miles	15,464	96	34	32	$22,324
Forest Hills	15,723	98	32	30	$23,122
Group 1 Averages	12,523	65	31	39	$18300

Peer Group Number 2:

Municipality/ Neighborhood	Pop Count	% Black	% Pop < 18	Poverty Rate	Median Income
Linndale	117	22	25	16	$21,500
Downtown	5,960	56	5	35	$26,161
North Collinwood	19,828	54	25	18	$27,082
Corlett	15,384	98	30	19	$27,649
Edgewater	8,571	16	16	18	$28,156
North Randall	906	73	16	11	$28,235
Euclid-Green	6,413	91	29	23	$29,225
West Boulevard	17,317	10	30	19	$31,627
Highland Hills	1,618	66	26	23	$31,731
Woodmere	828	50	21	11	$32,102
Industrial Valley	1,116	49	14	29	$33,826
Puritas-Longmead	15,200	24	26	14	$35,046
Euclid	52,717	31	22	10	$35,151
Riverside	4,982	25	31	17	$40,391
Group 2 Averages	10,783	48	23	19	$30,563

Peer Group Number 3:

Municipality/ Neighborhood	Pop Count	% Black	% Pop < 18	Poverty Rate	Median Income
South Collinwood	14,392	76	33	28	$23,737
Clark-Fulton	13,363	11	34	29	$24,807
Buckeye-Shaker	16,063	81	25	27	$25,283
Mt.Pleasant	23,197	98	31	25	$25,430
South Broadway	21,475	20	29	23	$26,090
Brooklyn Center	9,180	13	31	25	$26,437
Cudell	10,761	15	32	29	$27,439
Group 3 Averages	15,490	45	31	27	$25,603

Peer Group Number 4:

Municipality/ Neighborhood	Pop Count	% Black	% Pop < 18	Poverty Rate	Median Income
Brooklyn	11,586	2	19	7	$36,046
Bedford	14,214	18	20	8	$36,943
Parma Heights	21,659	1	19	8	$36,985
Mayfield Heights	19,386	3	16	6	$37,236
Bedford Heights	11,375	68	22	8	$37,861
Oakwood	3,667	57	21	6	$39,404
Maple Heights	26,156	45	26	6	$40,414
Cuyahoga Heights	599	0	22	6	$40,625
Kamms Corners	19,545	2	21	6	$44,529
Berea	18,970	5	21	6	$45,699
University Heights	14,146	21	21	6	$61,635
Walton Hills	2,400	2	17	2	$62,321
Shaker Heights	29,405	35	26	7	$63,983
Group 4 Averages	14,854	20	21	6	$44,899

Peer Group Number 5:

Municipality/ Neighborhood	Pop Count	% Black	% Pop < 18	Poverty Rate	Median Income
Richmond Heights	10,944	24	20	5	$43,625
Parma	85,655	1	22	5	$43,920
Brooklyn Heights	1,558	1	25	2	$47,847
Middleburg Heights	15,542	1	18	3	$47,893
Olmsted Township	10,575	1	22	3	$48,061
South Euclid	23,537	22	25	5	$48,346
Fairview Park	17,572	1	22	4	$50,487
Rocky River	20,735	0	21	2	$51,636
Seven Hills	12,080	0	18	3	$54,413
Broadview Heights	15,967	1	25	3	$56,989
Chagrin Falls Village	4,024	0	22	4	$64,531
Mayfield Village	3,435	1	21	3	$66,048
Bay Village	16,087	0	26	3	$70,397
Group 5 Averages	18,285	4	22	3	$53,399

Peer Group Number 6:

Municipality/ Neighborhood	Pop Count	% Black	% Pop < 18	Poverty Rate	Median Income
Old Brooklyn	34,169	3	22	11	$35,204
Lee-Miles	15,866	98	23	11	$36,234
Jefferson	19,949	8	24	10	$36,484
Warrensville Heights	15,109	91	26	11	$37,204
Newburgh Heights	2,389	3	22	12	$37,409
Glenwillow	449	5	22	5	$37,708
Garfield Heights	30,734	17	24	9	$39,278
Lakewood	56,646	2	21	9	$40,527
Brookpark	21,218	2	23	5	$46,333
Cleveland Heights	49,958	42	24	11	$46,731
Group 6 Averages	24,649	27	23	9	$39,311

Peer Group Number 7:

Municipality/ Neighborhood	Pop Count	% Black	% Pop < 18	Poverty Rate	Median Income
Lyndhurst	15,279	1	20	2	$52,272
North Olmsted	34,113	1	24	4	$52,542
North Royalton	28,648	1	24	2	$57,398
Independence	7,109	1	24	4	$57,733
Olmsted Falls	7,962	1	27	2	$57,826
Westlake	31,719	1	23	2	$64,963
Strongsville	43,858	1	26	2	$68,660
Highland Heights	8,082	1	27	4	$69,750
Gates Mills	2,493	1	24	1	$133,605
Bentleyville	947	1	36	1	$160,902
Group 7 Averages	18,021	1	26	2	$77,565

