

Title V 5-Year Needs Assessment Indicators

DATABOOK 2004 to 2015

Linda L. Remy, PhD
Ted Clay, MS
Geraldine Oliva, MD MPH

Family Health Outcomes Project
University of California, San Francisco
500 Parnassus Ave. Room MUE-336
San Francisco CA 94143-0900
Phone: 415-476-5283
Fax: 415-476-6051
Web: <https://fhop.ucsf.edu/>

Funding Provided by the
Maternal Child and Adolescent Health Branch
California Department of Health Services

June 2018

TABLE OF CONTENTS

DataBook Layout	1
Calculating Rates.....	2
Example Data Quality Tab	3
Example Rate Tab	4
Displaying and Testing Trends.....	6
Race/Ethnic Disparities	9
Conclusion	9
Appendix A: Other Statistical Issues	11
Endnotes.....	12

TABLES AND FIGURES

Table 1: Example Kotelchuck Index Data Quality Tab	4
Table 2: Fertility Rate Per 1,000 Female Population Age 15 to 17.....	5
Figure 1: Fertility Rate Trend Per 1,000 Female Population Age 15 to 17	6
Table 3. Fertility Rate Trend Regression Results Per 1,000 Female Population Age 15 to 17 ...	7
Table 4. Fertility Rate Trend Regression Results Per 1,000 Asian/Pacific Island Females Age 40-44.....	8
Table 5. Change of Rates within Level and Race/Ethnicity, Births to Females Age 15-17	9

Suggested Citation:

Remy LL, Clay T, Oliva G. (2018) Title V 5-Year Needs Assessment Indicators: DataBook 2004-2015. San Francisco, CA: University of California, San Francisco, Family Health Outcomes Project. Available at: <https://fhop.ucsf.edu/fhop-publications-data-analysis-methods-guidelines>.

TITLE V 5-YEAR NEEDS ASSESSMENT INDICATORS DATABOOK 2018

The 2018 version of the set of Title V Indicator DataBooks has changed in a few important ways. The purpose of this document is to provide an overview of the DataBooks and to introduce implications for using the DataBooks to inform local monitoring and planning activities.

DATABOOK LAYOUT

The DataBook contains a minimum of three types of tabs: Data, Rates, and Graphs. A few DataBooks also have a Definition tab or a Data Quality tab.

Data Tabs. As previously, the Data Tabs are a 2-tab set of local jurisdiction and state data summarizing required and optional indicators. Each Data Tab presents the numerators with the appropriate denominators to calculate rates. Data presented here are the source for calculating a Rates and Graphs tab for each indicator. Most indicators have 12 years of data, 2004-2015. Some indicators have fewer years, for example 2007-2015. This is because one or more of the variables needed to calculate an indicator first became available in 2007.

The Rate Tab is preset to print in three pages.

Page 1 defines the indicator and its risk factors. Below this is the rate table for total cases. It may have as many as 12 or as few as no data rows, depending on the number of cases available each year. Rules for determining the number of rows are described in the next section of this document. Below the rate table for all cases on page 1, we identify the data sources and additional analyses you might wish to undertake to understand your jurisdiction's performance on the indicator.

Page 2 of the rate table summarizes rates for White Non-Hispanic and Hispanic All-Race, and Page 3 summarizes results for Non-Hispanic African-American and Asian/Pacific Island populations. We used the same rules to calculate these tables as we used for the Total table.

The Graph Tab summarizes results of trend tests for data on the Rate Tab. As with the Rate Tab, page 1 summarizes trend results for all data (Total). Under the Total Statistics table, we have a table comparing the change in rates for State and Local by race/ethnicity at the 3-year start and the 3-year end of the trend period. Page 2 shows trend results for White Non-Hispanic and Hispanic All-Race, and page 3 for Non-Hispanic African American and Asian/Pacific Island populations. Appendix A describes methods to calculate trend statistics.

Definition Tab. A few DataBooks have a Definitions Tab to provide more information as to how indicators were calculated. These are mainly indicators using a population subset, e.g., births to mothers age 15 to 44, or singleton births. In these instances, total cases reported will be less than the source data total (e.g. all births vs. singleton births). Other indicators require adding cases from multiple data sources, e.g., births and fetal deaths. For these indicators the total number typically reported will be greater than either file independently.

CALCULATING RATES

MINIMUM NUMBER OF EVENTS (NUMERATORS)

If the minimum number of events over all years was greater than or equal to 10 in each year, the indicator data remained as given [1,2]. If the minimum number of events in any period was less than 10, we aggregated the data into 2-year periods. If the minimum still was less than ten, we aggregated into 3-year periods. If any 3-year period still did not meet the minimum of 10, we declared the number of cases not big enough and did not calculate a rate for that period. If all periods had fewer than 10 cases, the table on the Rates tab has the phrase "Rates not calculated." Otherwise, the Rates Tab tables show the period, numerator, rate, and rate confidence interval for every interval with 10 or more cases.

