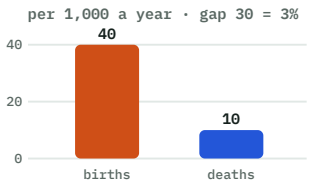
Why do poor families have many children, and then fewer?

How births and deaths set a population's growth and doubling time (rule of 70), the four stages of the demographic transition, why families choose fewer children when fewer die, how a trial with a control group measures an effect, and the real numbers for the world and Bangladesh.

1 Births – deaths

how fast it grows

- **Birth rate** / **death rate** = births / deaths for every **1,000 people** in a year
- `growth (% a year) = (births − deaths) ÷ 10` · 10 per 1,000 = 1%
- **Rule of 70** (Macro 10) · `years to double ≈ 70 ÷ growth in %`
- Palmera long ago · 40 − 40 → **0%** · medicine + clean water → deaths 10 → (40 − 10) ÷ 10 = **3%** → 70 ÷ 3 ≈ **23 years**
- Practice · Kofi's town 35 − 25 → **1%** → 70 years · clinic, deaths 15 → **2%** → **35 years** · deaths 10: births 20 → 1% → 70 years · births 10 = deaths → **0%**

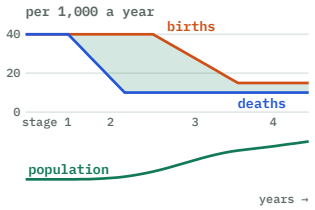


2 Four stages

the transition

- **Demographic transition** = from many births and many deaths → few of each · a **boom** in between

Stage	Births	Deaths	Growth	Doubles in
1 · both high	40	40	0%	never
2 · deaths fall first	**40**	**10**	**3%**	**≈ 23 yrs**
3 · births follow	25	10	1.5%	≈ 47 yrs
4 · both low	15	10	0.5%	≈ 140 yrs



- Read the stage · births ≈ 40, deaths low → **2** · births falling, still well above deaths → **3** · both low, close → **4** · fastest = biggest gap · practice: A 41 − 11 → **3%**

3 Why births fall

a choice, not a mystery

- **Child mortality** = share of children who die before age five
- Grandmother · **1 in 4** die → 8 births → 8 − 2 = **6** survive · Amara · **1 in 20** → 2 births → ≈ **2** · no births "just in case"
- Practice · Nia wants 3 grown children · 1 in 4 die → **4 births** · her daughter, 1 in 50 → **3 births** ⇒ **constraints, not character**
- ↑ births · many children die · children = only old-age support (no pension) · farm hands from young
- ↓ births · school fees + years of care · girls in school longer · savings account, pension

4 Chain + trial

cause → effect

- Medicine, clean water → fewer children die → parents **expect** them to survive → fewer births → more school per child · weights debated
- **Control group** = people in a trial who do **not** get the program, picked by lottery → what would have happened anyway
- Practice (toy) · girls' school fees paid in 20 of 40 villages · births per woman 4.0 → **2.5** (program) · 4.0 → **3.0** (control) · effect = 1.5 − 1.0 = **0.5** · not proof for other countries

5 Real numbers

and so what

- Children per woman · world ≈ **5** (1950) → ≈ **2.3** (2024) · Bangladesh ≈ **7** (1970) → ≈ **2** · sub-Saharan Africa (south of the Sahara) today ≈ **4** (UN)
- Child deaths before five · **93** per 1,000 (1990) → **37** (2024), ≈ 1 in 27 (UN child-mortality estimates) · world population **2.5** billion (1950) → **8** billion (Nov 2022)
- After the boom · a **bulge** of young workers → later **aging**: fewer workers per retiree (pensions: Finance 12) · gain with schools and jobs · strain without · **no verdict**

Watch out: growth = births **minus** deaths, then ÷ 10 (not births alone) · deaths fall **first**, births later → the boom · many births ≠ not planning: a plan for the odds · a fall in the program group ≠ the effect → subtract the **control** group's fall