NICHD R01 Project
"Global Age Patterns of Under-Five Mortality"

Project overview

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UN ESCWA
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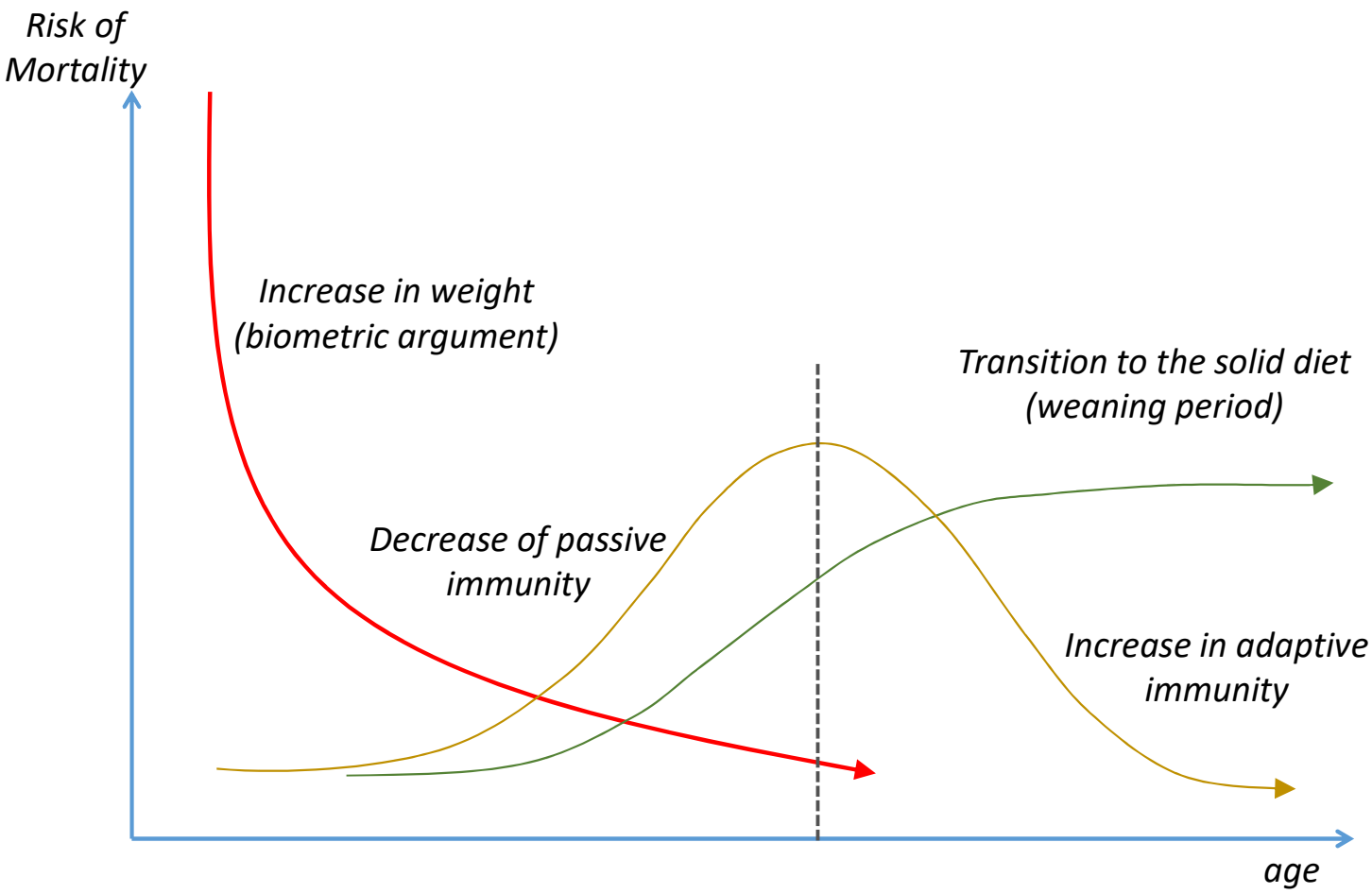
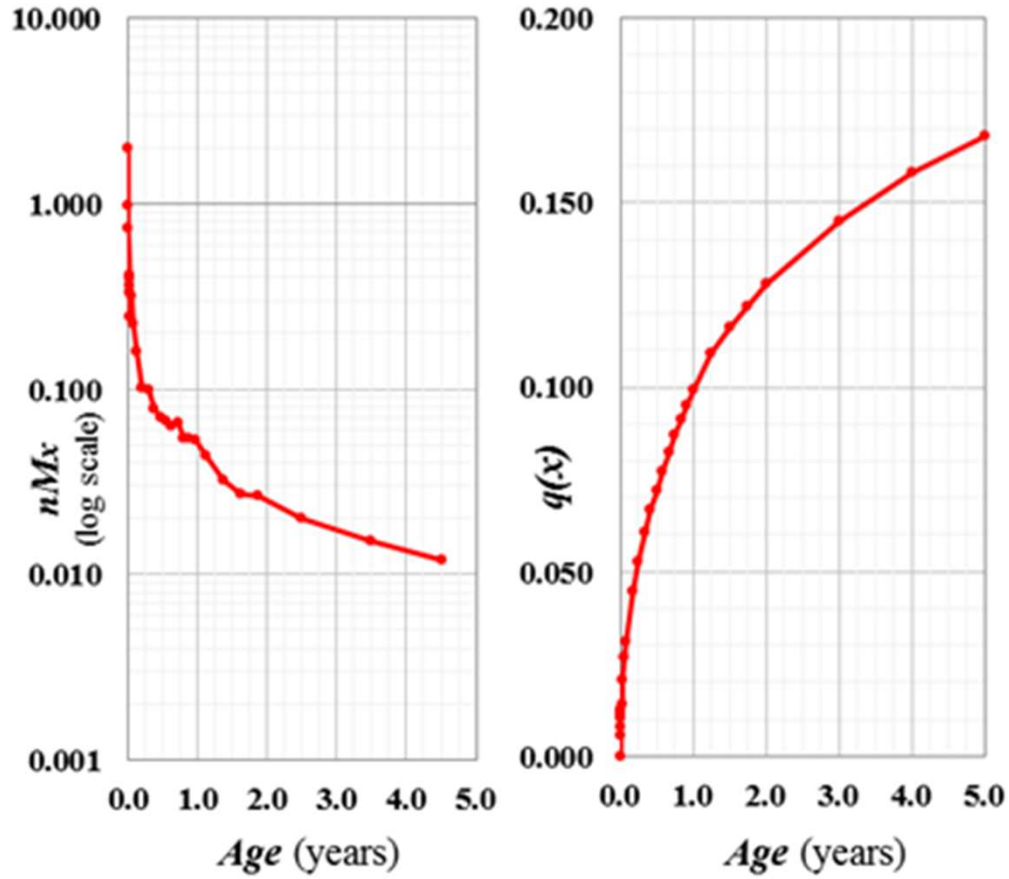
Significance