Given the final level of aggregation for the local data, we did the same aggregation on the corresponding California data. Then we merged the local and state data for side-by-side presentation in the Rate Tab.

If the number of events in a given year is in the range of 1-4, we suppress numbers to protect confidentiality. In addition to suppressing the count for the affected indicator, we also suppress the next smallest numbers in the same column for the same indicator. This ensures that the affected race/ethnic group is unknown in the given year. You will see spaces on the Local Tab or Rate Tab indicating suppressed numbers. FHOP did this to meet requirements of the CDPH Vital Statistics Advisory Committee, to protect confidentiality and prevent personal identification.

Some indicators typically have few events. Births to females age 10 to 14 is an example. For some indicators with few cases, we include the numerator and denominator data on the Data Tab, but we do not calculate rates or make graphs.

NUMBER OF PEOPLE (DENOMINATORS)

We used two different types of denominators: Annual county-level population estimates from the California Department of Finance (DOF) [3], or counts based on source files (e.g. hospital discharges, birth or fetal death certificates).

DOF one-year age categories were summarized as needed for indicators that use state population for their denominators. Some indicators use only certain ages in the female population for denominators, others use all population or all population in given age categories.

Some indicators have as their denominator the total number of records in a given category and file, for example from the birth certificates file, the number of women age 15 to 44 delivering a live born infant. Others need refinement: women age 15 to 44 delivering a singleton infant. Before deciding if a record meets the minimum qualifying condition(s), the macros check to be sure we are excluding invalid or unlikely cases (e.g., age missing, 92 year old mother, 27-month gestational age, 5 gram birth weight). We exclude cases outside allowable ranges set by the CDC/NCHS [4,5] and report frequency in the Data Quality tab present for some DataBooks.

RACE/ETHNICITY

All data sources used to make DataBooks do not define race/ethnicity similarly. For example, DOF denominators do not have population numbers when race is other, unknown, or missing. Hospital, emergency department, and ambulatory care data from the Office of Statewide Health

Planning and Development (OSHPD) and population data that some local jurisdictions provide FHOP do not have multi-race.

The proportion of cases with undefined race/ethnicity (other, unknown, missing, multi-race) is not random. It varies widely by data source, time, geography, and other characteristics such as age and hospital characteristics [6]. We now make a set of DataBooks that focus on data quality of race/ethnic reporting from major data sources (hospital discharges, emergency department visits, births). Additionally, we provide a hospital-level report to help jurisdictions identify the source of local race/ethnic data quality problems [7]. These resources are on FHOP's website.

To describe race/ethnic groups consistently across DataBooks, we first assign Hispanic all-race. Then we assign the remaining Black, Asian/Pacific Islander (API), and American Indian/Alaska Native (AIAN) codes. When datasets have multiple race variables (birth, death, fetal death), we use the constructed race variable that is provided.

When we need population denominators for periods before 2000, we proportionately reassign post-2000 undefined race/ethnicity to non-Hispanic groups for both numerator and denominator data as needed, following CDC [8] and DOF [9,10] recommendations. The result is five race/ethnic groups we can use longitudinally across all available time periods and data sources: White, Black, Hispanic All-Race, API, and AIAN.

Reassignment never affects Total or Hispanic rates but may result in slightly different statistics for White, Black, and API groups than may be published elsewhere. FHOP does not calculate rates for AIAN, multi-race, or other. Race coding rules used by different sources diminish their numbers so significantly that they are not reliable.

CALCULATING RATES AND CONFIDENCE INTERVALS

Rates were calculated overall and for each race/ethnic group by dividing the numerator (number of events) by its appropriate denominator (e.g. population, births, deaths), and multiplying the result times the appropriate factor (e.g. rate per 1000 births, etc.). The confidence interval for the rate was calculated using the Wilson score without continuity correction [11].

EXAMPLE DATA QUALITY TAB

The Data Quality Tab focuses on the numbers of cases set aside in the each year of the period for each grouped set of indicators due to data quality problems. Table 1 is an example of a Data Quality Tab. The top part identifies the indicator(s) screened for data quality, in this case for the Kotelchuck Index for Adequacy of Prenatal Care. The top section includes definitions of the indicator, numerator, denominator, the National Center for Health Statistics (NCHS) Standard for data quality, and risk factors associated with this indicator. A variable used to calculate this indicator changed in 2007.

