Dr. Sainan Zhang, Technical Specialist

Population and Development Branch
Technical Division, UNFPA
Dr Mathias Kuepie, Technical Specialist, GRID3 project, UNFPA-DRC

Better data for more effective policy and programmes: Small-area estimation of family planning indicators in Nepal

Challenges of Data Disaggregation

All data sources (administrative records, CRVS, census, surveys, etc.) provide possibilities for data disaggregation but also have limitations (completeness, periodicity, access, sampling, etc.)

Family Planning Indicators

Contraceptive dynamics are usually presented using three basic indicators:

Contraceptive prevalence rate (CPR)

Modern contraceptive prevalence rate (CPRm)

Unmet need for family planning rate (UNR)

Proportion of demand for contraception satisfied (PDS)

Proportion of demand for modern contraception satisfied (PDSm)

Family Planning Indicators

CPR is the percentage of women who are currently using, or whose sexual partner is currently using, at least one method of contraception, regardless of the method used

CPRm is the contraceptive prevalence rate due to modern methods

Unmet need is defined as the percentage of women of reproductive age, either married or in union, who want to stop or delay childbearing but are not using any method of contraception.

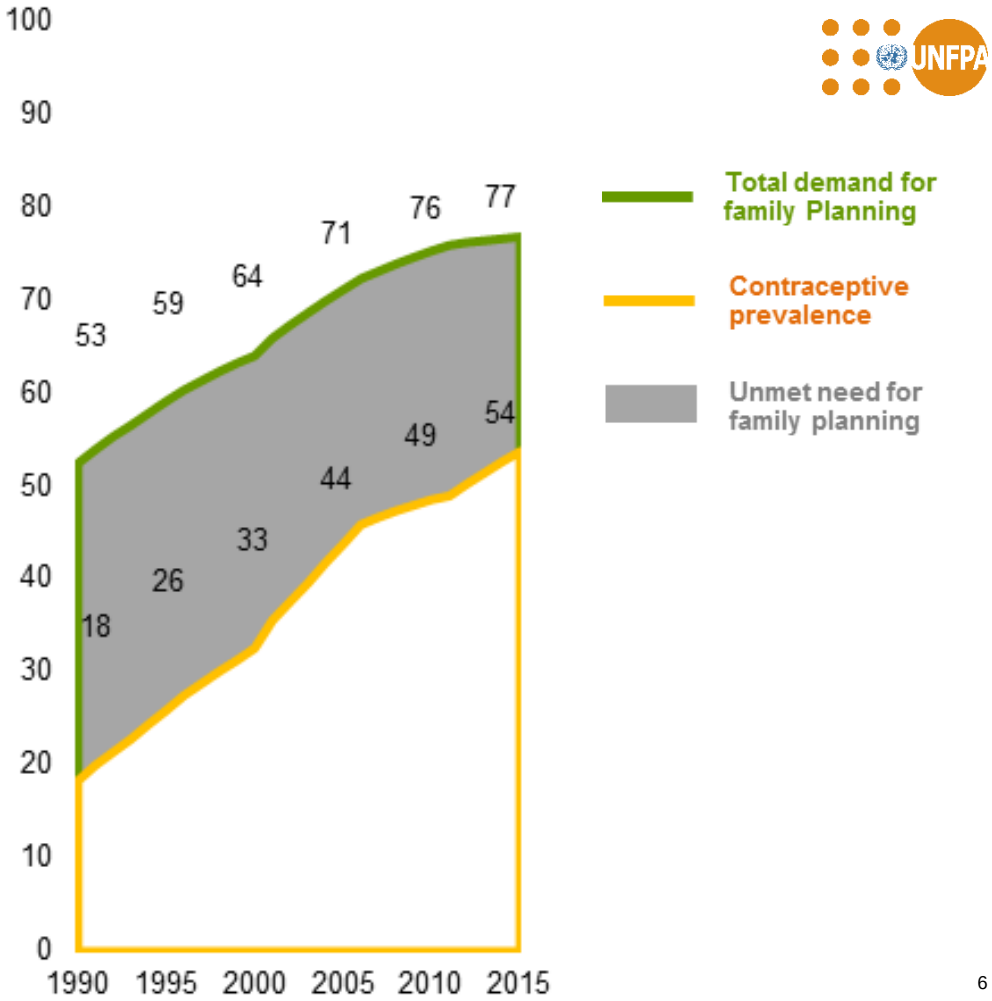
Family Planning Indicators

$$PDSm = \frac{CPRm}{CPR + Unmet\ need} X100$$

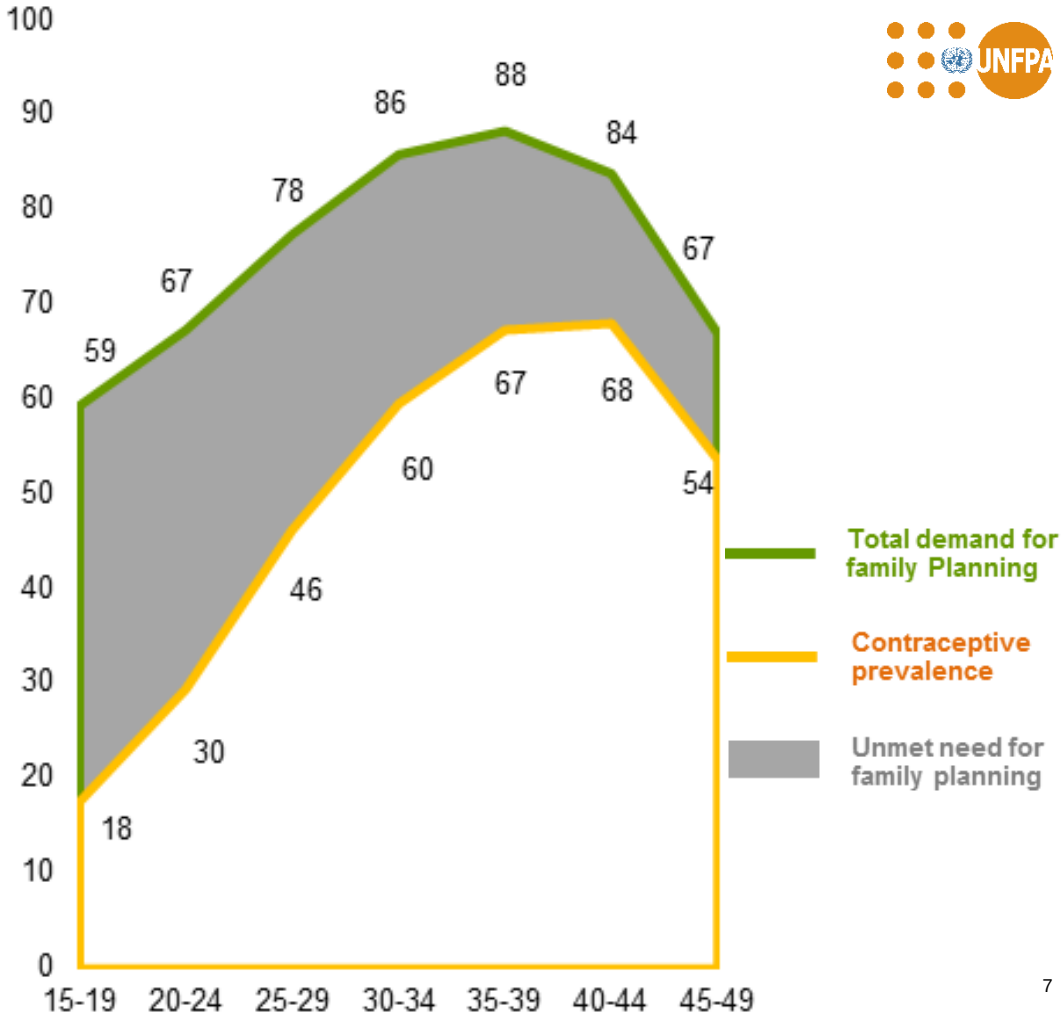
SDG Indicator 3.7.1: Percentage of women of reproductive age (15-49 Years) who have their need for family planning satisfied with modern methods

