Participatory Modeling and Mixed Methods Research:
Projecting Consequences of Women's Smokeless Tobacco Use In India

Jean Schensul. Ph.D.
Institute for Community Research, Hartford, CT.
David Lounsbury, Ph.D.
Albert Einstein College of Medicine, U.S.A.
Saritha Nair, Ph.D.
National Institute for Research on Reproductive Health, Mumbai

Saritha Nair, Kuala Lumpur, India PI

Field team, Vaishali, Sunitha, Yogitha, Rupali, Kirty, Sameena

Drs. Begum, Pasi, Balaiah, Schensul (US PI, Nair, Ms. Bilgi, Dr. Gupta, Cecily Ray

Background and Context

- India is the world's second largest producer of tobacco – most of the market is internal
- Recently conducted GATS (2009-2010) study shows SLT use among men is 33% and women 18% nationally. Rates vary from 18% to 60% across states (Ram et al., 2009-10) and are increasing.
- Mumbai rates for women are approximately 23 - 30% across "slum" communities (Nair et al., 2015; Mishra, et al., 2015)
- Popular products include *Khaini* or loose or packaged tobacco-lime mixture (12%), *gutkha,* a mixture of tobacco, lime and areca nut mixture (8%), banned, mishri and gul (toasted powdered tobaccos rubbed on gums and teeth), and betel quid with tobacco (Gupta & Ray, 2003; Nair et al, 2015; Schensul et al., 2012, Narain, 2012).
- Smokeless tobacco is believed to be responsible for 7% of all deaths in India (Gajalakshmi, V., & Kanimozhi, V. (2015) and 18% of female cancer deaths (Dikshit et al., 2012) and excess mortality for women of 260/100,000 (Gupta 2000).
- Use of smokeless tobacco with or without betelnut results in oral and aesophageal cancers and precancerous lesions and coronary heart disease Smokeless tobacco is associated with premature births, low birth weight and infant mortality (Gupta & Subramony, 2004;Krishna, 1978;Gupta *et al.,*2005; Gupta and Subramony, 2006) and anemia (Subramoney, 2008) (Deshmukh 1998; Gupta & Subramony 2004; Bhawna, 2013; England et al., 2012; Ratcch et al., 2014; Sinha et al., 2016).
- Quitting smokeless tobacco permanently without intervention is very uncommon (Gupta & Subramony, 2006).
- SLT use among women is positively normed and easily available (Schensul et al., 2013).
- Regulatory action has not reduced women's SLT use
- There are few studies of women's SLT use leading to preventive interventions (Amos et al., 2011)

Background and Context

India's Death Clock

Tobacco-related deaths from April 1*

16,004

A death every 32 seconds

Tobacco industry profit since April 1**

447,053 lakh rupees

National Level

Videshi/ Swadeshi

HARM)THE TOBACCO ATLAS)
Tobacco harms the health, the treasury, and the spirit of India. Every year more than 981100 of its people are killed by tobacco-caused disease, while more than 2542000 children and more than 120000000 adults continue to use tobacco each day. Complacency in the face of the tobacco epidemic will ensure the tobacco industry continues to run roughshod over the lives of India's citizens and ensure that tobacco's death toll will grow with each passing year. **Tobacco control advocates must reach out to other communities to strengthen their efforts in this mortal fight.**

Local Level

Woman applying Mishri to gums and teeth
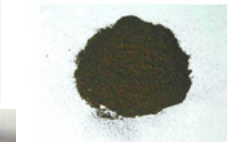
Loose tobacco, gutkha, mishri, betwlquid, supari, tobacco packets

Need for Study

- Need for research to guide multi-level interventions that:
  - Respond to the inability of regulatory efforts to curb SLT use , including bans and restrictions on marketing and sale because they have not modeled the complexity of factors, that influence women's SLT use and health consequences.
  - Engage women and other stakeholders in intervention planning and implementation by evaluating projected outcomes
  - Address community and structural factors influencing SLT use in women
  - Address social norms, beliefs and practices around women's smokeless tobacco use
  - Include cessation approaches to smokeless tobacco use especially during reproductive years

Study Objectives

- Describe smokeless tobacco distribution systems and their potential effect on women's use during the reproductive years (16 – 40)

- Identify patterns of smokeless tobacco use in women of reproductive age including pregnant women

- Identify predictors of smokeless tobacco use and preventing cessation among women especially of reproductive age

- Disseminate results to study community for intervention preparation

- Develop an SD model of SLT use among women that projects morbidity and mortality, with a user-friendly dashboard enabling SLT stakeholders to evaluate multiple interventions that support government regulatory action and reduce SLT use