Table 1: Example Kotelchuck Index Data Quality Tab

DEFINITION: Missing number of prenatal care visits or month of first prenatal care visit, or gestational age outside 17-47 weeks (%)

NUMERATOR: Number of births with number of prenatal care visits or month of first prenatal care visit missing or gestational age outside 17-47 weeks, by place of residence in one calendar year

DENOMINATOR: Number of births, by place of residence in one calendar year

NCHS Standard: Visits: 3.27%, with national median 2.18%

RISK FACTORS: Birth clerk training, staffing, supervision, hospital characteristics

TOTAL POPULATION								
Year	California				Local			
	Births	Rate	Confidence Limit		Births	Rate	Confidence Limit	
			Lower	Upper			Lower	Upper
2007	28,543	5.0	5.0	5.1	1,075	6.2	5.9	6.6
2008	25,624	4.6	4.6	4.7	2,215	13.2	12.7	13.7
2009	19,375	3.7	3.6	3.7	1,767	10.9	10.4	11.3
2010	17,865	3.5	3.5	3.6	1,954	12.0	11.5	12.5
2011	16,147	3.2	3.2	3.3	1,417	8.8	8.3	9.2
2012	16,157	3.2	3.2	3.3	1,151	7.2	6.8	7.6
2013	13,379	2.7	2.7	2.8	743	4.7	4.4	5.1
2014	11,426	2.3	2.2	2.3	630	4.0	3.7	4.3
2015	9,886	2.0	2.0	2.0	387	2.5	2.3	2.8

Sources: **Definition:** Number of prenatal care visits or month of first prenatal care visit is missing (.,99). National Center for Health Statistics (2011). Computer edits for natality data. Updated 11-Feb-2011.

The Rate Table shows data for state total and the local jurisdiction, over the most recent period for which data are available, in this case 2007 through 2015. For both the state and local jurisdiction, columns indicate the number of events, the rate, and lower and upper confidence limits for that rate. Notice that both state and local rates decline with time, meaning data quality is improving, with local rates about 2 to 3 times higher than state rates in most periods. Reviewing the lower confidence interval, the local rate is always higher than the state rate.

Jurisdictions with more records set aside face increasing uncertainty about their results than those with fewer set-asides. For example, with a national median of 2.18%, neither the state nor the local jurisdiction can be sure that their Kotelchuck score is relatively accurate until 2015.

EXAMPLE RATE TAB

Table 2 on the next page is an example of the Rate Tab for the number of live births per 1,000 females age 15 to 17. Below the rate table, we present information on the sources for the indicator definitions, the numerator, and the denominator. Recommended tables that can be made using CBInfo [12] (if a birth-certificate indicator) are shown. Finally, we present any notes that we think are important to understand the data presented. On pages 2 and 3 of a given Rate Tab, we show the same rate-based data for the other race/ethnic groups, as described earlier.

Comparing the state and local rates and confidence intervals on Table 2, from start to end of period, we see that the local rate and its upper confidence intervals are always below the state rate. This allows us to conclude that the local rate was significantly lower than the state throughout the period. In both cases, we also see that rates appear to be dropping. This leads us to wonder if the drop in rates is statistically significant. Is the rate of change the same for the jurisdiction and state? That is, do we have a trend, and if so, is it linear or curvilinear? How does the jurisdiction compare with the state?

Table 2: Fertility Rate Per 1,000 Female Population Age 15 to 17

DEFINITION: The number of live births per 1,000 females age 15-17
NUMERATOR: Number of live births to females age 15-17, by place of residence in a calendar year
DENOMINATOR: Population of females age 15-17, by place of residence in a calendar year
HP 2020 OBJECTIVE **FP 8.1:** Reduce the pregnancy rate among adolescent females aged 15 to 17 years to 36.2 pregnancies per 1,000 (Baseline: 40.2 per 1,000 in 2005)
RISK FACTORS: Poverty, education, access to family planning, substance use

TOTAL POPULATION								
Year	California				Local			
	Births	Rate	Confidence Limit		Births	Rate	Confidence Limit	
			Lower	Upper			Lower	Upper
2004	16,263	21.3	21.0	21.7	93	8.5	7.0	10.4
2005	16,740	21.6	21.3	21.9	92	8.8	7.2	10.7
2006	17,208	21.7	21.4	22.0	79	7.7	6.2	9.6
2007	17,582	21.8	21.4	22.1	99	9.6	7.9	11.7
2008	17,007	20.8	20.5	21.1	98	9.4	7.7	11.4
2009	15,418	19.2	18.9	19.5	90	10.8	8.8	13.3
2010	13,308	16.5	16.2	16.8	57	6.6	5.1	8.6
2011	11,839	14.9	14.7	15.2	72	8.7	6.9	10.9
2012	10,359	13.3	13.1	13.6	57	6.9	5.4	9.0
2013	8,525	11.1	10.9	11.4	37	4.7	3.4	6.4
2014	7,324	9.7	9.5	9.9	46	5.8	4.3	7.7
2015	6,448	8.6	8.4	8.8	28	3.5	2.4	5.1