Nepal

Contraceptive dynamics in Nepal, 1990-2015

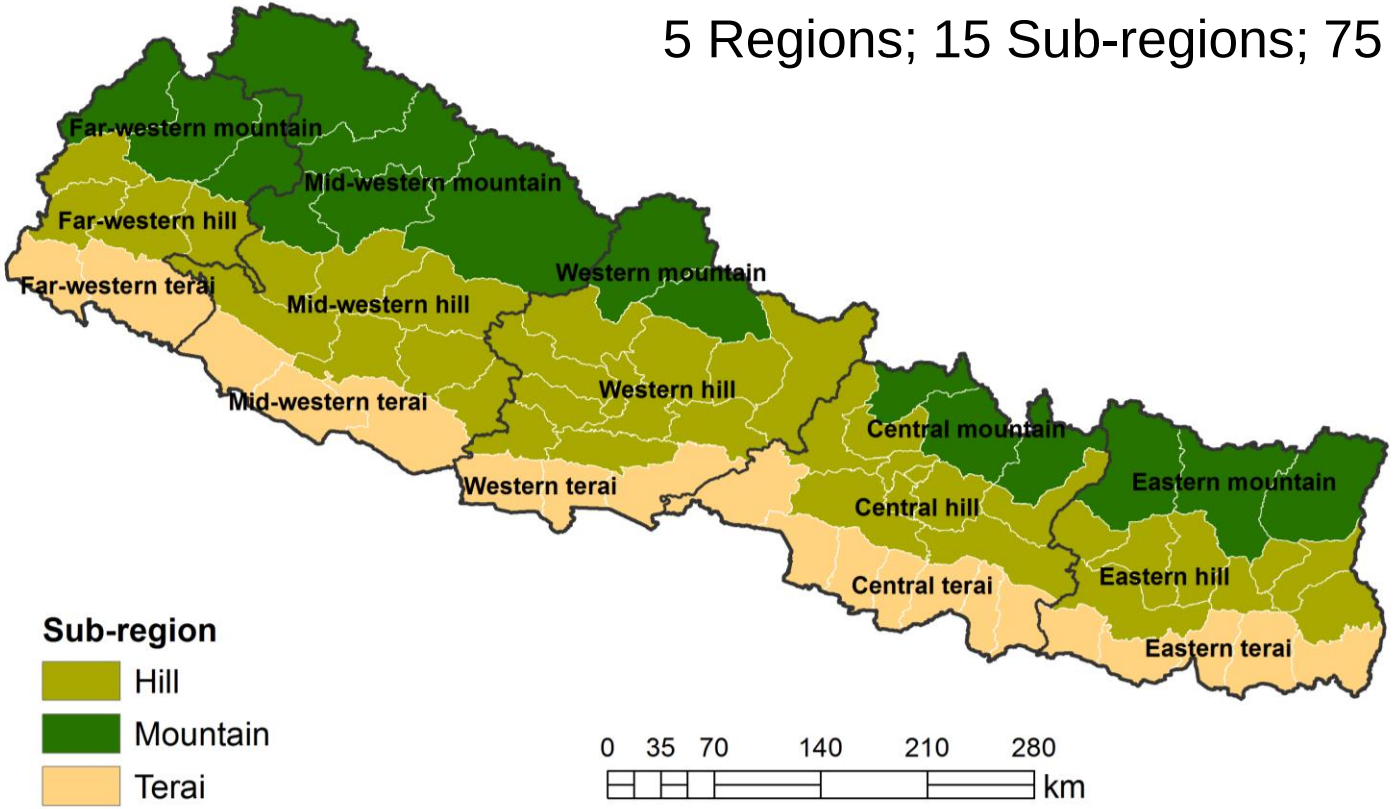


Contraceptive dynamics by Age 2011 NDHS



Nepal

5 Regions; 15 Sub-regions; 75 Districts

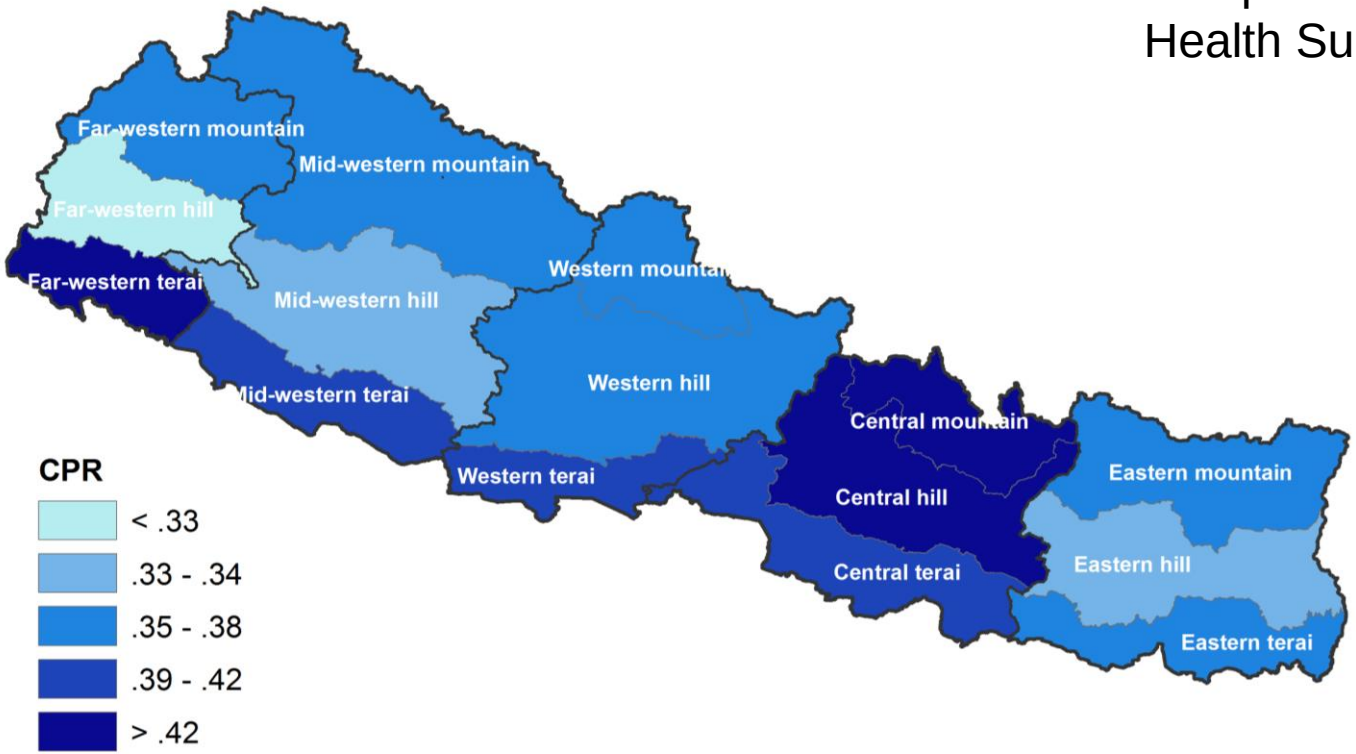


Data Disaggregation by Sub-region

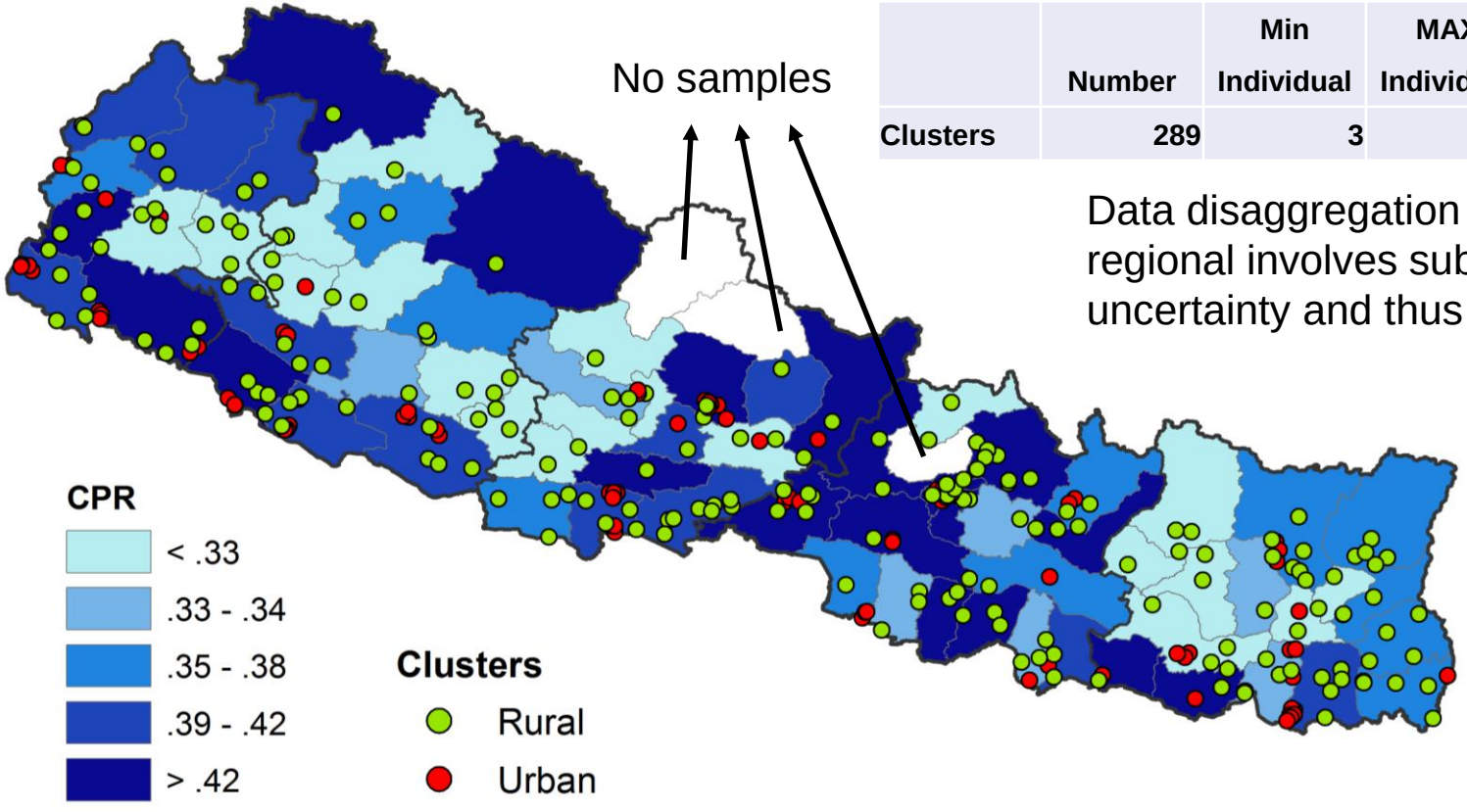
2011 NDHS	CPR	UNR	PDS
Total	**49.7**	**27.5**	**64.4**
Western Hill	42.9	36.1	54.3
Mid-Western Hill	41.6	32.0	56.5
Far-Western Hill	41.2	31.6	56.6
Eastern Hill	42.8	31.6	57.5
Eastern Mountain	44.4	28.3	61.1
Western Terai	50.3	31.2	61.7
Eastern Terai	48.4	29.4	62.2
Western Mountain	43.1	24.9	63.4
Central Terai	50.0	22.6	68.9
Mid-Western Terai	54.2	21.0	72.1
Central Mountain	59.4	20.0	74.8
Central Hill	62.2	20.2	75.5
Far-Western Terai	60.1	18.5	76.5