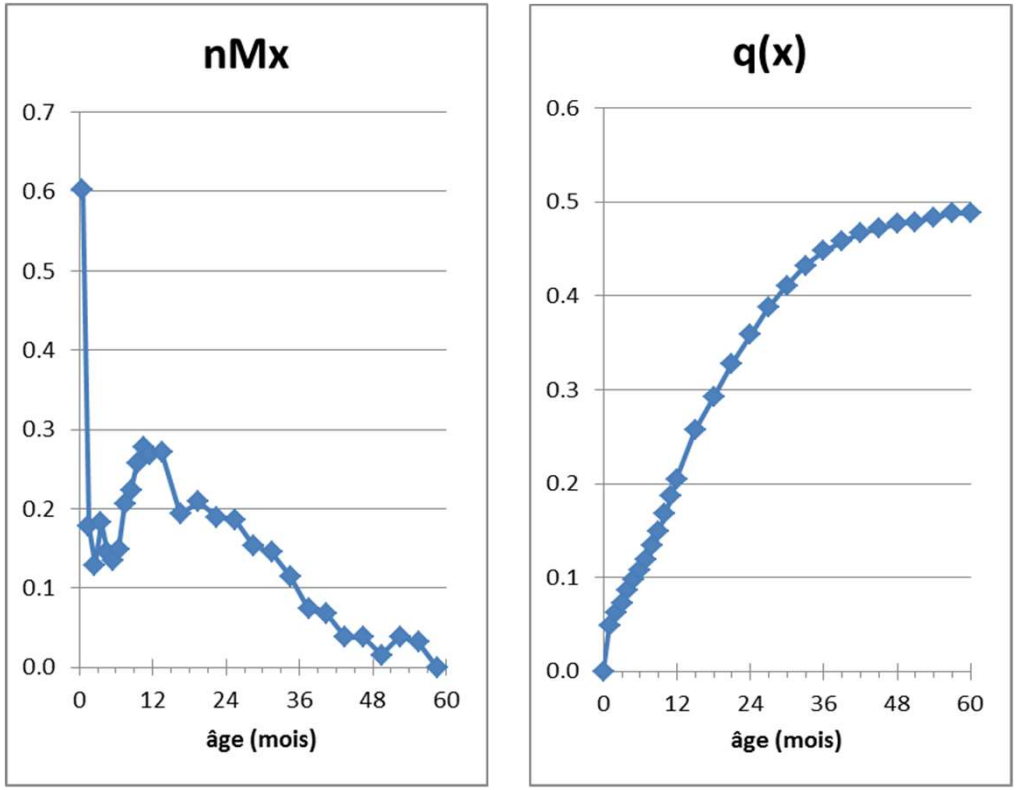
- Importance for health policy of examining how the risk of death varies within the 0-5 age range (by days, weeks, and months of age)
  - Provides useful information about a population's epidemiological context in the absence of causes of death
  - Useful for indirect estimation of under-five mortality
    - Knowledge about typical patterns can help detect errors and develop models for correction
    - Departure from typical patterns is indicative of errors
- To date, age patterns of under-five mortality have not been systematically examined.