Research Design and Methods

- **Mixed methods design**
  - Formative qualitative research to understand context of SLT use
  - Survey (N=471; 409 daily SLT users+62 nonusers ages 18-40)
- **Methods**
  - Mapping (geographical and social)
  - Collection of various tobacco products available in the community
  - Interviews with pan shop owners and people who sell tobacco
  - Key informant interviews (55)
  - Indepth interviews with women (42)
  - Surveys with a representative sample of 471 women, 409 tobacco users; 62 nontobacco users, 25% pregnant at time of interview
  - Repeat interviews with 79 *gutkha* users post ban.
  - Dissemination and dialogue with community stakeholders (women, sellers, key informants/providers)
- **Study Area**
  - Mankhurd, Mumbai

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Study Setting

Typical large Mumbai low income ("slum") community of approximately 65 – 70,000 in approximately 233116 square meters (23.3 hectares) of land. 52% of Mumbai consists of such slums.

Migrants from Maharashtra, Bihar, Uttar Pradesh (North) and states in South India

A minimum of 20% women are estimated to be current smokeless tobacco users (GATS)

Main Study Findings: System factors

- Sale of smokeless tobacco products has important commercial value for low income sellers.

- Point of sale advertising and marketing is permitted and exploited by tobacco manufacturers

- There are government anti- and manufacturers' pro-tobacco messages and messengers

- There are few or no cessation programs or self help groups to assist women to quit.

- Regulatory action has differential effect on selling and women's use of SLT

There is a 10% increase each year in POS disproportionate to population increase.
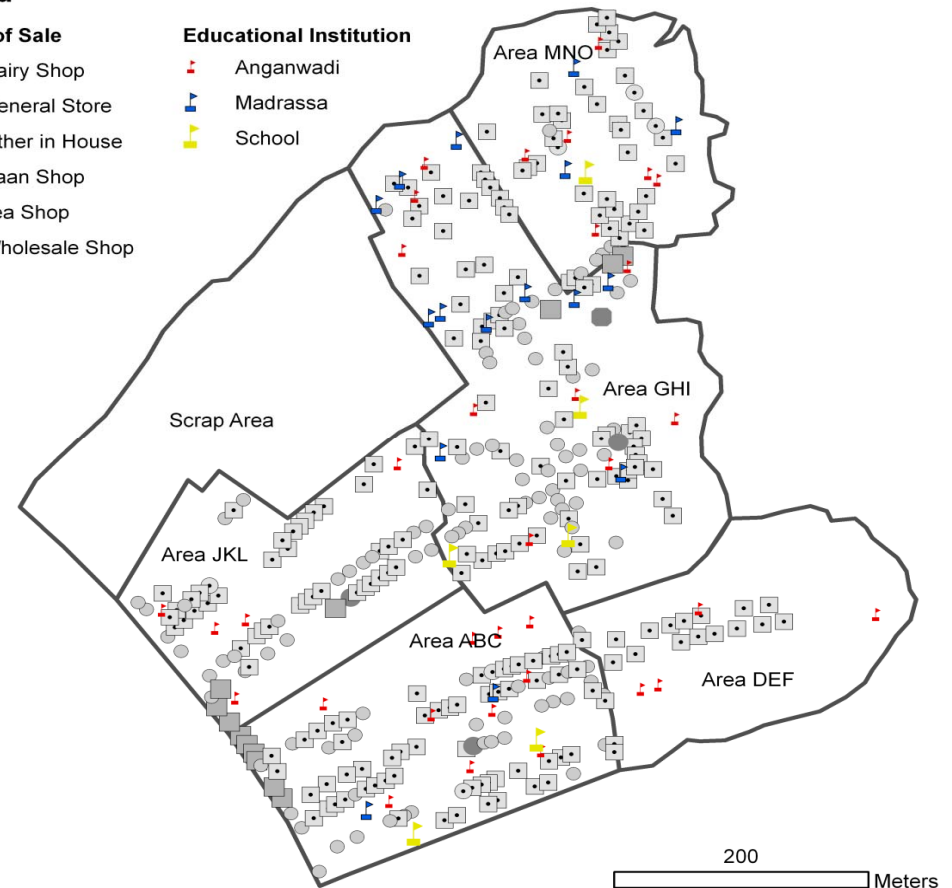
Study Findings: Individual level

