Workshop on "Sex-disaggregated data for the SDG indicators in Asia and the Pacific: What and how?"

Bangkok, Thailand
25-27 May 2016

Small Area Estimation and its application for producing disaggregated statistics in Nepal".

Content

Introduction
Methodology
Data Sources
Implementation
Results for Food Poverty and Low Kilocalorie Intake
Results for Child Undernutrition and Diahorea
Conclusions and Discussion

Introduction

- Small area estimation is a mathematical and statistical method that models data collected from one or more data sources, to produce estimates. It is a technique present data at disaggregate level.
- The additional accuracy is achieved in many such models by "borrowing strength" for the estimate for a particular small area by using information from areas to which it is similar. Some small area estimation techniques combine data from different sources.

Introduction

- In 2006, the Central Bureau of Statistics (CBS), World Food Programme (WFP) and the World Bank jointly produced a publication "Small area estimation of poverty, caloric intake and undernutrition in Nepal"
- Combining data from Nepal Living Standard Survey II (NLSS-II) 2003/04; Nepal Demographic and Health Survey (NDHS) 2001; Population Census 2001

Introduction

- The World Bank and CBS have updated the small area estimations for poverty in July 2013.
- The current small area estimation work (Dec. 2014) is based on statistical models for low kilocalorie intake and undernutrition using ward-level or VDC -level means from the 2011 National Population and Housing Census (NPHC 2011), plus the 2011 Nepal Demographic and Health Survey (NDHS 2011) and the 2010/11 Nepal Living Standards Survey (NLSS-III).

Methodology

$$Y = X\beta + u$$

$$Y_{ij} = X_{ij}\beta + c_i + e_{ij}$$

Here β represents the estimated regression coefficients giving the effect of the *X variables on Y*

Elbers Lanjouw and Lanjouw (ELL) method "poverty mapping".

Bootstrapping is a set of statistical procedures that use computer-generated random numbers to simulate the distribution of an estimator (Efron and Tibshirani, 1993).

$$\hat{Y}_{ij} = X_{ij}\hat{\beta}$$

	Region	District	Ilaka	VDC/Mun	Ward
Nepal	5	75	976	3973	36041
Mean no. households	1085460	83497	6358	1600	174

Key: VDC= Village Development Committee, Mun=Municipality

Methodology

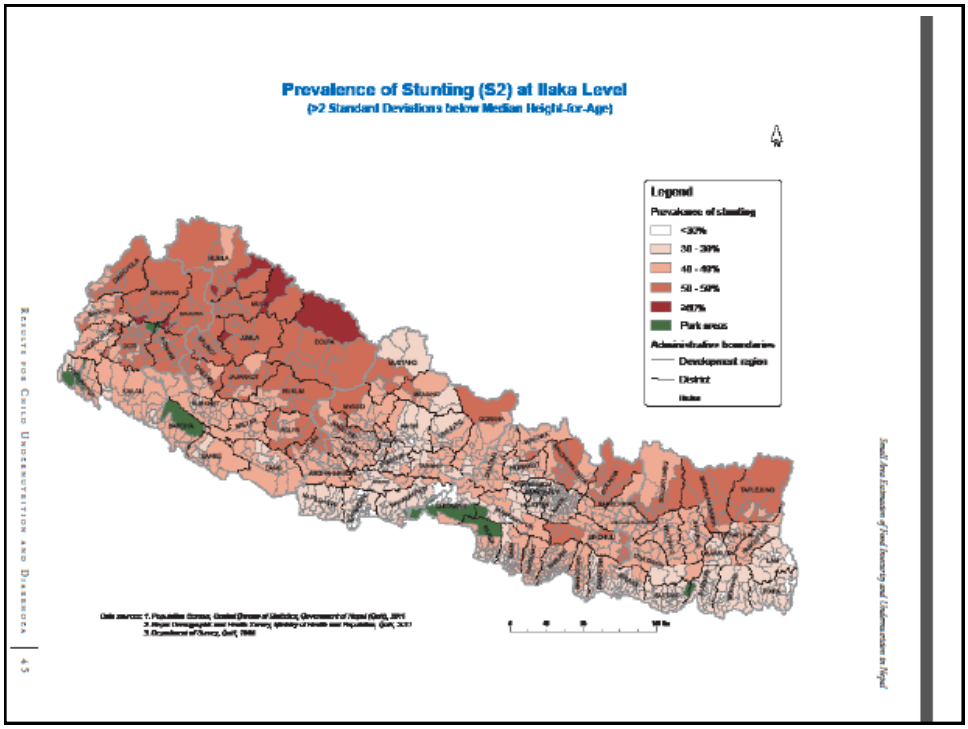
- A target variable, denoted Y, for which require estimates over a range of small subpopulations, usually corresponding to small geographical areas.
- Y is log-transformed per capita expenditure for food poverty measures, and standardized height-for-age or weight-for-age for the under nutrition indicators, stunting and underweight.
- The sample sizes within the subpopulations typically will be very small, these direct estimates will have large standard errors and hence not be reliable.
- Auxiliary information, denoted X, can be used under some circumstances to improve the estimates, giving errors.