Risk of Mortality
Increase in weight (biometric argument)
Transition to the solid diet (weaning period)
Decrease of passive immunity
Increase in adaptive immunity
age

Sweden, Females, 1891



Niakhar (Senegal), Both Sexes, 1962-68



Cantrelle & Léridon 1971

Specific aims

- Gather global database on high-quality mortality information by detailed age (days, weeks, months, trimesters and years) between 0 and 5 years.
  - Historical and contemporary periods
  - More- and less-developed contexts
- Develop models for indirect estimation of mortality by detailed age from 0 to 5 for evaluating and correcting data:
  - Incomplete VR data
  - DHS

Specific contributions

- New database, publicly available
- Modeling approach that takes all age groups at once into account
- New strategy for evaluating and correcting data in LMICs
  - Particularly useful for incomplete VR information in the context of global initiatives to strengthen CRVS in LMICs
- Improved mortality estimates
- New information for informing substantive questions

Baseline model (Model A) based on high-quality VR information from more-developed countries

- Database: similar geographic and temporal coverage as the Human Mortality Database, but with more age details between 0 and 5
- Two components:
  - UN database since 1970
  - Archival work for the pre-1970 period
- Deaths and population
- Typical cut-off points in raw death data (exact age):
  - 1d, 2d, 3d, 4d, 5d, 6d
  - 1w, 2w, 3w, 4w
  - 1m, 2m, 3m, 4m, 5m, 6m, 7m, 8m, 9m, 10m, 11m, 12m
  - 15m, 18m, 21m
  - 2y, 3y, 4y, 5y

UN database

- Focus on HMD countries, excluding small populations (Iceland, Luxembourg) and Former Soviet Republics
- 772 empirical life tables for 24 countries from 1970 to 2015
- Mostly European countries, as well as Australia, Canada, Chile, Japan, New Zealand and the US

Data collection in archives

Norway 1876

C. No. 1.

TABELLER

VEDKOMMENDE

Folkemængdens Bevægelse

I AARET 1876.