Sources: **Objective:** Healthy People. See: https://www.healthypeople.gov/node/4467/data_details. Last accessed 13-Sep-2016

Definition: **NAPHSIS.** Age-specific birth rate. Last accessed 16-Sep-2016 at: https://naphsis-web.sharepoint.com/about/Documents/ASBR_Final_Scott.pdf

Numerator: California Center for Health Statistics, Vital Statistics, Births Statistical Master File. To order: <http://www.cdph.ca.gov/data/dataresources/requests/Pages/BirthandFetalDeathFiles.aspx>. Last accessed 26-Aug-2016.

Denominator: 2004-2009: State of California, Department of Finance, Race/Hispanics Population with Age and Gender Detail, 2000-2010. Sacramento, California, September 14, 2012 (Revised to include decimal detail). Last access 27-Aug-2016 at: http://www.dof.ca.gov/research/demographic/data/race-ethnic/2000-2010/Intercensal_2000-2010_DBInput_csv.zip

2010-2015: State of California, Department of Finance, Report P-3: State and County Population Projections by Race/Ethnicity, Detailed Age, and Gender, 2010-2060. Sacramento, California, Dec 2014. Last access 27-Aug-2016 at: http://www.dof.ca.gov/research/demographic/reports/projections/P-3/P-3_CAProj_database.zip

Recommended Tables: *Can be analyzed using CBIInfo*

- Births by mother's race/ethnicity -- Review Crude Birth Rate Tables
- Births by mother's age, parity, geographic area (ZIP code, if available)
- Map of distribution of births by geographic area (ZIP code)

Notes: **Race/Ethnicity.** DataBook rates are based on race and ethnicity as originally reported in the source files. In preparing national statistics, the National Center for Health Statistics (NCHS) randomly reassigns undefined groups ("multi-race" and "other" (which includes "unknown")) to defined single-race groups (white, black, API, and AIAN) based on the local underlying population distribution [1]. Hispanic all-race counts are not changed. As a result, race-specific rates in DataBooks may not match NCHS published rates.

For some DataBooks, FHOP calculates rates using California Department of Finance (DOF) population estimates. DOF estimates race-specific population from various data sources, some of which include undefined groups. DOF uses the NCHS method to reassign "other" but not "multi-race" [2,3].

The accuracy of race/ethnic-specific rates depends on the completeness of race and ethnicity reporting, which varies by geography, reporting year, and reporting source. Incomplete reporting reduces the number of events in the defined groups, and affects the accuracy and stability of rates. It reduces the number of events in the numerator (and sometimes the denominator) for rate calculations, and may underestimate incidence or prevalence. Before interpreting results of statistical tests on rates and trends tabs, FHOP recommends reviewing local tab rows for undefined groups. Consider the extent to which numbers for undefined groups may increase uncertainty about defined group rates.

- Hamilton BE, Martin JA, Ventura SJ. (2013). Births: Preliminary data for 2012. National vital statistics reports; Vol 62, No 3. Hyattsville, MD: National Center for Health Statistics. Last access 23-Jul-2014
 - California and its Counties Population by Age, Race/Hispanics, and Gender: 2000-2010. Base population. Last access 03-Dec-2013 at: <http://www.dof.ca.gov/research/demographic/data/race-ethnic/2000-2010/index.php>
 - U.S. Census Populations with Bridged Race Categories. Last access 03-Dec-2013 at: http://www.cdc.gov/nchs/nvss/bridged_race.htm
- Confidence Limit = the boundary of the 95% confidence interval.

DISPLAYING AND TESTING TRENDS

If rates are on the Rates Tab, as for our example, we display local and state rates over the period on the Graph Tab and show results of statistical tests for trends and rate differences. If the data permit 12 years of rates, as here, we also test for non-linear trends.

THE TREND GRAPH

Figure 1 shows the graph made using the rates from Page 1 of the Graph Tab for our example indicator. Depending on the number of events the data allow us to calculate, a given graph might have no points, 1 to 4 points, or 6 or 12 points. Note that these graphs do not include confidence intervals, which would be inappropriate for a trend test. Here, we focus on the rate of change over time rather than within a given period such as a year.

