We are modeling female reproduction as a cycle of pregnancy, birth, pregnancy, birth, in a periodic fashion. This is based off of Keyfitz & Caswell.

Average length of the cycle is w = 1/p + s months, where p = probability of conception for a nonpregnant woman in any given month and s is the sterile period (270 days of preganancy plus postpartum sterility). Then length of the postpartumn anovulatory period depends on lactation and other factors and includes any time lost by spontaneous or voluntary abortion).

Knowing the length of the cycle of conception (w), or the interbirth interval, is equivalent to knowing the birth rate for the population. The average monthly birth rate is 1/w, and the annual birth rate is 12/w.

Assumption #1: contraception use does not affect s

Purpose of contraception is to reduce the probability of conceiving, which increases time between successive births.

The efficiency of contraception, e, is defined by the reduction in the probability of conceiving.

p\* = p(1-e)

Here, we model e by summing efficiency of various types of contraception.

cx is the frequency (proportion) of the population using a particular type of contraception, and ex is the efficiency of that particular type of contraception (the number out of every 100 women who experienced an unintended pregnancy within the first year of typical use of each contraceptive method)

Nation-level data on proportion of the population using each type of contraception was obtained from “Trends in Contraceptive Use Worldwide”, United Nations, 2015. Here we use data for the US.

Efficacy data was obtained from “CDC Effectiveness of Family Planning Methods, 2011.” Because this value is reported for the first year of typical use, we divided this by 12 to get an average number of women who experienced an unintended pregnancy per month during the first year of typical use.

Assumption #2: no one is using more than one type of contraception, and efficacy of contraception does not change after the first year of typical use.

The reduction in birth rate due to contraception use is calculated from the ratio of:

Our calculation of e can be adapted, so ex is the age-specific rate of contraception use. Sample data is available for the US through the CDC’s National Survey of Family Growth.