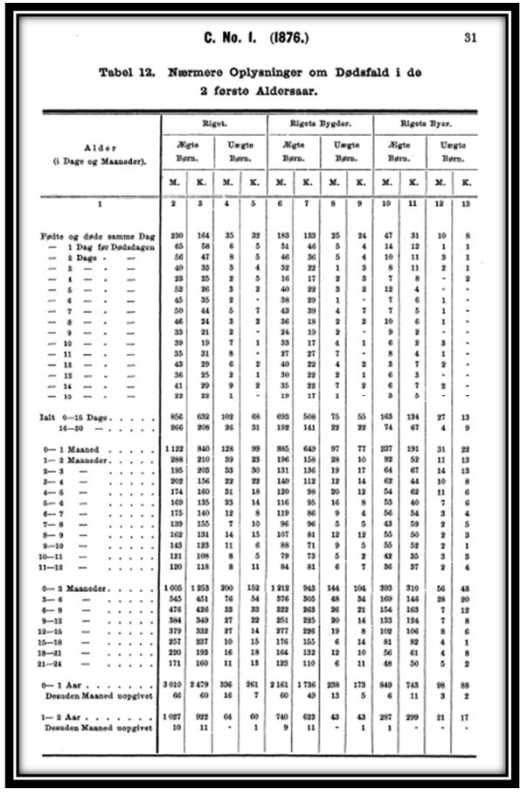
Udgivne af

Det statistiske Centralbureau.

KRISTIANIA.

TRYKT I RINGVOLDS BOGTRYKKERI.

1882.

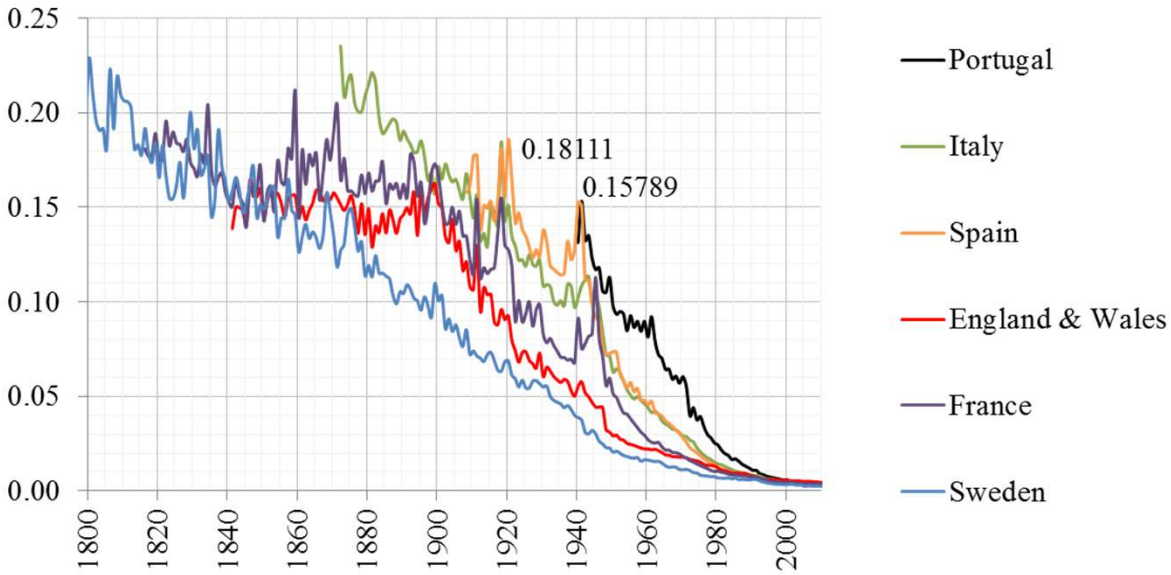


C. No. I. (1876.) 31

Tabel 12. Nærmere Oplysninger om Dødsfald i de 2 første Aldersaar.