Figure 1: Fertility Rate Trend Per 1,000 Female Population Age 15 to 17

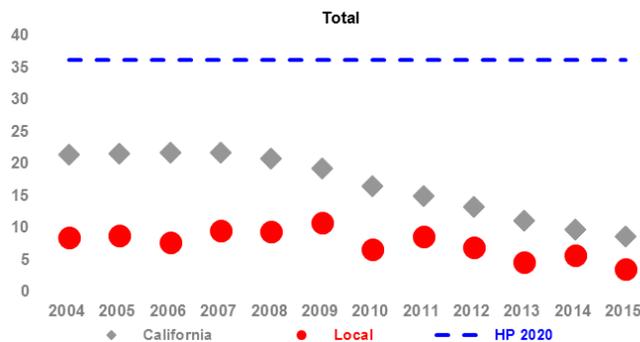


Figure 1 has 12 points, because the local number of events was 10 or more in all years. If the indicator had too few cases in a period, the local year space would be blank. Red dots (●) show the local rate and grey diamonds (◆) the state rate. When an indicator has a Healthy People (HP) 2020 objective, it shows with a dashed blue line. For this indicator, the HP objective is 36.2 births per 1,000 female population age 15 to 17.

STATISTICAL TESTS

We evaluated the indicator data on the rate tab two ways. First, we evaluated it to learn if the trend we see is statistically significant. The emphasis here is on the rate of change over time, asking in essence if the local jurisdiction is changing at a rate similar to or different from the state and in what direction. Second, we tested if the local jurisdiction rate is significantly different from the state at the start and end of our period. The emphasis here is whether local jurisdiction results are lower than, higher than, or the same as the state. Table 3 reports the results of these two types of statistical tests for our example: trend test and difference test.

Trend Test. Sometimes the "eyeball" test may make you think that significant linear trends are present when in fact the data are not linear or the trend is not significant. For example, the linear trend test may be non-significant because the data has some other shape like \cap or \cup . When the data has another shape, it would be inaccurate to describe a trend as linear.

We used JoinPoint software to test for trends. When JoinPoint finds that one or more segments of a period have slopes that are significantly different from the slope of the previous period or finds significant shifts in the intercept, it breaks the trend into segments. This means that JoinPoint found a bend, or change in the angle of the trend line or intercept that is statistically significant from the previous segment at $P = 0.05$ or less. If it finds bends, JoinPoint defines the time-based segment and describes the slope and intercept during each period. Each time the segment slope changes, its intercept also changes.

We allow JoinPoint to search for segments if the series had 12 periods, as in our example. We report the multiple segment model when one or more segments have a slope significantly different from zero. Otherwise we report the simple linear model. If the numbers of local cases were too few to test 12 periods, we restrict JoinPoint to a simple linear trend test. Table 3 summarizes findings for this indicator.

Table 3. Trend Regression Results
Births Per 1,000 Female Population Age 15 to 17

Level	Date Range	Intercept		Slope			Sig?
		Est.	Std. Err	Est.	Std. Err	P-Value	
State	2004-2007	21.33	0.47	0.24	0.36	0.530	No
	2007-2015	27.28	0.53	-1.74	0.06	0.000	Yes
Local	2004-2015	9.88	0.80	-0.47	0.11	0.002	Yes
State Avg	2004-2006	21.56	0.10				
Local Avg	vs State	8.34	0.51			0.000	Yes
State Avg	2013-2015	9.80	0.07				
Local Avg	vs State	4.64	0.44			0.000	Yes

State Trend. The first data row in the Level column contains the word "State". The "Date Range" column shows one or more time intervals. If a simple linear model was justified, one line of State results shows, and the Date Range column shows the 12-year range. In our example, JoinPoint found 2 segments, so 2 State rows show.

For each trend segment, the next column sets show the intercept and its standard error, the slope and its standard error, and the P-value associated with the slope. In the last column, we identify by "Yes" or "No" if the slope in the time segment is significantly different from zero at $P = 0.05$ or less.

JoinPoint rejected the hypothesis that the best fit for the state trend is linear and found that a 2-segment model offered the "best" description of the state data. By best, we mean that this model explained significantly more variance than the simple linear model. From 2004-2007, the state rate was essentially flat (Slope = 0.24), as shown by the P-value of 0.530, then it declined significantly during 2007-2015 (Slope -1.74, P-value 0.000).

Local Trend. The first column contains the word "Local". In all other respects reporting the local trend is like the state trend discussed above. For our example, JoinPoint found the local trend declined steadily throughout the period (Slope = -0.47, P-value 0.002). For an overall sense of how the jurisdiction did, look at the slope estimate section of the table. The last column summarizes the "big picture": "Yes" means the local trend is statistically significant.

If the local jurisdiction has too few cases to calculate trends, we show the text "Too few cases", and the rest of the table is blank.

Difference of Slopes Test. If JoinPoint accepts a linear model for both the State and jurisdiction, we test to see if their slopes are significantly different from each other. That is, we test the null hypothesis that the local and state trends are equal, assuming the data are independent and had a normal distribution. In essence, we perform a T-test on the slopes.