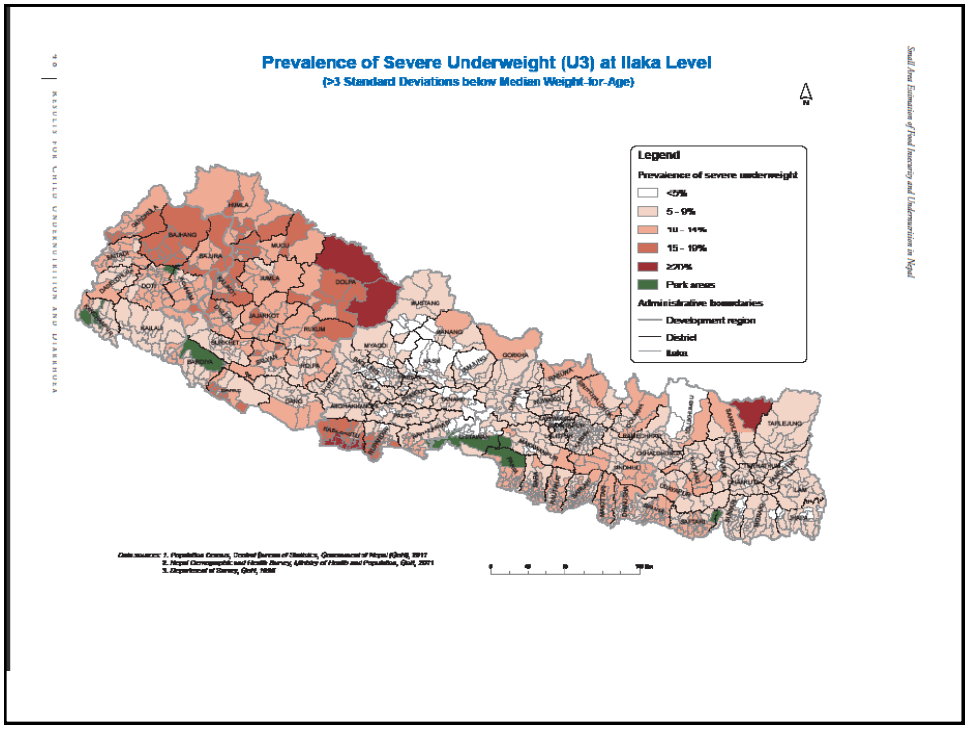
Implementation

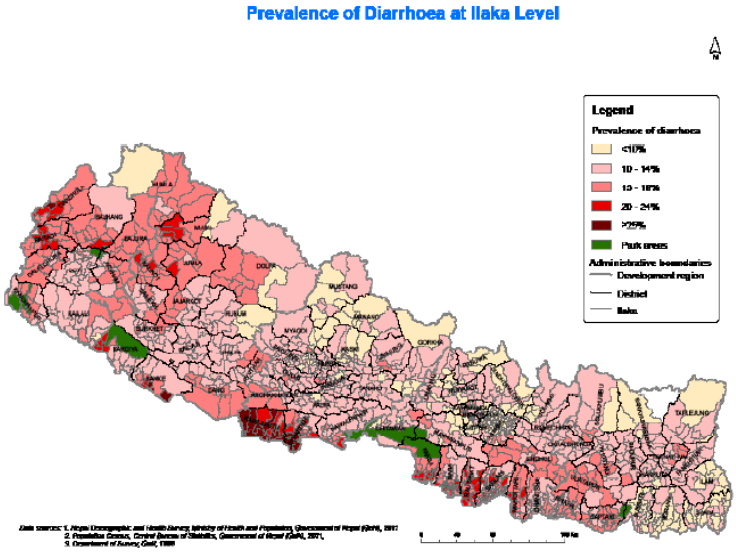
- Selection of auxiliary data
- First stage regressions
- Variance modelling
- Simulation of predicted values
- Production of final estimates