Alder (i Dage og Maaneder).	Riget.				Rigets Bygder.				Rigets Byer.			
	Ægte Børn.		Uægte Børn.		Ægte Børn.		Uægte Børn.		Ægte Børn.		Uægte Børn.	
	M.	K.	M.	K.	M.	K.	M.	K.	M.	K.	M.	K.
1	2	3	4	5	6	7	8	9	10	11	12	13
Fødte og døde samme Dag	230	164	35	32	183	133	25	24	47	31	10	8
— 1 Dag før Dødsdagen	65	58	6	5	51	46	5	4	14	12	1	1
— 2 Dage - —	56	47	8	5	46	36	5	4	10	11	3	1
— 3 — - —	40	33	3	4	32	22	1	3	8	11	2	1
— 4 — - —	23	25	2	5	16	17	2	3	7	8	-	2
— 5 — - —	32	26	3	2	40	22	3	2	12	4	-	-
— 6 — - —	45	35	2	-	38	29	1	-	7	6	1	-
— 7 — - —	50	44	5	7	43	39	4	7	7	5	1	-
— 8 — - —	46	34	3	2	36	18	2	2	10	6	1	-
— 9 — - —	33	21	2	-	24	19	2	-	9	2	-	-
— 10 — - —	29	19	7	1	23	17	4	1	6	2	3	-
— 11 — - —	35	31	8	-	27	27	7	-	8	4	1	-
— 12 — - —	43	29	6	2	40	22	4	2	3	7	2	-
— 13 — - —	36	25	3	1	30	22	3	1	6	3	-	-
— 14 — - —	41	29	9	2	35	22	7	2	6	7	2	-
— 15 — - —	22	22	1	-	19	17	1	-	3	5	-	-
Ialt 0—15 Dage.	856	632	102	68	695	508	75	55	163	124	27	13
16—30 —	266	208	26	31	192	141	22	22	74	67	4	9
0— 1 Maaned	1 122	840	128	99	885	649	97	77	237	191	31	22
1— 2 Maaneder.	288	210	39	23	196	158	28	10	92	52	11	13
2— 3 —	195	203	33	30	131	136	19	17	64	67	14	13
3— 4 —	202	156	22	22	140	112	12	14	62	44	10	8
4— 5 —	174	160	21	18	120	98	20	12	54	62	1	6
5— 6 —	149	135	23	14	116	95	16	8	33	40	7	6
6— 7 —	175	140	12	8	119	86	9	4	56	54	3	4
7— 8 —	139	155	7	10	96	96	5	5	43	59	2	5
8— 9 —	162	131	14	15	107	81	12	12	55	50	2	3
9—10 —	143	123	11	6	88	71	9	5	55	52	2	1
10—11 —	121	108	8	5	79	73	5	2	42	35	3	3
11—12 —	120	113	8	11	84	81	6	7	36	32	2	4
0— 3 Maaneder.	1 005	1 253	200	152	1 212	943	144	104	393	310	56	48
3— 6 —	545	451	76	54	376	305	48	34	169	146	28	20
6— 9 —	476	426	33	33	322	263	26	21	154	163	7	12
9—12 —	384	349	27	22	251	225	20	14	133	124	7	8
12—15 —	379	332	27	14	277	226	19	8	102	106	8	6
15—18 —	257	227	10	15	176	155	6	14	81	72	4	1
18—21 —	220	193	16	18	164	132	12	10	56	61	4	8
21—24 —	171	169	11	13	125	110	6	11	46	59	5	2
0— 1 Aar	3 010	2 479	336	261	2 161	1 736	238	173	849	743	98	88
Dessuden Maaned uopgivet	66	60	16	7	60	49	13	5	6	11	3	2
1— 2 Aar	1 027	922	64	60	740	623	43	43	287	299	21	17
Dessuden Maaned uopgivet	10	11	-	1	9	11	-	1	1	-	-	-