- Women initiate tobacco use before marriage, after marriage and during their first pregnancies.
- About 1/3 of women are polytobacco users 2 – 5 years after initiation.
- Different social networks influence initiation prior to and after marriage (Parents and friends influence women prior to marriage, husbands, neighbors, local relatives and observation after marriage).
- There are no differences in beliefs and tobacco practices between pregnant and nonpregnant women. Women do not stop use when pregnant
- Women view SLT use as conferring 2/1 benefits over risks
- Women see potential harms to their babies but not to themselves
- Women are not affected by anti or pro tobacco messaging
- 157 women, about 1/3 of sample made quit attempts for at least one form of tobacco in the past year, but did not succeed in quitting.
- Women recognize their addiction and are motivated to quit and to participate in promoting anti-tobacco community norms.
  (Nair, et al. 2015; Begum, et al. 2015)

Mean Tobacco Consumption (gm./day for single/polyusers by Product Used (Nair et al., 2015)

	Amount of tobacco consumption each day in gms	
Specific Product	**Single Users (N=261) Mean (SD)**	**Poly – Users (N=148)* Mean (SD)**
Mishri	10.3 (+/- 9.0)	11.3 (+/12.1)
Pan with Tobacco	1.0 (+/-.07)	8.4 (+/ 7.6)
Chewed tobacco	7.5 (+/- 5.0)	11.3 (+/- 8.5)
Gul	6.9 (+/- 4,3)	8.9 (6.2)
Gutkha	11.9 (+/- 17.7)	14.3 (+/- 10.5)
Total	6.5 (+/- 8.8)	9.5 (+/-8.2)

*Poly-users use the specific product in far left column with one or more other products on the same day.

Participatory Dissemination Process: Community Dialogues

- **Community dialogues** with women users using street plays to convey main messages about access, social norms, use, habituation and consequences followed by discussion about causes, consequences and interventions (5 sessions, 55 or so women)

- **Community dialogues with shop owners** to discuss role of POS in making tobacco available, and implications of selling tobacco to children, followed by discussion about eliminating sales to children, income replacement and controlling giveaways to pregnant women. (2 sessions, 17 owners)

Aims of SD Modeling

- Develop a causal loop diagram illustrating the factors and processes contributing to SLT use and health consequences among women
- Develop a simulation model of perinatal health burden at the community level and calibrate to existing primary and secondary data.
- Integrate system components of the causal model as specific contributors to tobacco use and perinatal outcomes, and potential sources of intervention
- Transform into user friendly dashboard for use by community women and other anti-tobacco advocates and test to evaluate the relative efficacy of planned interventions.

Level	Domain	Variable
Community (and some individual level measures)	Accessibility	Proximity of shops
	Promotions	Efforts to sell tobacco through POS and directly
	Availability	Cost and types of tobacco
	Pro tobacco activities	Marketing, media promotion, persuasion and use, giveaways,
	Tobacco Surveillance	Paid personnel to shut down, tax/fine or penalize sellers,buyers/users
	Anti-tobacco activities	Any activity advocating against tobacco supply and demand
	Tobacco sentiment	Social norms promoting (or preventing) tobacco use
	Adverse health effects	Perinatal health, infant mortality
Individual level measures	SLT prevalence	Prevalence in community
	Social network use	Use by any member of social network
	Household expenditure on tobacco use	Proportion of money spent on tobacco/HH income
	SLT initiation	Rates during reproductive stages
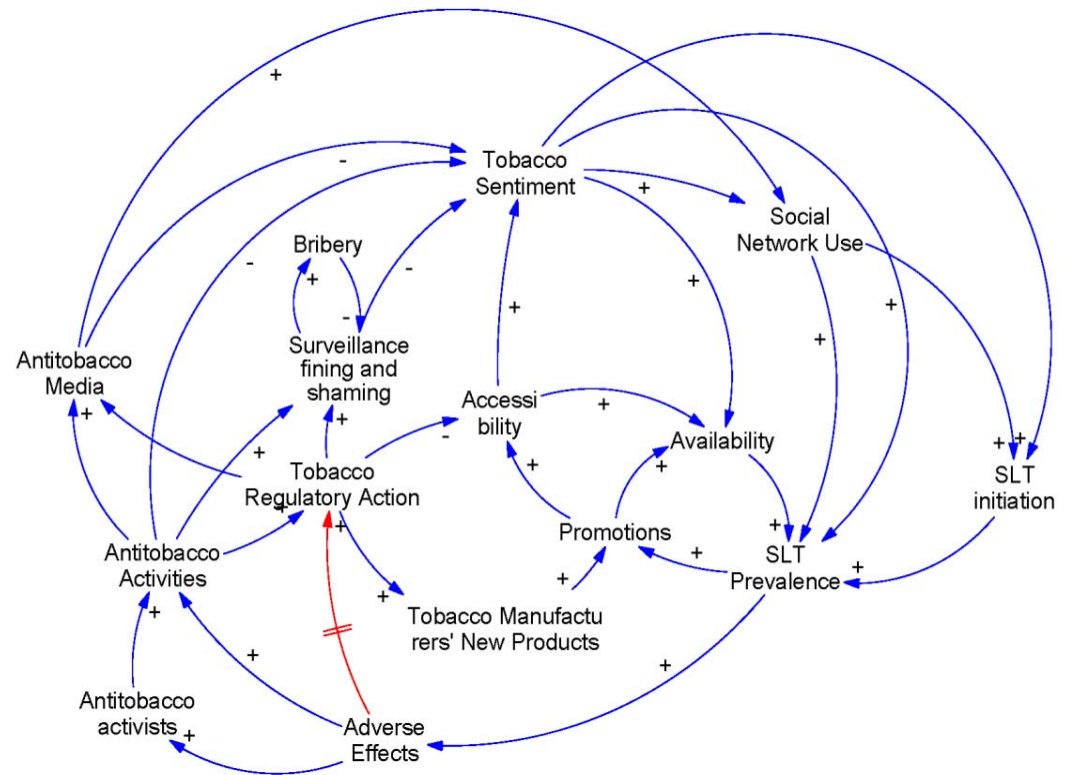
CLD model of subsystems affecting SLT use and consequences