Geographic/administrative information				Measures of food insecurity								
				Food poverty prevalence		Food poverty gap		Food poverty severity		Low kilocalorie intake prevalence		Low kiloca g
Region	dcode	District name	Total population	P0	seP0	P1	seP1	P2	seP2	K0	seK0	K1
1	1	Taplejung	126448	0.42304	0.03742	0.10050	0.01220	0.03466	0.00503	0.35499	0.02007	0.07356
1	2	Panchthar	190491	0.23975	0.01891	0.04765	0.00500	0.01466	0.00189	0.23643	0.01989	0.06410
1	3	Ilam	287932	0.14693	0.01374	0.02683	0.00324	0.00783	0.00115	0.31983	0.01745	0.05976
1	4	Jhapa	807934	0.07141	0.00672	0.01219	0.00148	0.00343	0.00051	0.18187	0.01247	0.02759
1	5	Morang	959568	0.10617	0.00827	0.01916	0.00196	0.00558	0.00069	0.19435	0.01283	0.02966
1	6	Sunsari	753244	0.10827	0.00930	0.01935	0.00225	0.00559	0.00082	0.22363	0.01439	0.03509
1	7	Dhankuta	161398	0.20883	0.01774	0.04122	0.00451	0.01264	0.00167	0.34742	0.02127	0.06670
1	8	Terhathum	100833	0.20610	0.01770	0.03954	0.00450	0.01188	0.00169	0.33559	0.01965	0.06349
1	9	Sankhuwasabha	158222	0.38895	0.03271	0.09111	0.01092	0.03114	0.00460	0.36683	0.02004	0.07627
1	10	Bhojpur	181225	0.25687	0.02221	0.05220	0.00567	0.01625	0.00208	0.28758	0.02652	0.05308
1	11	Solukhumbu	105119	0.41714	0.03926	0.09866	0.01295	0.03398	0.00539	0.38520	0.01930	0.08099
1	12	Okhaldhunga	146824	0.29107	0.01968	0.06101	0.00575	0.01938	0.00230	0.33851	0.01998	0.06483
1	13	Khotang	205225	0.29155	0.02016	0.06079	0.00555	0.01926	0.00212	0.35073	0.02339	0.06764
1	14	Udayapur	315429	0.21657	0.01940	0.04407	0.00482	0.01380	0.00179	0.34460	0.01970	0.06617
1	15	Saptari	637844	0.17938	0.01436	0.03341	0.00361	0.00984	0.00130	0.18452	0.01664	0.02806
1	16	Siraha	635627	0.17058	0.01452	0.03154	0.00354	0.00927	0.00126	0.18465	0.01501	0.02806
2	17	Dhanusha	753682	0.18218	0.01170	0.03795	0.00324	0.01242	0.00131	0.21397	0.01459	0.03693
2	18	Mahottari	625207	0.20320	0.01462	0.04306	0.00435	0.01425	0.00180	0.21815	0.01482	0.03756
