SIR Model for English acquisition among immigrants:

**Parameters**

: Native population at time *t,* assumed to be 100% English-speaking.

: Immigrant population at time *t*.

: Total population at time *t*.

: English-speaking immigrant population at time *t*.

: Total Non-English-speaking population at time *t*.

: Total English-speaking population at time *t*.

: Number of arrived migrants at time *t,* assumed to be entirely non-English speaking.

: Annual birth rate

: Annual death rate

: Contact parameter between immigrant and native communities.

: Transmission rate of English between individuals in contact.

+: Weighted transmission rate under non-homogenous mixing.

: Discrete time evolution of *N.*



**Assumptions**

1. Immigrant’s children are not English speakers from birth but acquire it later.
2. Incoming immigrants do not speak English at all.
3. Identical birth and death rates between immigrant and native populations.
4. Non-homogenous mixing (different rates of contact between immigrants and natives).
5. Same rate of transmission between immigrant-immigrant pairs and native-immigrant pairs.
6. No ‘R’ group; that is, people who acquire English speak it for the rest of their lives, so there is no ‘removed’ or ‘recovered’ group.

**Data needed for calibration**

1. Native and immigration population counts in communities
   * Gunadi estimates
2. Proportion/counts of immigrants who speak English.
   * ACS and Census
3. Birth and death rates.
   * Nation averages
4. Annual migration flows.

**Possible expansions:**

* SEIR model; English incubation period for newly exposed persons.
* Different immigrant communities that contact each other at non-1 rates.
* Variable migration flow.
* Some migrants speak English.