PFHS-380.665 FAMILY PLANNING POLICIES AND PROGRAMS

Contraceptive Technologies: Continuation and Failure Rates

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A.   Couple-Years of Protection (CYP)

1.   Definition: "A composite person-time measure of the total amount of protection conferred by all methods to all acceptors practicing for any length of time." (Wishik and Chen, 1973)

2.   Data sources and utility

3.   Strengths and weaknesses

B.   Contraceptive Continuation and Prevalence

1.   Relationship between fertility and contraceptive prevalence from population surveys

2.   Relationship of acceptance and continuation to prevalence

a.   Basic formula from epidemiology:

$$P = I \times D$$

where: P = prevalence
I = incidence /year
D = duration in years

b.   The contraceptive prevalence rate (C) is a function of:

incidence rate = acceptors /year (A)
        duration = average "life expectancy" of
                contraceptive use (D)

So: $C = A \times D$ (1)

3.   Average life of contraceptive use (D) is a function of the annual dropout rate (r). If there is a constant annual dropout rate, then the proportion (P) of acceptors still practicing at time (t) is:

a. $P_t = e^{-rt}$ (2)
 where e = base of the natural logarithm.

If there are some immediate dropouts, then:

$P_t = ae^{-rt}$ (3)

where: 1-a = proportion dropping out immediately, and

a = proportion remaining after immediate dropout.

Using calculus, the "life expectancy" (or average duration) of contraceptive use becomes:

$$D = \frac{1}{r} \text{(with no immediate dropouts)} \qquad (4)$$

$$D = \frac{a}{r} \text{(with 1 - a immediate dropouts)} \qquad (5)$$

4.   In a steady state situation contraceptive prevalence (C) can be related to acceptance (incidence) rate (A) and drop-out rate (r) as:

$$C = A\left(\frac{1}{r}\right) \quad (6)$$

$$or, with\ immediate\ dropout:$$

$$C = A\left(\frac{a}{r}\right) \quad (7)$$

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C. Contraceptive Failure

1. Definitions of contraceptive "efficacy"

   a. Effectiveness (e) = proportion (percent) reduction in the <u>monthly</u> probability of (live-birth) conception by contraception

   b. Failure rate (f) = proportion (percent) of contracepting women conceiving in a specified interval

   $$f = c (1-e) \qquad (8)$$

   where: f = monthly failure rate
   c = monthly probability of conception with unprotected intercourse (fecundability)
   e = effectiveness

   c. Annual failure rate (F) may be <u>approximated</u> as 12 x the monthly failure rate:

   $$F \sim 12f = 12c (1-e) \qquad (9)$$

   <u>Note</u>: F does <u>not</u> equal (1-e), that is, effectiveness (e) <u>does not</u> equal (1-F)

   <u>But</u>: if fecundability (c) = 0.0833 or 1/12,

   then F ~ 12f = 12 (1/12) (1-e) = (1-e).   (10)

   <u>Therefore</u>: Because fecundability is close to 1/12 in healthy women in the mid reproductive years, the <u>observed</u> <u>annual</u> <u>failure</u> <u>rate</u> is taken as a measure of effectiveness, e.g. if 5% of contracepting women conceive a live birth in 1 year (F=0.05), the contraceptive effectiveness (e) is estimated at 0.95 or 95% (e=0.95).

D. Covariates (determinants) of failure

      a.   age and marital status

      b.   education and cultural background

      c.   concomitant use of other methods

      d.   motivation to delay versus prevent

      e.   gravidity

      f.   previous failures

      g.   method

E. Significance of Contraceptive Failure for Program Strategy

1. Cumulative risk of failure by duration of use

2. Relative significance of contraceptive failure in high fertility (low contraception prevalence) versus low fertility (high prevalence) populations.

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