2	19	Sarlahi	769330	0.21069	0.01408	0.04459	0.00411	0.01468	0.00170	0.23955	0.01482	0.04150
2	20	Sindhuli	293173	0.29439	0.02050	0.06959	0.00665	0.02458	0.00285	0.36684	0.01878	0.07847
2	21	Ramechhap	201423	0.28583	0.01862	0.06574	0.00595	0.02283	0.00257	0.31712	0.01721	0.06571
2	22	Dolakha	185099	0.34929	0.02961	0.08773	0.01042	0.03226	0.00463	0.34099	0.01747	0.07679
2	23	Sindhupalchok	285770	0.36941	0.03466	0.09297	0.01212	0.03421	0.00536	0.35366	0.01681	0.08010
2	24	Kabhre	375221	0.21654	0.01289	0.04912	0.00416	0.01701	0.00184	0.34684	0.01703	0.07344
2	25	Lalitpur	457606	0.14495	0.01097	0.03039	0.00296	0.01006	0.00117	0.39116	0.01606	0.08523
2	26	Bhaktapur	298704	0.12269	0.01283	0.02479	0.00303	0.00804	0.00114	0.35102	0.01538	0.07379
2	27	Kathmandu	1699289	0.20014	0.01565	0.04445	0.00454	0.01521	0.00183	0.40138	0.01576	0.08810
2	28	Nuwakot	275775	0.25324	0.01562	0.05700	0.00488	0.01956	0.00206	0.36716	0.01813	0.07810
2	29	Rasuwa	42133	0.40823	0.03481	0.10731	0.01256	0.04065	0.00572	0.36110	0.02055	0.08200
2	30	Dhading	334292	0.26459	0.01656	0.06077	0.00528	0.02114	0.00230	0.35248	0.01583	0.07539
2	31	Makawanpur	415601	0.25610	0.01758	0.06044	0.00561	0.02140	0.00239	0.41408	0.01589	0.09151
2	32	Rautahat	686059	0.24024	0.01627	0.05185	0.00479	0.01725	0.00195	0.23634	0.01567	0.04090
2	33	Bara	685831	0.21053	0.01312	0.04470	0.00385	0.01473	0.00160	0.25496	0.01537	0.04455
2	34	Parsa	597769	0.22239	0.01395	0.04805	0.00411	0.01605	0.00171	0.26987	0.01542	0.04751
2	35	Chitawan	569732	0.10628	0.00796	0.02199	0.00228	0.00725	0.00093	0.28056	0.01757	0.05075
3	36	Gorkha	268942	0.21629	0.01452	0.04554	0.00435	0.01479	0.00181	0.30882	0.01599	0.06188
3	37	Lamjung	166150	0.19244	0.01380	0.03960	0.00382	0.01272	0.00153	0.31080	0.01596	0.06284
3	38	Tanahu	320547	0.17702	0.01350	0.03648	0.00388	0.01172	0.00161	0.33230	0.01535	0.06831