Peer Group Number 8:

Municipality/ Neighborhood	Pop Count	% Black	% Pop < 18	Poverty Rate	Median Income
Valley View	2,179	0	24	3	$64,063
Beachwood	12,186	9	20	4	$65,406
Bratenahl	1,337	12	11	4	$76,028
Brecksville	13,382	2	24	3	$76,159
Solon	21,802	6	31	3	$78,903
Orange	3,236	13	29	4	$89,660
Moreland Hills	3,298	3	23	3	$113,977
Pepper Pike	6,040	5	24	4	$133,316
Chagrin Falls Township	135	0	33	0	$188,774
Hunting Valley	590	0	22	2	$200,001
Group 8 Averages	6,419	5	24	3	$108,629

Trend Analysis:

Analysis was done to see if there was significant change in the rates from 1995-1997 to 1998-2000. This was done at the neighborhood/municipality level where available, and on the county level for all indicators that had data from two separate time periods. Neighborhoods/municipalities were excluded from this analysis if there were less than 100 possible cases (the denominator) in either time period because the small number of cases may produce rates are too unstable. The significance was tested by calculating 95% confidence intervals around the difference between the two independent rates. If the confidence interval included zero, which is the expected difference, then the rates were not significantly different. If there were 30 or less events (the numerator) for a given neighborhood/ municipality in a given time period (i.e. 30 or less births over either three year time period) the poisson formula was used. Otherwise a binomial formula was used.

The formulas for calculating the confidence intervals are:

Poisson: $CI = r_1 - r_2 \pm 1.96 \sqrt{\frac{r_1}{n_1} + \frac{r_2}{n_2}}$

Binomial: $CI = r_1 - r_2 \pm 1.96 \sqrt{\frac{r_1(1- r_1)}{n_1} + \frac{r_2(1- r_2)}{n_2}}$

Even if the numbers weren't significantly significant it was still noted whether or not the trend was moving towards the Healthy People 2010 Goal.

Overview of Adequacy of Prenatal Care Utilization Index (Kotelchuck Index)

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September, 1994

The Adequacy of Prenatal Care Utilization (APNCU) Index attempts to characterize prenatal care (PNC) utilization on two independent and distinctive dimensions - namely adequacy of initiation of PNC and adequacy of received services (once PNC has begun). The index uses information readily available on U.S. birth certificates (month of initial PNC visit, number of visits, and gestational age). It is a major improvement over existing indices, and is consistent with the 1985 American College of Obstetricians and Gynecologist (ACOG) recommendations for PNC utilization. This index does not assess quality of the prenatal care that is delivered, only its utilization.

The initial dimension "Adequacy of Initiation of Prenatal Care" characterizes the adequacy of the timing of initiation of PNC. The assumption underlying this scale is that the earlier PNC begins the better. ACOG recommends PNC begin in the first month of pregnancy; the Institute of Medicine now encourages pre-conceptual care. The month or trimester prenatal care begins is widely used as a measure to assess the adequacy of timing of initiation of PNC, since it accurately and succinctly describes when PNC begins. The APNCU Index uses this measure to assess Adequacy of Initiation of PNC, though the initiation months are collapsed into four distinct groupings: (1,2) (3,4) (5,6) (7-9 or none) months.

The second dimension "Adequacy of Received Services" characterizes the adequacy of received PNC visits during the time period after prenatal care is begun until the delivery. This dimension attempts to characterize if the woman received the appropriate number of prenatal care visits for the time period they were receiving PNC services. It is based on ACOG standards (one visit per month through 28 weeks, one visit every 2 weeks through 36 weeks, and one visit per week thereafter, adjusted for data of initiation of PNC). This is the newly measured dimension of the APNCU Index.

To assess the Adequacy of Received Services requires four steps. First, it is necessary to determine the number of expected PNC visits for each pregnancy, given the date PNC began and the date of delivery. This can be done easily (by computer or by hand) by noting the number of ACOG recommended visits for a given gestation and then adjusting or reducing that number based on the date of PNC initiation (assuming missed visits are not made up). For example, in a 40-week pregnancy ACOG recommends 14 visits; if PNC began in month 4 (3 missed visits), then the expected number of visits = 11 (14-3). Second, observed PNC visits are directly obtained from the recorded number of PNC visits noted on

the birth certificate (or any other PNC data source). Third, the proportion of observed visits/expected visits is calculated. Fourth, the results are scaled: 0-49% of expected visits = Inadequate; 50-79% = Intermediate; 80-109% = Adequate; 110+% = Adequate Plus. A similar ratio concept is implicit in the existing Kessner Index. Thus, this second dimension basically uses the fixed ACOG visit recommendation schedule as an underlying metric; defines an (expected) sector of it, beginning at the date of PNC initiation and ending at the gestational date at delivery; and then compares the expected visits with the actual visits received to judge the utilization adequacy. This dimension of Adequacy of Received Services is independent of the prior dimension of Adequacy of Initiation of PNC. The two dimensions are important in their own right and should be examined separately.