Geographic disaggregation

2011 Nepal Demographic and Health Survey



Geographic disaggregation problems



	Number	Min Individual	MAX Individual	MEAN Individual	Total Individual
Clusters	289	3	153	42	12,023

Data disaggregation below the sub-regional involves substantial level of uncertainty and thus not recommended

Small Area Estimates (SAE) as an Alternative

Use SAE to produce estimates of FP indicators at VDC level in Nepal

The SAE technique takes advantage of the existing correlation between a set of common variables in the 2011DHS and the 2011 Population Census Public Use Microdata Sample (PUMS) data (age, number of children, urban/rural residence, education, water and sanitation, etc.) to predict values for contraceptive dynamics indicators at the district level using regression models.

ELL Method

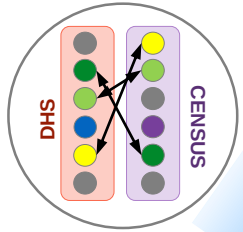
Small Area Estimates (SAE) as an Alternative

Elbers, C., Lanjouw, J., and Lanjouw, P., (2003), “Micro-level Estimation of Poverty and Inequality”, Econometrica, Vol. 71, pp. 355-364.

The World Bank uses the ELL small area estimation method for poverty mapping.

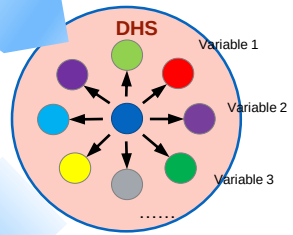
Key Steps

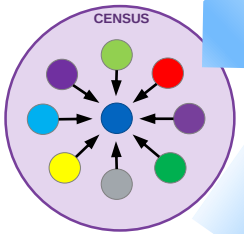
1. Data Analysis and Assessment
2. Regression model coefficients for predicting probability of using contraception for an individual woman are obtained from the 2011 NDHS data
3. The national coefficients from DHS are applied to the 2011 Census Data to predict the probability of using contraception for individual women
4. The individual contraceptive use probabilities from census data are aggregated to VDC level



1. Identify common variables associated with contraceptive indicators in DHS and census data

2. Develop a model for predicting the probability of individual contraceptive use using DHS data





3. Apply the model to census and estimate the probability of individual contraceptive use

4. Aggregate the estimation of individual contraceptive use to small area administrative level and map results

15 Variables Selected for SAE model

Variable category	Variable List
Age	Age 15-24
	Age 25-34
	Age 35-49
Education	Level of education is No Education
	Level of education is Primary
	Level of education is Some secondary
	Level of education is SLC above
Number of children	Number of living children is 0
	Number of living children is 1-2
	Number of living children is 3 and more
Place of residence	Place of residence is urban
	Place of residence is rural
Household amenities	Household has radio
	Household has TV
	Household has motorcycle/scooter
	Household has bicycle
	Household has refrigerator

15 Variables Selected for SAE model

Variable category	Variable List
House floor	Type of foundation of the house is cement bonded bricks/stone
House wall	Type of outer wall of the house is cement bonded bricks/stone
House roof	Type of roof of the house is galvanized sheet/metal
Drinking water	Main source of drinking water is tap/piped drinking water
Electricity	Usual source of lighting is electricity (including solar)
Toilet	Type of toilet is flush toilet (septic tank)
Religion	Religion is Hindu
	Religion is Bouddha
	Religion is Islam
	Religion is other than the above four
Mother tongue	Mother tongue is Nepali
Sex of the head of household	Sex of head of household is Male
	Sex of head of household is Female
Relation to the head of household	Relation to the household head is Head
	Relation to the household head is Head's wife
	Relation to the household head is Head's daughter
	Relation to the household head is other than Head's wife or daughter

Liner regression model for SAE:

$$P = \beta_0 + \sum_{i=1}^{n} \beta_i x_i$$

(or)

Use this space to drop an image or a chart on top of this text!

$$P = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 \ldots\ldots$$

(P = Predicted value)