Since JoinPoint found the state model was nonlinear, we do not show a difference of slopes test. When one area has a linear trend and another has a curvilinear trend, or when both are curvilinear, we cannot test if the slopes for these trends are different. But we can show the difference of slopes test for API females age 40-44 in this same jurisdiction.

Table 4. Trend Regression Results Per 1,000 Asian/Pacific Island Females Age 40-44

Level	Date Range	Intercept		Slope			Sig?
		Est.	Std. Err	Est.	Std. Err	P-Value	
State	2004-2015	13.95	0.36	0.48	0.06	0.000	Yes
Local	2004-2015	14.21	0.71	0.83	0.12	0.000	Yes
	Different?					0.007	Yes
State Avg	2004-2006	14.70	0.16				
Local Avg	vs State	15.09	0.69			0.577	No
State Avg	2013-2015	19.32	0.17				
Local Avg	vs State	22.93	0.85			0.000	Yes

Table 4 shows that both the state and local jurisdiction had significant linear trends. When both trends are linear, line 3 of the "Level column is blank and the "Date Range" column contains the word "Different?". The P-value is from the test that the local slope equals the state slope over the trend period.

Again, a "Yes" or "No" indicates whether the P-value is statistically significant. In this case, both trends are statistically significant, and the local rate of change (Slope = 0.83) is statistically different from the state rate of change (Slope = 0.48). In any circumstance where the difference of slopes test is not statistically significant, report the state trend, since the local trend is not different from that, and the state trend has more power. Only when the two trends are significantly different should the local trend be reported in favor of the state trend.

Difference of Rates Tests. The trend tests above describe the rate at which outcome indicators are changing and their direction (improving, getting worse, or no change), and, if the trends are simple linear, whether the local jurisdiction is changing at the same or a different rate than the state. But these do not answer a question of central importance to most jurisdictions: Did they do better, the same as, or worse than the state as a whole? To approach this question, we did difference of rates tests, comparing the local jurisdiction to the state for the first three years and the last three years of the trend period. These results also are shown on the graph tab, with Tables 3 and 4 containing the example results.

State Average in First 3 Years. The first column shows "State Avg", and the Date Range column identifies the first 3 years in the period. The three-year average state rate and its standard error are displayed in the Intercept Estimate and Standard Error columns. In the first three years of the example period for Table 3, the state average rate was 21.56 births per 1,000 females age 15 to 17. In the first three years of the example period for Table 4, the state average rate was 14.70 per 1,000 API females age 40-44. In both cases, notice that the jurisdiction standard error is larger than the state, since the jurisdiction is smaller.

Local Average in First 3 Years and Comparison to State. This is located on the line after the State Average. The first column contains "Local Avg" and the Years column contains the words "vs State". The three-year average local rate and its standard error are displayed in the Intercept Estimate and Standard Error columns. In the first three years of the trend period for Table 3, the local jurisdiction rate was 8.34 births per 1,000 females age 15 to 17. In the first three years of the trend period for Table 4, the local jurisdiction rate was 15.09 per 1,000 API females 40-44.

The "P-value" column shows the P-value for the test that the state and local 3-year rates are the same. "Yes" indicates that the P-value is less than 0.05 and the state and local rates are significantly different. "No" indicates that they are not significantly different. During the first 3-year period, the local jurisdiction had a statistically lower rate than the state for births to females age 15-17 and a statistically similar rate for API females age 40-44.

State Average in Last 3 Years. Similar to the first 3 Years described above, the State as a whole had a rate of 9.80 births per 1,000 females age 15 to 17 and a rate of 22.93 births per 1,000 API females age 40-44.

Local Average in Last 3 Years and Comparison to State. This is similar to the first three years described above, with the local jurisdiction having a rate of 4.64 births per 1,000 females age 15 to 17 and a rate of 20.82 per 1,000 API females age 40-44. During the last three years in the trend period, the "Yes" in the last column, and the P = 0.000 indicates that the local jurisdiction had statistically lower rates than the state for births to females age 15-17 and statistically higher rates than the state for births to API females age 40-44.

RACE/ETHNIC DISPARITIES

Immediately below the analysis of Total trend regression results, the table labeled “Change of rates within race/ethnicity” shows State and Local rates and confidence intervals for the four primary race/ethnic groups for the 3-year start- (2004-2006) and end-of-period (2013-2015). The column labeled “Change” shows the rate of change over the interval, if results for a given race/ethnic group were statistically significant, and if so, the direction of change. The column labeled “Chng” (Change) shows the percent change over the interval. If the rate rose, the number will be positive. If the rate dropped, the number will be negative. The word “No” indicates no important change for that race/ethnic group over the interval, and “Yes” indicates a significant change in rates