Pathways (positive feedback loops)

  Protobcco sentiment supports social network use (husband, family, neighbors)
    Social network use leads to initiation pre and during marriage
   higher initiation leads to higher prevalence
    higher availability leads to higher prevalence
    More promotional activity leads to higher availability and prevalence
    New tobacco production and markets leads to higher availability
    Regulatory action promotes more production of new products
    Bribery and financial incentives of black market tobacco reduce effectiveness of surveillance
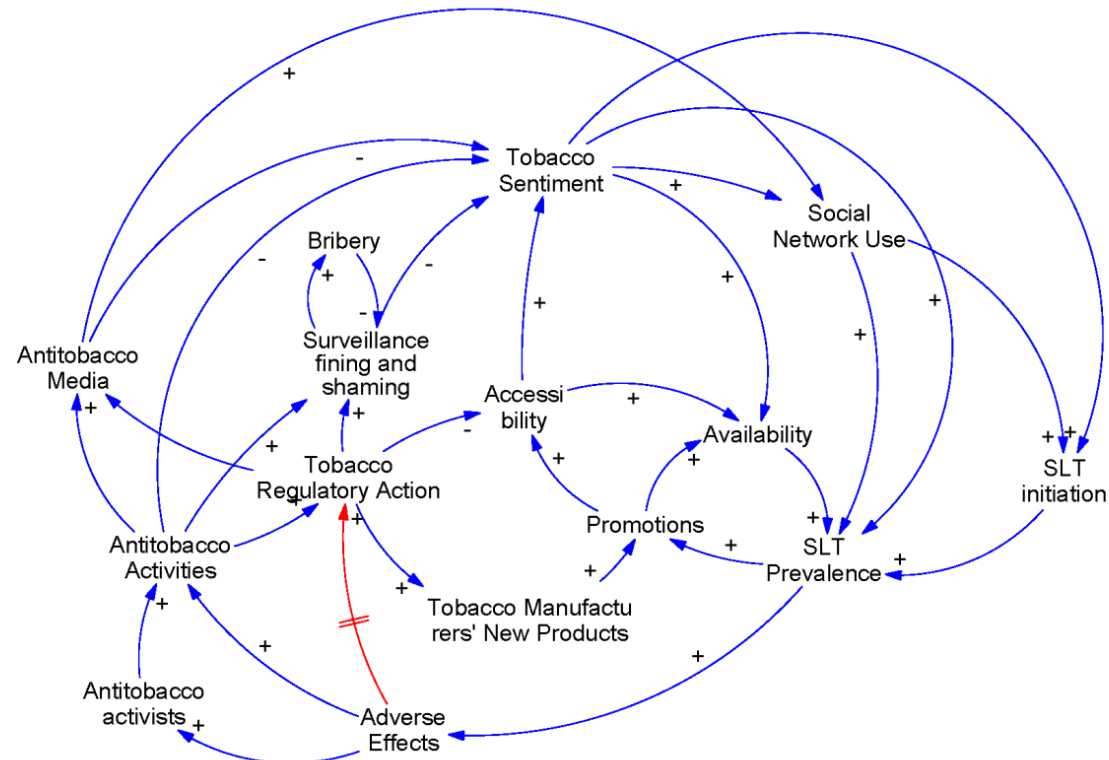
Negative feedback loops