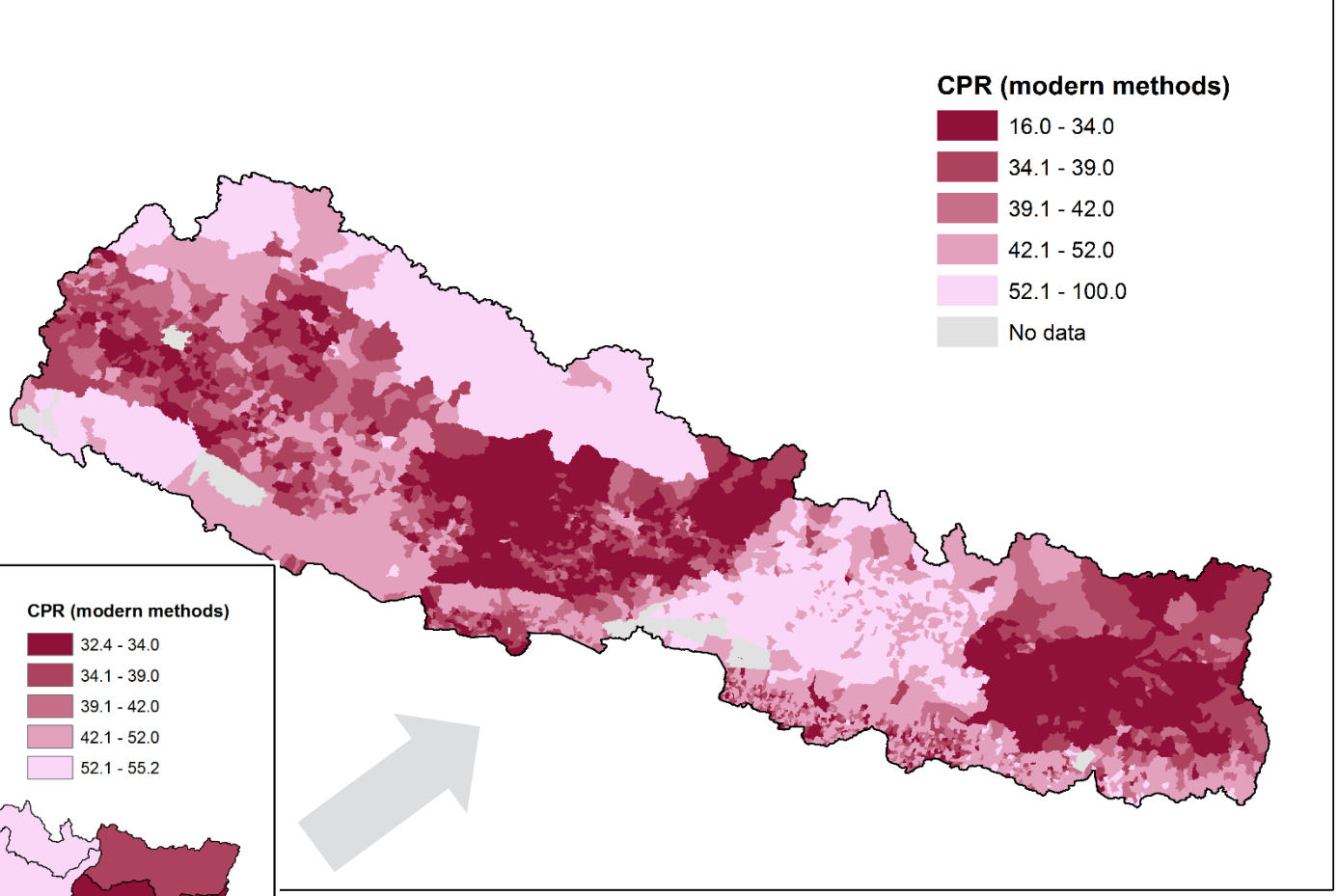
Logistic regression model for SAE

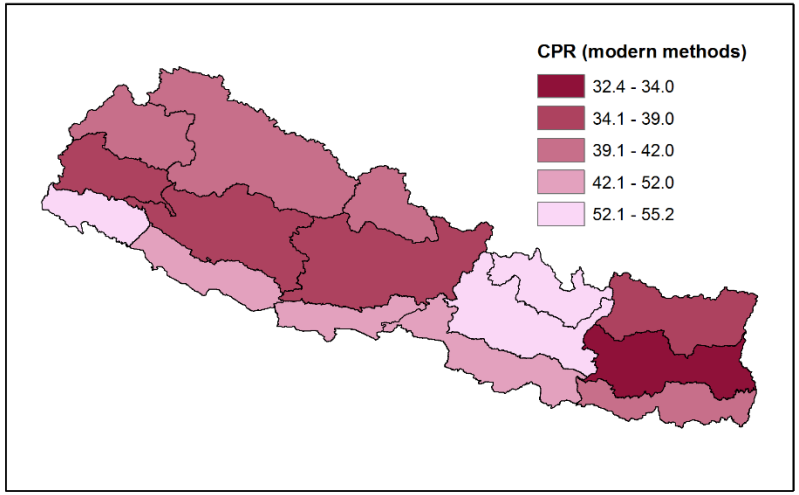
$$Logit\,(P) = \beta_0 + \sum_{i=1}^{n} \beta_i x_i$$

Probability of contraception use for each case

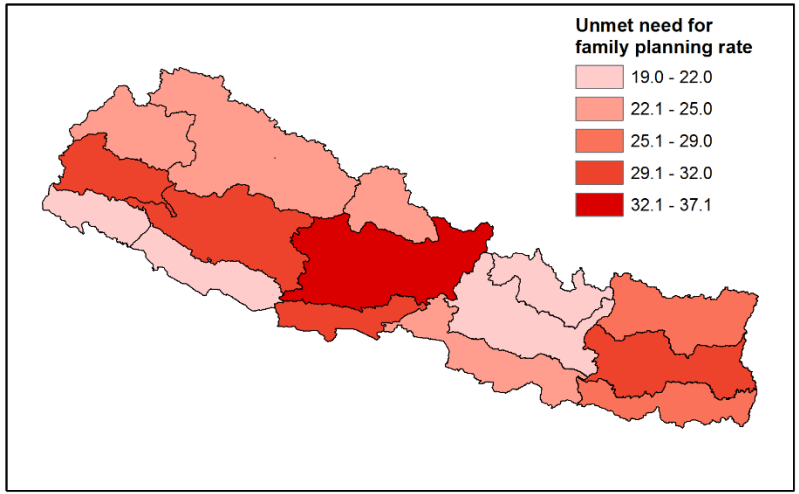
$$P = \frac{exp(\beta_0 + \sum_{i=1}^{n} \beta_i x_i)}{1 + exp(\beta_0 + \sum_{i=1}^{n} \beta_i x_i)}$$

