

Reproductive and Birth Outcomes: Sex Ratio

Type of EPHT Indicator	Health Outcome
Measures	Sex Ratio
Derivation of measure	Sex ratio=total males/total females at birth among term singleton births only
Unit	Ratio
Geographic Scope	Iowa
Geographic Scale	County
Time Period	2000-
Time Scale	Year
Rationale	Population growth is, in part, related to the number of live male children (1). Numerous studies have reported changes in the ratio of males to females at birth; many of the studies have found a reduction in male relative to female births in different countries throughout the world (2-5). Although the mechanism that determines the sex of the infant is not completely understood, some (6-12), but not all (3-4), have suggested that environmental hazards can affect the number of males. Biological parent(s) and/or the fetus can come in contact with and become exposed to different hazards referred to as endocrine disruptors (7-8,10,12). Fewer males are conceived when exposure to endocrine disruptors results in a decrease in testosterone. Because states have accurate Vital Statistics (VS) records on the sex of live births, changes over time in the sex ratio of infants can be measured as the ratio of males to females. This ratio of total males/total females born in a pre-defined polygon (e.g., state, county, ZIP code, census tract, block group) at a certain time (one birth year or multiple years) is referred to as the Sex Ratio (SR).
Use of the Measure	The SR can be used to monitor the proportion of males to females in states, counties, or smaller-resolution polygons, when data are available and such analyses are justified. Baseline data can be used to determine if the proportion of males is changing over time. When the number of male births is the same as the number of female births, the SR is equal to 1.000. Many studies have observed baseline SR values that are usually higher than 1.000, and closer to 1.050(1,3,13). In 2002, the U.S. SR was 1.048(1). If the SR is decreasing over time, the implication is that fewer males than females are born for that period of time. If consistent decreases in the SR occur, this outcome could be used to determine if such changes are the result of environmental hazards that can disrupt the endocrine system or some other physiological system related directly or indirectly to the expression of the neonates' sex at birth.
Limitations of the Measure	Unfortunately, other factors besides endocrine disruptors can affect the expression of sex (6,13-15). Decreases in male births are inversely related to parental smoking, gestation length, parental age, and birth order. Reproductive practices and social morays regarding sex preferences—males over females, for example, can affect the observed SR (3-4,7). Case-control studies have to be carried out to determine if decreases in the SR over time are due to contact with and exposure to endocrine disruptors; but effect

	modifiers have to be controlled (8).
Data Sources	State's VS data, CDC Wonder, CDC VS data, and U.S. Census 2000 data in Summary File (SF) 1.
Limitations of Data Sources	There may be discrepancies between national and state data as noted in the templates for measures of prematurity and growth retardation above.
Related Indicators	Proportion or percent of males, defined as total males divided by total births.
Recommendations for Future Development of the Indicator and Measures	The SR can be used to determine when and where changes to baseline values for total males born relative to total female births have occurred. The SR indicator can be used to examine polygons that are smaller than states and counties. Geographic resolution should be selected based on how the SR indicator is used. This indicator can be used to conduct screening analyses in census tracts or block groups, provided that examined polygons include enough total births to produce stable SR values. The advantage of using SR as a screening indicator is that results could reveal the extent to which a hazard point source or exposure can lower male births relative to female births over time. The SR may be useful to screen special populations such as children with birth defects.