  Higher SLT prevalence leads to more visible short term adverse effects (premature births, deaths, low birth weight
    More visible adverse effects lead to antitobacco groups and antitobacco activities (national, state and local)
    Antitobacco activities lead to more regulatory action and antitobacco media
    Antitobacco media and post regulatory action surveillance reduce positive tobacco norms
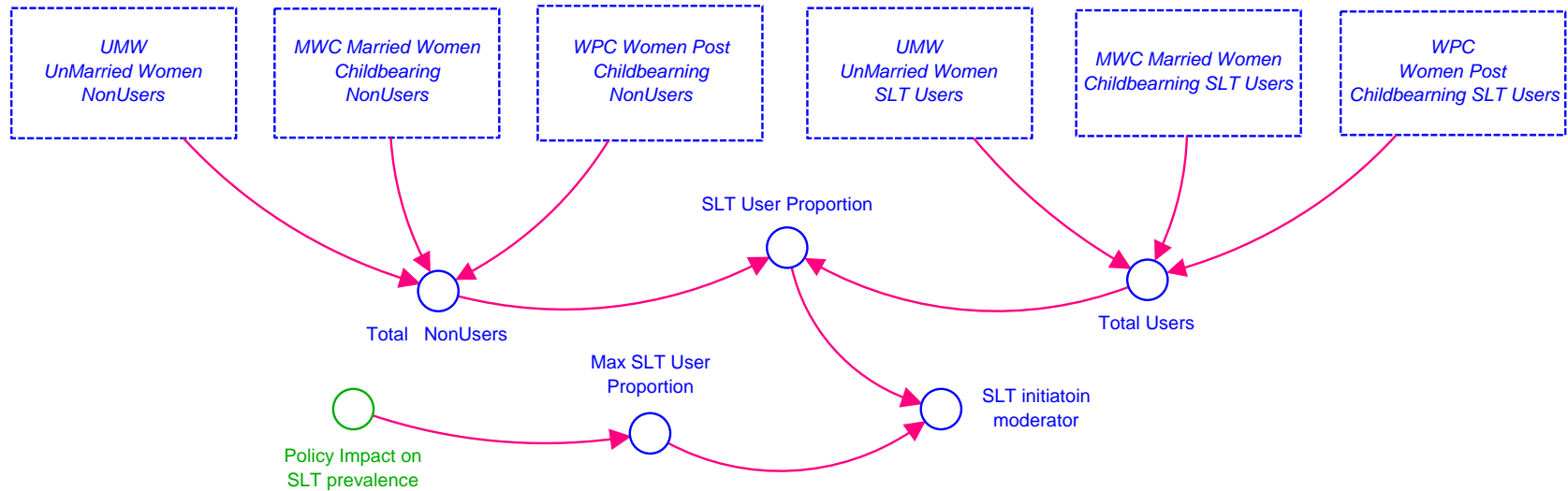
CLD Model: Analyzing the result of the Gutkha Ban

- **POS/supply responses**: stockpiling, price fixing of other forms of tobacco, shifting selling to interior locations, and selling black market *gutkha* to known customers.

- Increased surveillance via publically funded BMC and locally employed monitors including arrests and fines for selling *gutkha*

- Short term reductions in *gutkha* sales and increases in sales of other tobaccos;

- **Users/demand responses**: shifting to other products, increasing use of other products, buying *gutkha* "in the black" from sellers in the interior.

- **POS/supply and System responses**. As BMC surveillance support declined, local monitors took bribes for overlooking gutkha sales.

- Information reached POS about increased options for purchasing *gutkha*

- *S*tockpiling leveled off, and gutkha was sold openly though illegally, old forms of *gutkha* reappeared, and former users reported returning to regular use.

- **Visible consequences and and anti-tobacco system responses**. There were no visible use-related adverse effects, no anti-tobacco formal education programs, and no local anti-tobacco advocacy activities.

Observing The Gutka Ban

- Antitobacco advocates and media (exogenous influences) resulted in a ban against gutkha and gutkha like products. The ban called for government paid surveillance to close shops and arrest and fine people using gutkha.

- This produced anti-gutkha sentiment and social influence to avoid use, reduced availability, eliminated initiation by gutkha, increased price, reduced availability, accessibility and use of gutkha with potential reductions in adverse events.

- Government reductions in surveillance financing, plus local surveillance personnel acceptance of bribes reduced surveillance activities.

- Tobacco companies produced and promoted new gutlka surrogates (similar products) and retained product names, anticipating lifting the ban.