The policy and practice issues underlying them may be quite distinct. However, recognizing the popularity of a unitary PNC utilization index and the possible importance of the broadest characterization of PNC utilization adequacy, the two dimensions can be combined into a single summary APNCU Index. The proposed index uses the popular characterization of PNC as inadequate, intermediate and adequate, but also adds a new fourth category of intensive or adequate plus care. Inadequate care is defined as PNC begun after the 4th month or under 50% of expected visits were received. Intermediate care is defined as PNC begun by month 4 and between 50-79% of expected visits were received. Adequate care is defined as PNC begun by month 4 and of 80-109% of expected visits were received. Adequate plus (intensive) care is defined as PNC begun by month 4 and 110% or more of expected visits were received. Inadequate care can be subdivided to isolate those with no PNC.

The present APNCU Index does not adjust for risk conditions of the mother. As ACOG notes, its recommendations are for women without additional risks or complications; more visits would be expected in those cases. Thus, this Index is conservative; it underestimates utilization adequacy (e.g., the number of expected visits has not been increased to account for higher maternal risk status). Future development of the Index will include a maternal risk factor adjustment to increase the number of expected visits for known risk conditions of the mother.

The proposed Adequacy of Prenatal Care Utilization Index can be seen as the second generation of adequacy of prenatal care indices. It improves upon the widely-used Kessner/I.O.M. index, by correcting some of its principle faults - namely its inaccurate characterization of PNC adequacy for women of more than 36 weeks gestation; its failure to distinguish inadequacy due to late initiation from inadequacy due to insufficient visits; its bias towards measurement of adequacy of initiation of care; and its various computational algorithms due to inadequate initial documentation. The APNCU Index should be of great utility to public health officials, health care providers, and health services researchers.

Determination of Elevated Blood Lead Levels

If a child had a venous test result that was $\geq$ 10 µg/dl, the child was considered to have an elevated blood lead level. If a venous test was not available, but two capillary tests (performed within 90 days of each other) were $\geq$ 10 µg/dl, the child was considered to have an elevated blood lead level. In this instance, the value of the second test was used to indicate the blood lead level. On rare occasions, the second test was performed when the child was $\geq$ 72 months of age, thus the first test was used. Additionally, if the two capillary tests (as described above) were higher than an available venous test, the capillary test results were used. If a venous test was not available and only one capillary test was performed, regardless of the result, the child was considered negative for elevated blood lead.

Sampling and Analysis for Childhood Immunization Survey

All Cuyahoga County municipal schools with at least one kindergarten were invited to participate in the survey. If school had 50 or less kindergarten students all immunization records were reviewed. If a school had more than 50 kindergarten students, a random number generator was used to select 50 students. If a selected student had a birthday outside the birth cohort, a date of birth from September 2, 1997 through September 1, 1998, they were replaced with another randomly selected student.

All data were initially collected and entered using the Centers for Disease Control and Prevention's Clinic Assessment Software Application (CASA) version 2.6. The CASA software calculated up-to-date status and the data were exported in an Excel file format. The data were then imported into SPSS v12.0. Survey weights were developed using the inverse of the probability of selection for each student. Data were further analyzed using SUDAAN v8.0 to produced weighted estimates for the percentage of children with up-to-date immunization schedules.

Initially, a total of 29 school districts participated in the survey and data were obtained for 8,208 kindergarten students. Six school districts were identified as having documentation issues (i.e. only the last dose of Hib was noted in the immunization records). Therefore, we excluded these districts from the analysis. This left a total of 6,990 for the final analysis. We compared the results with and without the six districts with the documentation issues and found a 1-3% difference in the percentage of children that had up to date schedules.

Sampling and Analysis for Percentage of Children who were Overweight or Obese

Height and weight data were obtained for the students that were selected for the immunization survey (see above for details). Among the 8,208 students selected, height and weight data were available for 1,751 students (21%). Although randomly selected, we did not produce weighted estimates because of the large amount of missing data.

To determine the percentage of kindergarteners who were overweight or obese, we calculated Body Mass Index (BMI) data. The height and weight data were collected in inches and pounds and subsequently converted to meters and kilograms, using standard conversion factors. Once converted, a BMI was calculated using the following formula:

$$\text{BMI} = \frac{\text{Weight in Kilograms}}{(\text{Height in Meters})^2}$$

A child is classified as overweight if their bmi falls between the 85% and 95% percentile for their age and sex. A child is classified as obese if their bmi is equal to or greater than the 95% percentile for their age and sex.

Data tables including information on sex, age in months, and bmi percentiles were obtained from the CDC's National Center for Health Statistics.