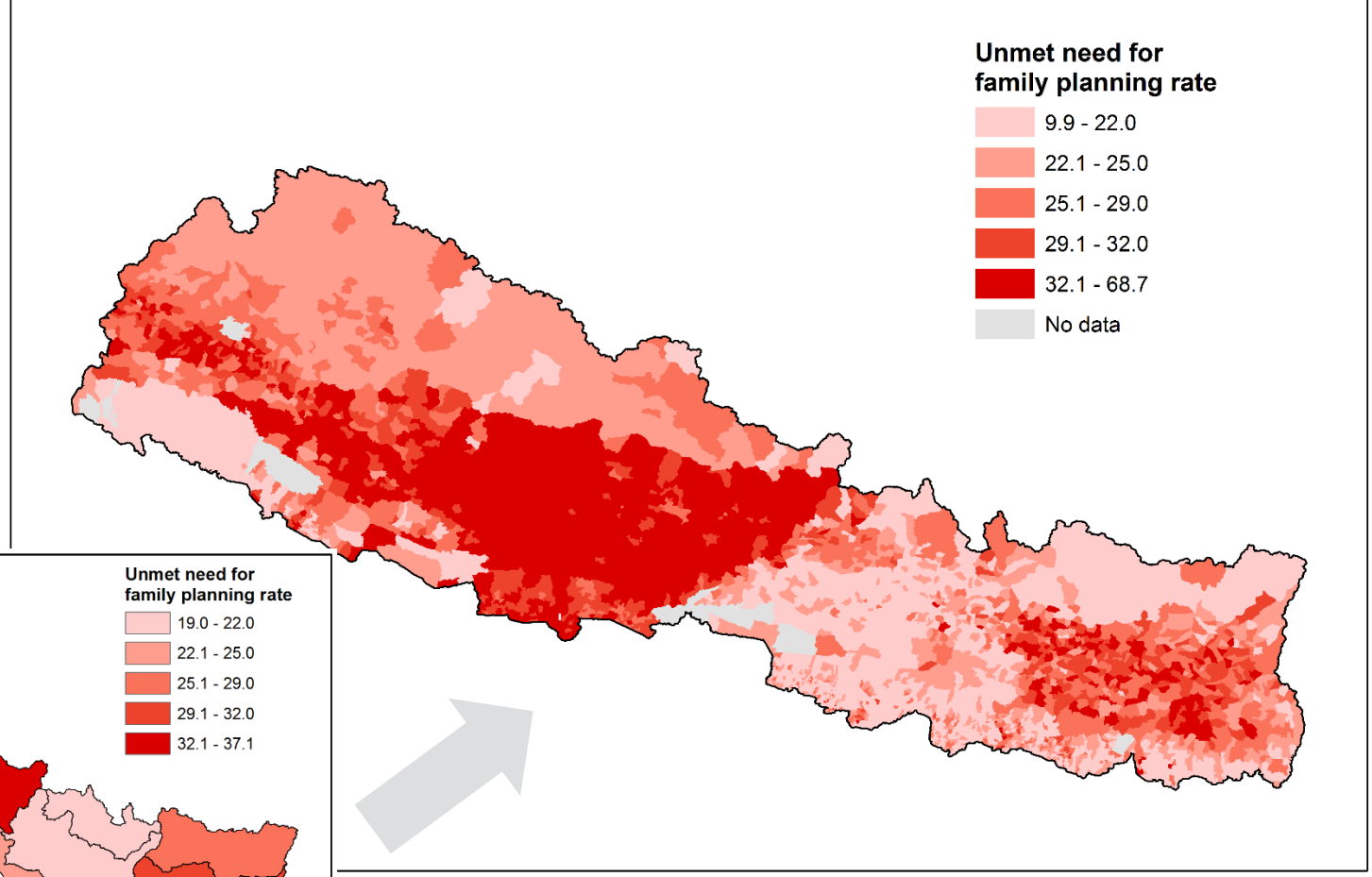
SAE Results


CPR (modern methods)
16.0 - 34.0
34.1 - 39.0
39.1 - 42.0
42.1 - 52.0
52.1 - 100.0
No data