Significance of the period of analysis



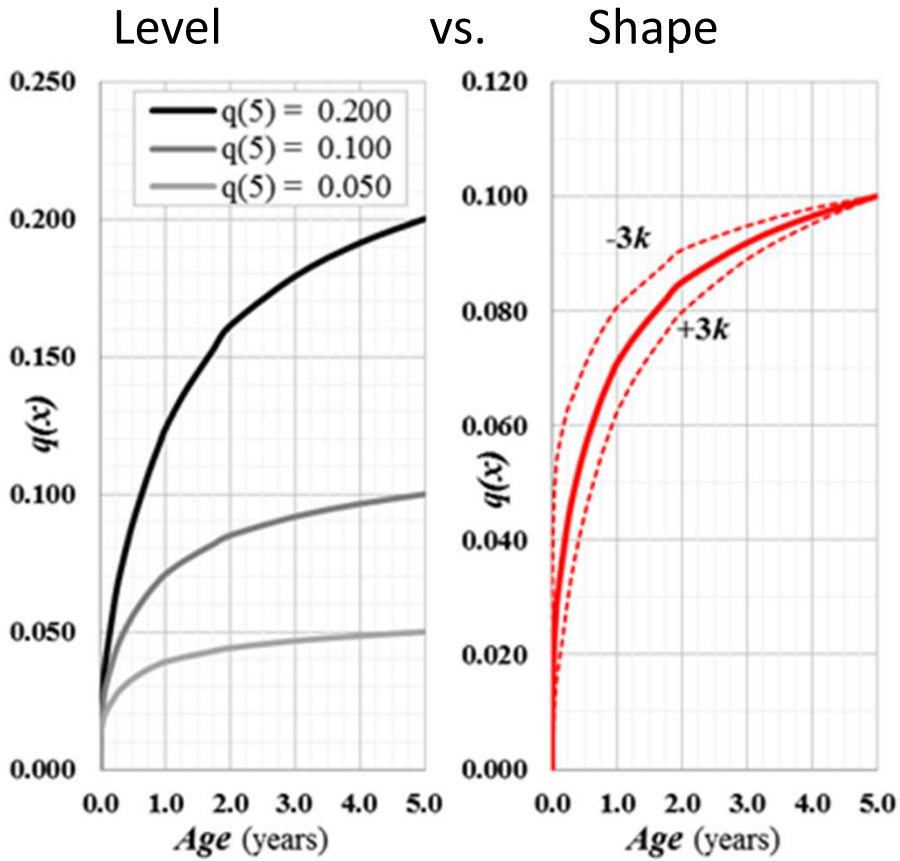
U5MR

Preliminary modeling approach

$\ln[q(x)] =$

$a_x + b_x \cdot \ln(q(5y)) + c_x \cdot \ln(q(5y))^2 + v_x \cdot k$

- Adapted from Wilmoth et al. (2012)
- Preliminary results based on: Belgium 1841-, Denmark 1890-, England & Wales 1908-, Finland 1881-, France 1899-, Germany 1950-, Japan 1950-, Netherlands 1848-, Norway 1875-, Portugal 1929-, Sweden 1891-, and US 1933-
- Other modelling approaches will be explored over the course of the project



Update Model A with validated prospective data sources from less-developed countries

- Second database
- Four types of sources:
  1. Sample Registration Systems (SRS)
  2. Health and Demographic Surveillance Systems (HDSS)
  3. Cohort Studies (CS)
  4. Urban Vital Registrations (UVR) systems
- All prospective sources
- Data quality assessment prior to inclusion in database
  - Internal consistency checks (age heaping, suspicious age progression during first few weeks, etc.)

Update Model A with validated prospective data sources from less-developed countries

- Use second database to update Model A → Model A'
- Model B for populations with pattern distinct from Model A (e.g., populations with age reversals in the force of mortality)
- Set of models covering the range of age-specific variation in mortality by detailed age given a certain level of U5MR

Using model age patterns for the indirect estimation of mortality by detailed age

- Data sources to be evaluated:
  - Demographic and Health Surveys (DHS)
  - Incomplete Vital Registration (IVR) systems
- Possible data errors in these sources requiring adjustments:
  - Misclassification of live births vs. still births
  - Underreporting of deaths, particularly at neonatal ages
  - Age heaping

Using model age patterns for the indirect estimation of mortality by detailed age

- Demographic and Health Surveys (DHS)
  - Full birth histories
  - ~230 surveys covering 78 LMICs throughout the world
- Incomplete Vital Registration (IVR) systems, from UN database (Site PI: Patrick Gerland)
  - Countries with a medium Vital Statistics Performance Index (VSPI)
  - Primarily located in Eastern Europe, Central Asia, Western Asia, South-East Asia, South-East Asia and Latin America
  - More intensive inquiries with VR data from Russia, Turkey, Iran via local collaborations

Using model age patterns for the indirect estimation of mortality by detailed age

- Approach based on Models A’ and B
- Use robust age ranges as entry points in model and use model parameters to produce adjusted mortality estimates
- Generate uncertainty bounds for adjusted mortality estimates
- Prior experience with Kyrgyzstan produced promising results

Implications for the ESCWA region

- Proposed approach would be particularly useful for estimating coverage of under-five deaths in countries of the ESCWA region
- VR coverage in the region is not complete but high enough to provide robust anchors for applying the model and generating adjusted under-five mortality estimates
- Data requirements
  - Microdata on under-five deaths with exact dates of birth and death

  or
  - Aggregate tabulations of deaths: distributions of deaths by detailed age (days, weeks, months, years) from 0 to 5.