Table 5. Change of rates within level and ethnicity, Births to Females Age 15-17

Level	Race/ethnic Group	2004-2006		2013-2015		Change	
		Rate	CI	Rate	CI	%	Sig?
State	White	6.55	0.18	2.79	0.13	-57	Yes
	Black	21.83	0.70	10.80	0.55	-51	Yes
	Hispanic	37.80	0.37	15.47	0.23	-59	Yes
	API	5.60	0.29	1.67	0.16	-70	Yes
Local	White						
	Black	18.76	4.62	10.05	4.60	-46	Yes
	Hispanic	25.72	3.89	12.52	2.85	-51	Yes
	API	1.68	0.73				

Table 5 shows births to females age 15-17 in the example jurisdiction. Births plummeted statewide 51-70 percent (all significant). Local rates dropped 46-51 percent for Black and Hispanic. Notice that no local rates appear for White females at either period or for API females during 2013-2015.

While the Black and Hispanic disparity closed locally (see overlapping confidence intervals), there were too few local cases to compare for White and API females age 15-17.

CONCLUSION

Reality is often complex, and complexity trumps simplicity when reporting statistical results. Thus, when a statistically significant nonlinear trend exists, the interpretation must reflect this *even in the presence of a statistically significant linear trend*. In our example, the jurisdiction trend for teen births is nonlinear for the state and linear for the local jurisdiction. In such a circumstance, the reporter must summarize trends separately. Only when the best description for *both* trends are linear can rates of change be compared directly using statistical tests.

The local rate of live births per 1,000 females age 15-17 (Table 3) declined linearly at the statistically significant rate of -0.47 over the period. By contrast, the state rate was essentially flat through 2007 then declined at the statistically significant rate of -1.74 through end of period. The local rate was significantly below the state rate at period start and end.

On the other hand, state and local each had a statistically significant linear trend for increased births to API females age 40-44 (Table 4). The local trend of 0.83 was significantly different from the state trend of 0.48 per 1,000 population.

In this jurisdiction, young women age 15-17 were much less likely to have a baby than the state average. On the other hand, API females age 40-44 in this jurisdiction were more likely to have a baby than the state average.

Over the period, both state and local rates were well below the HP 2020 objective for births to females age 15-17 (36.2 per 1,000). Rate disparities plummeted for all race groups, and locally, disparities closed between Black and Hispanic, with too few White and API to report.

Readers with a non-statistical background will find it most helpful to focus on the last column of the trend results table. "Yes" means the trend is significant at $P = 0.05$. Those who want a statistical refresher might review the FHOP monograph, "Do We Have a Linear Trend?" [13].

APPENDIX A: OTHER STATISTICAL ISSUES

The process of creating DataBooks is macro driven using SAS. The process starts by classifying cases as to the presence or absence of a given indicator, then summarizing the indicator data and the appropriate denominator data to the geographic level of interest (state, county, super region (e.g., Bay Area) or sub-region (Berkeley, Long Beach, Pasadena, LA County Service Provider Areas). We calculate rates, feed numerators and denominators into JoinPoint, bring the results back into SAS, and output results directly into preformatted Excel template files.

We use JoinPoint to estimate linear trends for the jurisdiction and state and to test whether the resulting slope for each trend is significantly different from zero [14,15]. The Statistical Research and Applications Branch (SRAB) of the National Cancer Institute developed JoinPoint as one among a set of new statistical methods and associated software tools for the analysis and reporting of cancer statistics. This group of powerful shareware statistical packages is appropriate for the analysis of any population-based data [16]. In this set of software, JoinPoint was developed explicitly to estimate linear and curvilinear trends.

JoinPoint takes trend data and fits the simplest trend model that the data allow. The user supplies the minimum and maximum number of joinpoints. The program starts with the minimum number of joinpoints (e.g. 0 joinpoints, which is a straight line, or a standard trend test) and then tests whether more joinpoints are statistically significant and must be added to the model (up to that maximum number). This enables the user to test if an apparent change in trend from one period to another is statistically significant. The tests of significance use a Monte Carlo Permutation method.

Models may incorporate estimated variation for each point (e.g. when the responses are age adjusted rates) or use a Poisson model of variation. In addition, models may be linear on the log of the response (e.g. for calculating annual percentage rate change). The software allows viewing one graph for each joinpoint model, from the model with the minimum number of joinpoints to the model with maximum number of joinpoints.

Joinpoint uses a complex algorithm to decide whether to add a bend (“join point”) to a simple linear model. For each line segment, or for the whole time period, Joinpoint tests whether the slope is equal to zero (i.e. the line is flat). When calculating the standard error of the slope of a segment it ignores points at the bend, which reduces the effective sample size when calculating the standard errors of the slopes. Consequently, Joinpoint tests comparing the slopes to zero are quite conservative.