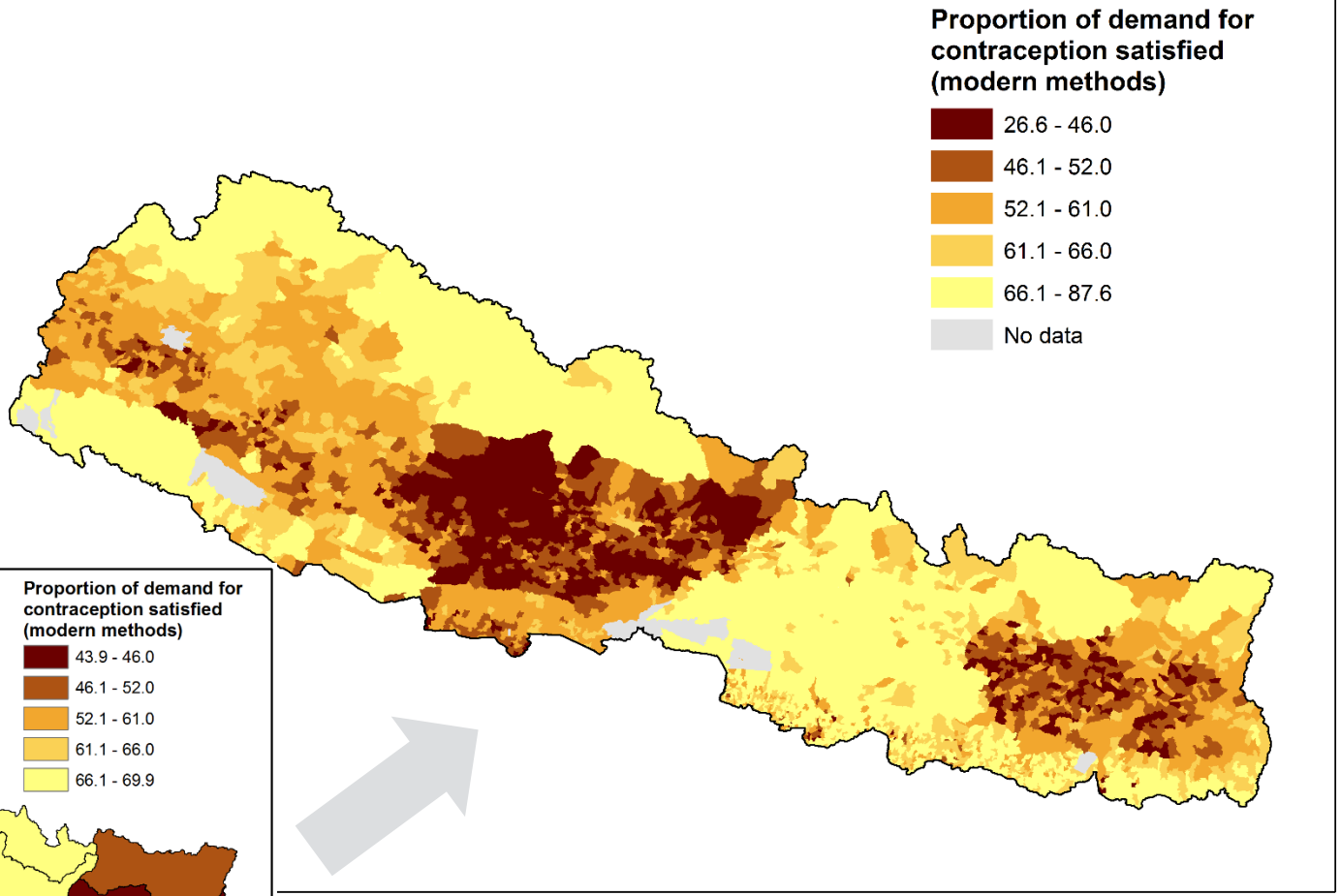

CPR (modern methods)
32.4 - 34.0
34.1 - 39.0
39.1 - 42.0
42.1 - 52.0
52.1 - 55.2

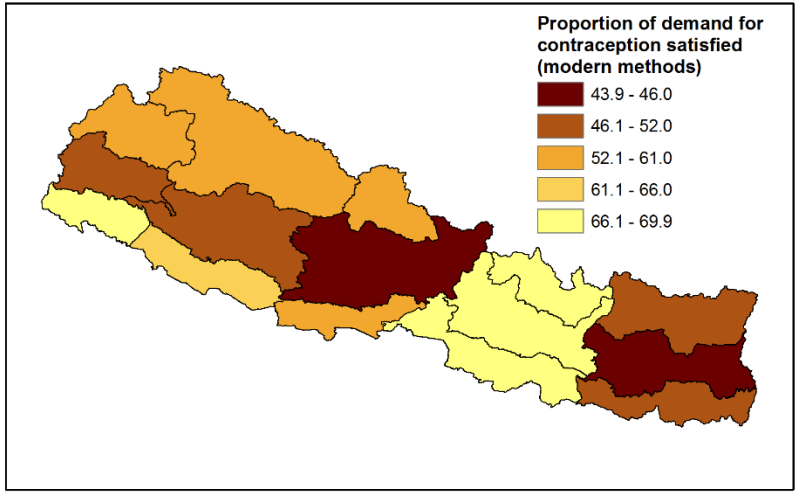
SAE Results


Unmet need for family planning rate
19.0 - 22.0
22.1 - 25.0
25.1 - 29.0
29.1 - 32.0
32.1 - 37.1


Unmet need for family planning rate
9.9 - 22.0
22.1 - 25.0
25.1 - 29.0
29.1 - 32.0
32.1 - 68.7
No data

SAE Results

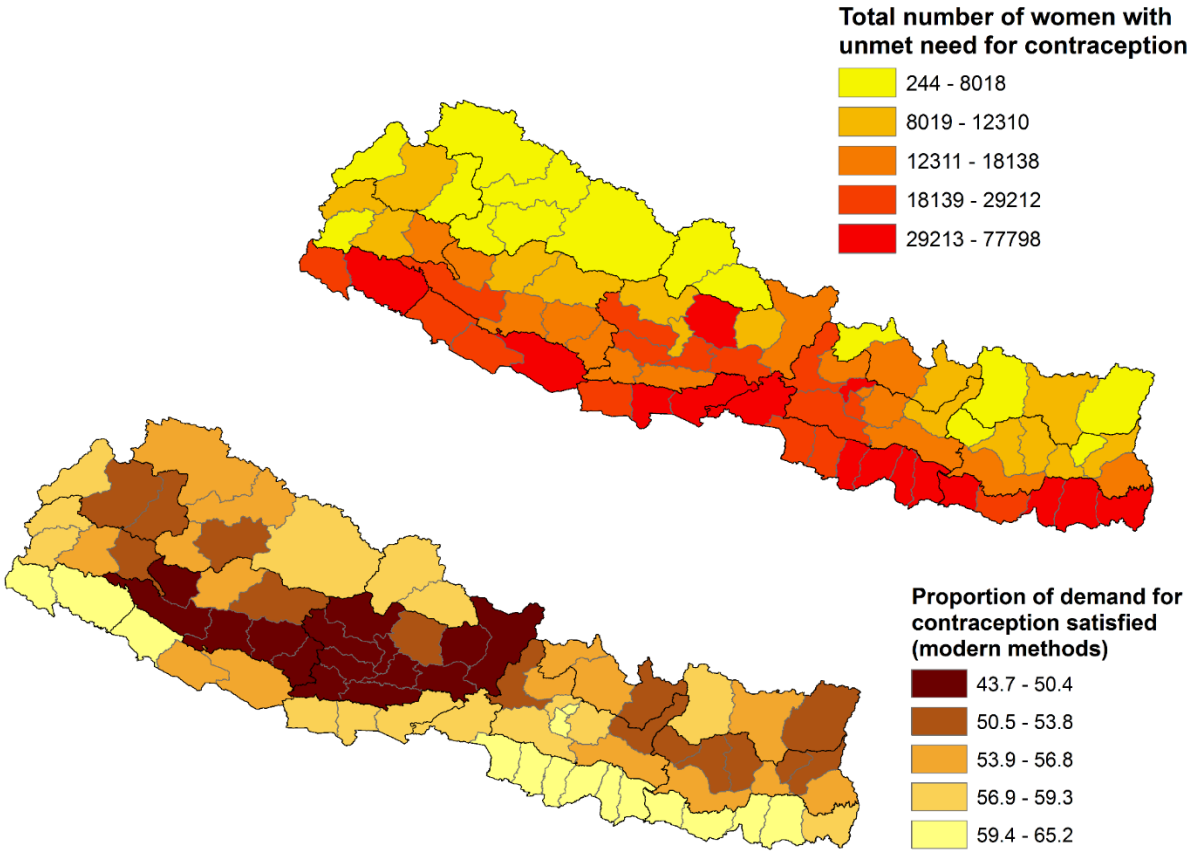

Proportion of demand for contraception satisfied (modern methods)
26.6 - 46.0
46.1 - 52.0
52.1 - 61.0
61.1 - 66.0
66.1 - 87.6
No data


Proportion of demand for contraception satisfied (modern methods)
43.9 - 46.0
46.1 - 52.0
52.1 - 61.0
61.1 - 66.0
66.1 - 69.9