- POS sold "in the black" (reduced availability and accessibility) and then increased their sales as threat reduced. Addicted women continued their use; others shifted to other tobaccos including new products. Most women did not quit; and many increased their use.

SLT Prevalence Dynamics

UMW
UnMarried Women
NonUsers

MWC Married Women
Childbearing
NonUsers

WPC Women Post
Childbearning
NonUsers

UMW
UnMarried Women
SLT Users

MWC Married Women
Childbearning SLT Users

WPC
Women Post
Childbearning SLT Users

SLT User Proportion

Total   NonUsers

Total Users

Max SLT User
Proportion

SLT initiatoin
moderator

Policy Impact on
SLT prevalence

UMW UnMarried Women NonUsers	57
MWC Married Women Childbearing NonUsers	572
WPC Women Post Childbearning NonUsers	72
Total NonUsers	700

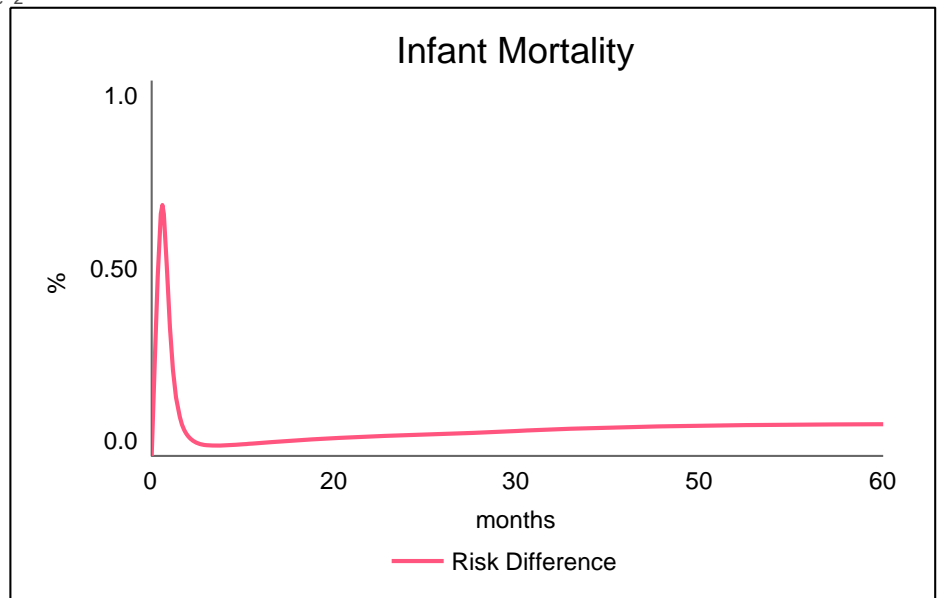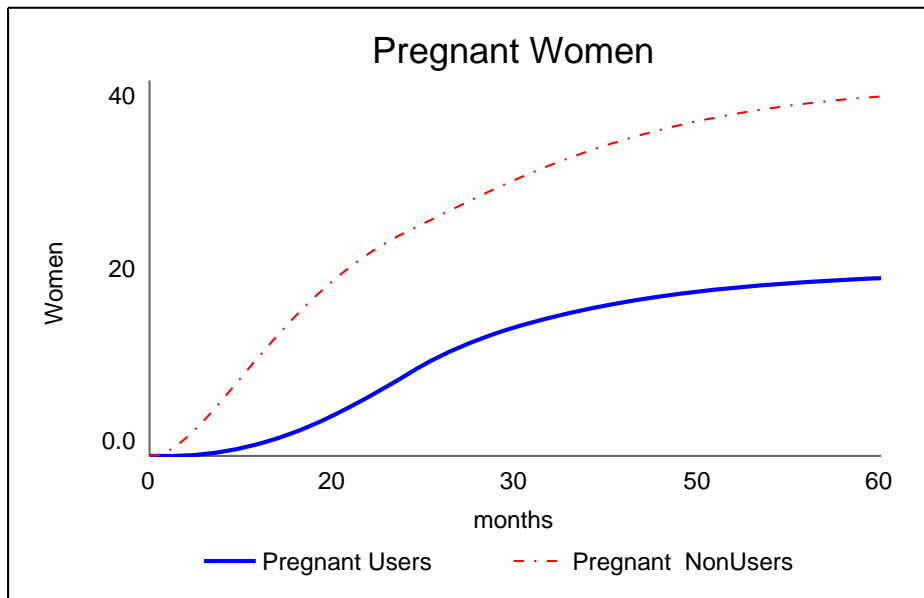| UMW UnMarried Women SLT Users	25
MWC Married Women Childbearning SLT Users	245
WPC Women Post Childbearning SLT Users	31
Total Users	300