Joinpoint program options we used to calculate trends are: 1) input numerators and denominators, 2) test for bends at whole years, 3) use a minimum of two years between bends and between a bend and either end of the data, 4) test for a maximum of 2 bends, 5) fit a linear (not log-linear) model with uncorrelated errors.

We use the single line model unless one or more line segments have a slope significantly different from zero. If both the local and state data used a simple linear model, we test the equality of the two slopes by using the estimates and standard errors reported by Joinpoint. The standard error of the difference was calculated as the square root of the sum of the squared standard errors.

In calculating state and local three-year rates, we use the total of the numerators and average of the denominators over the 3 years. Then we divide the resulting rates and confidence limits by 3. In this calculation we use the same methodology as used to calculate 1-year rates and confidence intervals displayed on the rates table, namely the Wilson approximation method. The 95% confidence intervals convert into an estimated standard error by dividing the width of the confidence intervals in half and then dividing by 1.96. We test the equality of the two rates using the estimated rates and standard errors.

ENDNOTES

- 1 Minimum numbers are smaller than suggested in FHOP's "Small Numbers Guidelines". The focus here is longitudinal trends rather than one-year comparisons, and statistical tests use counts rather than rates.
- 2 McCandless R, Oliva G. Guidelines for Statistical Analysis of Public Health Data with Attention to Small Numbers. July 2003. Family Health Outcomes Project, University of California, San Francisco. Last access 26-Jun-2018 at <https://fhop.ucsf.edu/fhop-publications-data-analysis-methods-guidelines>
- 3 See: State of California Department of Finance at: <http://www.dof.ca.gov/Forecasting/Demographics/> Last accessed 26-Jun-2018.
- 4 National Vital Statistics System (NVSS), Instruction Manual Part 12: Computer Edits for Natality Data Effective 1993. Hyattsville MD, March 1995. Last accessed 26-Jun-2018 at: https://www.cdc.gov/nchs/nvss/instruction_manuals.htm
- 5 National Vital Statistics System (NVSS) Computer Edits for Natality Data (Revised States). September 23, 2008 (Updated 2/11/2011). Received by email from J. Martin to L. Remy. Available on request.
- 6 Remy LL, Oliva G, Clay T (2013). The impact of a birth clerk training program on California birth data quality 1998-2009. Family Health Outcomes Project, University of California, San Francisco. Available at: fhop.ucsf.edu/
- 7 Remy L, Clay T. (2016) Managing Longitudinal Research Studies: Crosswalking Hospital Identifiers. San Francisco, CA: University of California, San Francisco, Family Health Outcomes Project. Available <https://fhop.ucsf.edu/data-management-methods>
- 8 Ingram DD, Parker JD, Schenker N, Weed JA, Hamilton B, Arias E, Madans JH. United States Census 2000 population with bridged race categories. National Center for Health Statistics. Vital Health Stat 2(135). 2003. Last accessed 26-Jun-2018 at: <http://wonder.cdc.gov/wonder/help/populations/bridged-race/VitalHealthStatistics-Series2No135.pdf>
- 9 Sharygin E. California fertility: measurement and trends. Demographic Research Unit, California Department of Finance. June 2015. Last accessed 26-Jun-2018 at: <https://scag.ca.gov/calendar/Documents/demo26/Table2-EthanSharygin.pdf>
- 10 Sharygin E. Racial/ethnic self-identification: issues for demographic forecasting. Demographic Research Unit, California Department of Finance. June 2016. Last accessed 26-Jun-2018 at: <http://scag.ca.gov/calendar/Documents/demo27/pmTable03.pdf>
- 11 Newcombe RG. Two-sided confidence intervals for the single proportion: Comparison of seven methods. Statist. Med. 17, 857-872 (1998). Note that this is a different test than is recommended in FHOP's "Small Numbers Guidelines," which focuses on easy-to-calculate statistics.
- 12 CBInfo: California Birth Information System. Family Health Outcomes Project. Last accessed 26-Jun-2018 at: <https://fhop.ucsf.edu/software>.

-
- 13 Remy LL, Clay T, Oliva G. (2005) Do We Have a Linear Trend? A Beginner's Approach to Analysis of Trends in Community Health Indicators. San Francisco, CA: University of California, San Francisco, Family Health Outcomes Project. Last accessed 26-Jun-2018 at: <https://fhop.ucsf.edu/fhop-publications-data-analysis-methods-guidelines>
 - 14 The Joinpoint software program was obtained at: <http://surveillance.cancer.gov/joinpoint/>. Last accessed 26-Jun-2018.
 - 15 Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. *Stat Med* 2000;19:335-51 (correction: 2001;20:655).
 - 16 See Methods & Software for Population-Based Cancer Statistics: <http://surveillance.cancer.gov/software/>. Last accessed 26-Jun-2018.