Accuracy Assessment

		DHS (2011)			SAE
		Value	Confidence Intervals		
		R	R-2SE	R+2SE	Value (2011)
CPR Any method					
	National Total	49.7	47.6	51.8	49.7
1	Eastern	46.4	42.4	50.3	48.1
2	Central	54.7	50.3	59.1	53.8
3	Western	46.1	41.2	51.0	44.8
4	Mid-Western	46.9	42.1	51.6	47.6
5	Far-Western	51.9	46.8	57.0	51.8
CPR Modern method					
	National Total	43.2	41.0	45.3	43.8
1	Eastern	36.2	31.8	40.6	39.2
2	Central	49.9	45.9	54.0	48.8
3	Western	38.7	33.7	43.7	37.8
4	Mid-Western	42.8	38.4	47.2	44.3
5	Far-Western	47.1	41.7	52.6	46.8
Unmet need for family planning rate					
	National Total	27.0	--	--	25.6
1	Eastern	30.0	--	--	25.0
2	Central	21.6	--	--	20.8
3	Western	34.0	--	--	34.2
4	Mid-Western	26.1	--	--	28.2
5	Far-Western	24.1	--	--	23.4

Identification of Priority District: Total Number of Unmet Need and Proportion of Demand Satisfied



Taking both relative numbers and absolute numbers into consideration

Recent Activities at WDF and ICFP

United Nations WORLD DATA FORUM

Leaving No One Behind

(TA3.07) SAE Method Training Workshop:

Combining Data Sources to Generate Small Area Estimates for Family Planning

10:45AM - 12:15PM
TUE, JAN17, 2017

Welcome: Tapiwa Jhamba, Ph.D, Technical Adviser, UNFPA
Presenter: Sainan Zhang, Ph.D., Technical Specialist, UNFPA

Background:
UNFPA aims to strengthen the national capacity for production and dissemination of quality disaggregated data on population and development issues that allow for mapping of demographic disparities and social and economic inequalities, and for programming in humanitarian settings.

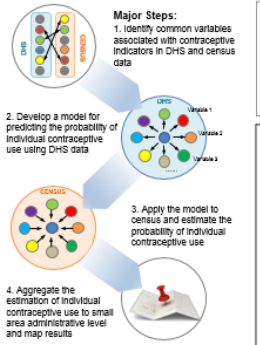
Purpose:
The purpose of developing a Small Area Estimation (SAE) method is to better identify the areas where the need for family planning support are the greatest, in order to geographically target investment to enhance family planning.

Methodology:
Develop regression models to use DHS and census data to estimate key family planning indicators at small area level, e.g. district and municipality level, including Contraceptive prevalence rate (CPR), Unmet need for contraception rate, and Proportion of demand for contraception that is satisfied (SDG indicator 3.7.1).

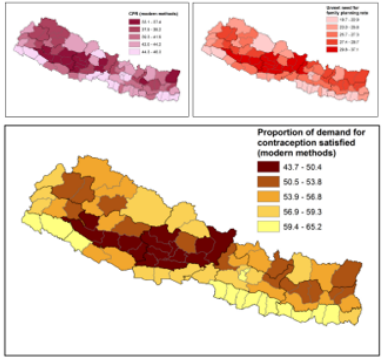
Challenge:
One of the challenges for data utilization is estimation of key family planning indicators at lower administrative level, which is critical to decision making process. Most of the data used for contraceptive dynamics analysis, in the developing world, is collected via household surveys. However, sample limitations allows for data disaggregation only for regional level and in few cases at the provincial/state level.

What Will This SAE Training Workshop Illustrate?

- DHS and census Data
- SAE methodology
- Nepal case study
- Interactive demonstrations of key steps of SAE - DHS and census PUMS data processing, modeling and mapping



Major Steps:
1. Identify common variables associated with contraceptive indicators in DHS and census data
2. Develop a model for predicting the probability of individual contraceptive use using DHS data
3. Apply the model to census and estimate the probability of individual contraceptive use
4. Aggregate the estimation of individual contraceptive use to small area administrative level and map results



Population and Development Branch, United Nations Population Fund
605 3rd Ave, New York, NY 10158, Rachel Snow, Branch Chief, +1 212 297 5259, rsnow@unfpa.org

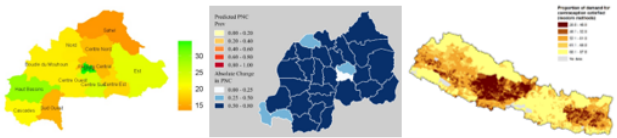
INTERNATIONAL CONFERENCE ON FAMILY PLANNING
KIGALI, RWANDA • 12-15 NOVEMBER 2018

SIDE EVENT

Small Area Estimation -
Advances in Measurement of Family Planning Indicators

Wednesday 14 November 2018
18:00 – 19:30
Hôtel des Mille Collines, Room Kivu 1
(2 KN 6 Ave, Kigali, Rwanda)

Shuttle service will be provided to commute between the ICFP conference venue and Mille Collines Hotel. One shuttle with a Mille Collines Hotel Sticker will depart from the ICFP Conference Venue at 5:15 pm and 5:30 pm respectively, and will return to the conference venue at 7:45 pm after the side event.



The objectives of this panel are to bring together experts in small area estimation to share existing methodologies and their application for family planning indicators. The side event will inspire innovative discussion on advantages and limitations of each method and generate recommendations based on the context of different countries.

Panel chair: Dr. Rachel Snow, Chief, Population and Development Branch, United Nations Population Fund

Panelists:
Dr. Laina Mercer, Institute for Disease Modeling
Dr. Sainan Zhang, Technical Division, United Nations Population Fund
Dr. Kristine Nilsen, WorldPop, University of Southampton
Dr. Qingfeng Li, PMA2020, Johns Hopkins University
Dr. Laura Dwyer-Lindgren, Institute for Health Metrics and Evaluation, University of Washington

Discussant: Dr. Tomas Bird, Flowminder/WorldPop, University of Southampton

UNITED NATIONS POPULATION FUND
605 Third Ave, New York, NY 10158 USA
Rachel Snow, Chief, Population and Development Branch. Email contact: szhang@unfpa.org

Summary

- SAE based on ELL method is an alternative to obtain estimates of key population indicators at lower geographic levels
- The application of SAE to contraceptive dynamics proves to be useful to identify policy and program issues: Use of relative versus absolute estimates to allocate resources
- The SAE can contribute to SDG monitoring and programming, sub-national Demographic Dividend (Empowerment) and other agendas

The Way Forward

Apply the SAE methodology into other SRH issues such as maternal mortality, antenatal care, skilled birth attendance, etc.

Linking SAE results with other geospatial data for access to services assessment

Targeting the locations of the most vulnerable groups. e.g. women aged 15-24

Carry out capacity development activities on to enhance the capacity of National Statistical Systems

Thank you