Link to model
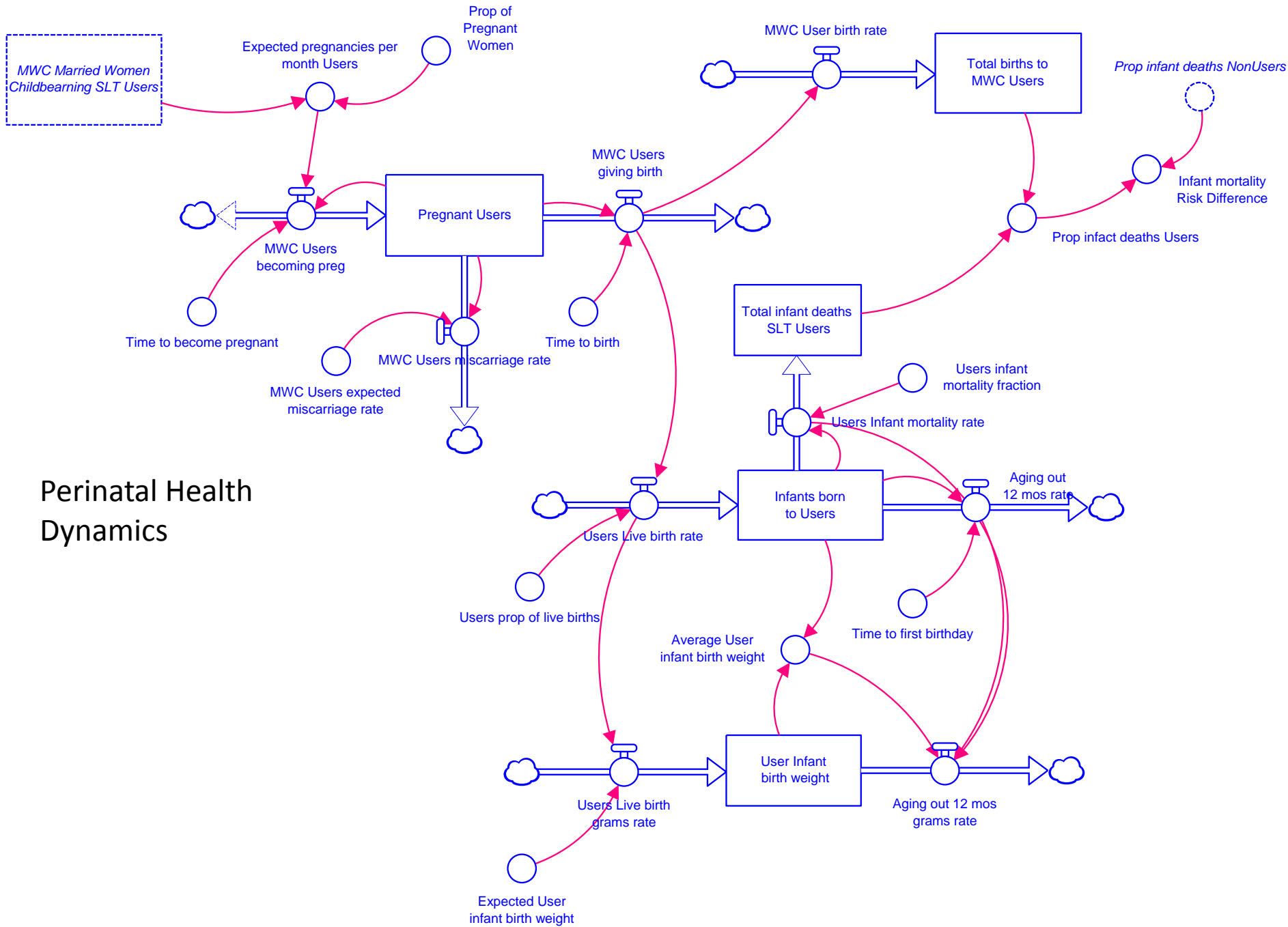
Perinatal Health Dynamics

Preliminary Simulated Output for Selected Indicators
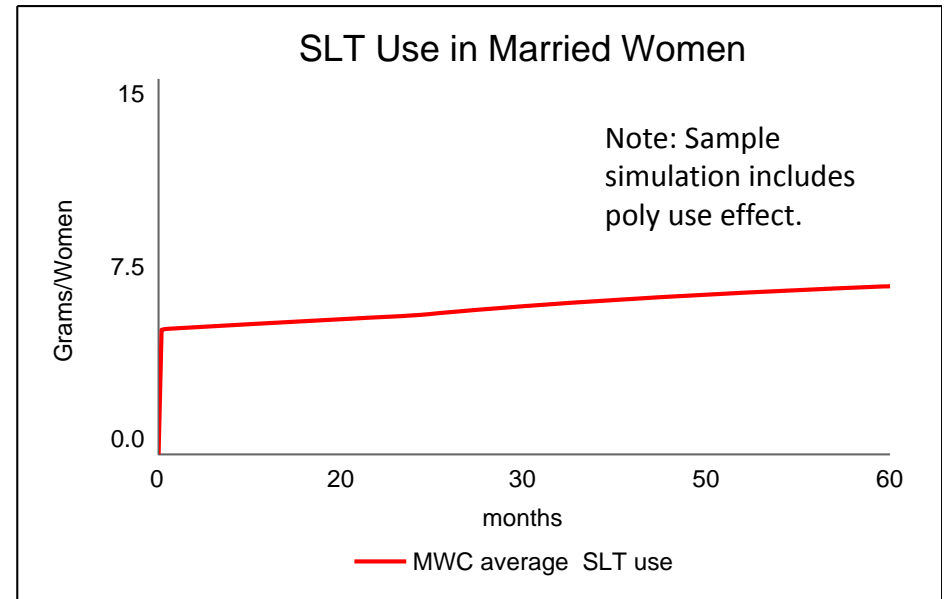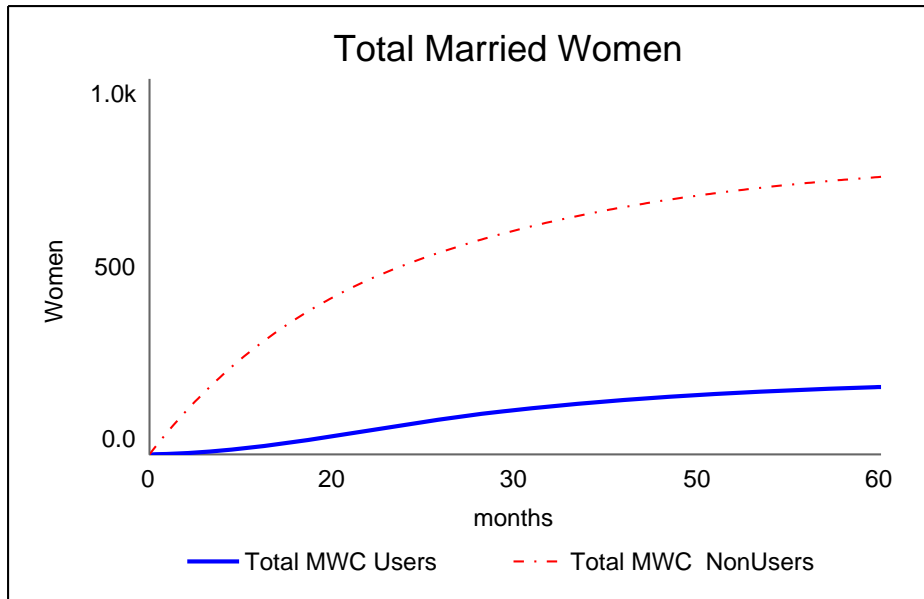
Benefits of SD Modeling of Consequences of SLT Use in Indian Context

- Model based on Indian reality
- Can be used to project both reproductive and oral health morbidity and mortality
- Can integrate "interventions" that illustrate reinforcing and balancing feedback loops as described in the CLD model
- Provides a common language to apply with stakeholders at different levels, especially community women, examining tobacco control policies and local responses and introducing multiple interventions to reduce women's SLT related morbidity and mortality

Issues and Requirements

- Data quality
  - No secondary data available tracking smokeless tobacco use
  - Data bases do not connect reproductive health (or cancer) and tobacco use
  - Current model generated based on mixed methods research (epidemiological, secondary and qualitative)
  - Estimates based on a single community; need for replication

- Stakeholder engagement
  - Research and dissemination are participatory, current modeling process is not
  - Modeling for affected women different than for clinicians, public health

- Approaches to democratizing the science of complex modeling
  - Creating a participatory CLD model through GMB is possible in community settings, and is required to understand factors contributing to use and to prevention/cessation.
  - CLD modeling requires technical expertise and community collaboration
  - Simulation model requires technical expertise and the process of translating and utilizing it in limited resource low literate communities requires innovative approaches and a user friendly dashboard. The dissemination process requires research.

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