Geographic/administrative information					Stunting		Severe stunting	
Region	dcode	Ilaka	ilakaid	Number of children under five	S2	seS2	S3	seS3
5	72	4	7204	3400	0.40391	0.02490	0.15578	0.01582
5	72	5	7205	2352	0.42544	0.03814	0.17095	0.02519
5	72	6	7206	4485	0.39846	0.02494	0.15444	0.01585
5	72	7	7207	4357	0.37434	0.02952	0.13870	0.01780
5	72	8	7208	8839	0.32170	0.02358	0.11070	0.01310
5	72	10	7210	2015	0.34455	0.03430	0.12306	0.01993
5	72	11	7211	5434	0.41783	0.02613	0.16564	0.01744
5	73	1	7301	2177	0.38207	0.02373	0.14837	0.01677
5	73	2	7302	1146	0.49718	0.03483	0.22001	0.02595
5	73	3	7303	1885	0.50200	0.03903	0.22357	0.03006
5	73	4	7304	1432	0.48194	0.03362	0.20981	0.02628
5	73	5	7305	649	0.43710	0.04021	0.17898	0.02809
5	73	6	7306	6413	0.44451	0.02656	0.18313	0.01871
5	73	7	7307	1662	0.46457	0.02806	0.19584	0.02063
5	73	8	7308	936	0.47706	0.03720	0.20460	0.02842
5	73	9	7309	866	0.43234	0.03234	0.17594	0.02362
5	74	1	7401	1788	0.45797	0.02904	0.19001	0.02092
5	74	2	7402	2286	0.44697	0.02800	0.18633	0.02097
5	74	3	7403	2031	0.44251	0.02887	0.18048	0.02045
5	74	4	7404	2358	0.50056	0.02904	0.22157	0.02364
5	74	5	7405	2428	0.47364	0.02745	0.20369	0.02156
5	74	6	7406	1667	0.35000	0.02899	0.12509	0.01649
5	74	7	7407	2027	0.45590	0.02688	0.19191	0.01985
5	74	8	7408	2360	0.48709	0.02914	0.21111	0.02300
5	74	9	7409	3453	0.49848	0.02729	0.21900	0.02311
5	74	10	7410	2143	0.45781	0.02909	0.19313	0.02105
5	74	11	7411	3414	0.45285	0.02536	0.18720	0.01834
5	74	12	7412	2519	0.47942	0.02673	0.20602	0.02044
5	74	13	7413	3504	0.49059	0.02926	0.21350	0.02252
5	75	1	7501	851	0.49929	0.03024	0.21982	0.02122
5	75	2	7502	1327	0.48824	0.03173	0.21340	0.02410
5	75	3	7503	1644	0.42360	0.03878	0.17159	0.02445


Prevalence of Stunting (S2) at Ilaka Level
(>2 Standard Deviations below Median Height-for-Age)
Legend
Prevalence of stunting
<30%
30 - 39%
40 - 49%
50 - 59%
≥60%
Park areas
Administrative boundaries
Development region
District
Ilaka
Results for Child Undernutrition and Diarrhoea
45
Small Area Estimation of Food Insecurity and Undernutrition in Nepal


Prevalence of Severe Underweight (U3) at Ilaka Level
(>3 Standard Deviations below Median Weight-for-Age)
Legend
Prevalence of severe underweight
<5%
5 - 9%
10 - 14%
15 - 19%
≥20%
Park areas
Administrative boundaries
Development region
District
Ilaka
46 | Results for Child Undernutrition and Diarrhoea
Small Area Estimation of Food Insecurity and Undernutrition in Nepal



Conclusion

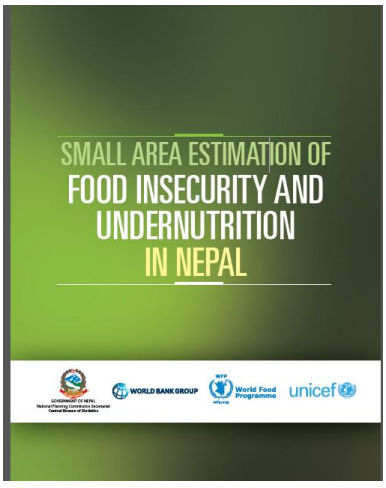
Small area models are not perfect, and standard errors derived from them depend on the model being at least approximately correct, or at least correct enough to make sound predictions.

Despite these caveats, from a practical point of view the Nepal small area food security, undernutrition and health estimates presented are at a much finer geographical level than is possible using survey data alone, and consequently should be of considerable benefit when a mechanism for allocation of development assistance is required.

Conclusion contd …

- Small area estimation is a technique that works best in aggregate - not every small area estimate can be expected to give precise information.

Further readings



www.cbs.gov.np


Thank You