Operations Research and Implementation Science

Introduction

Operations Research Mini-Course

July 2011

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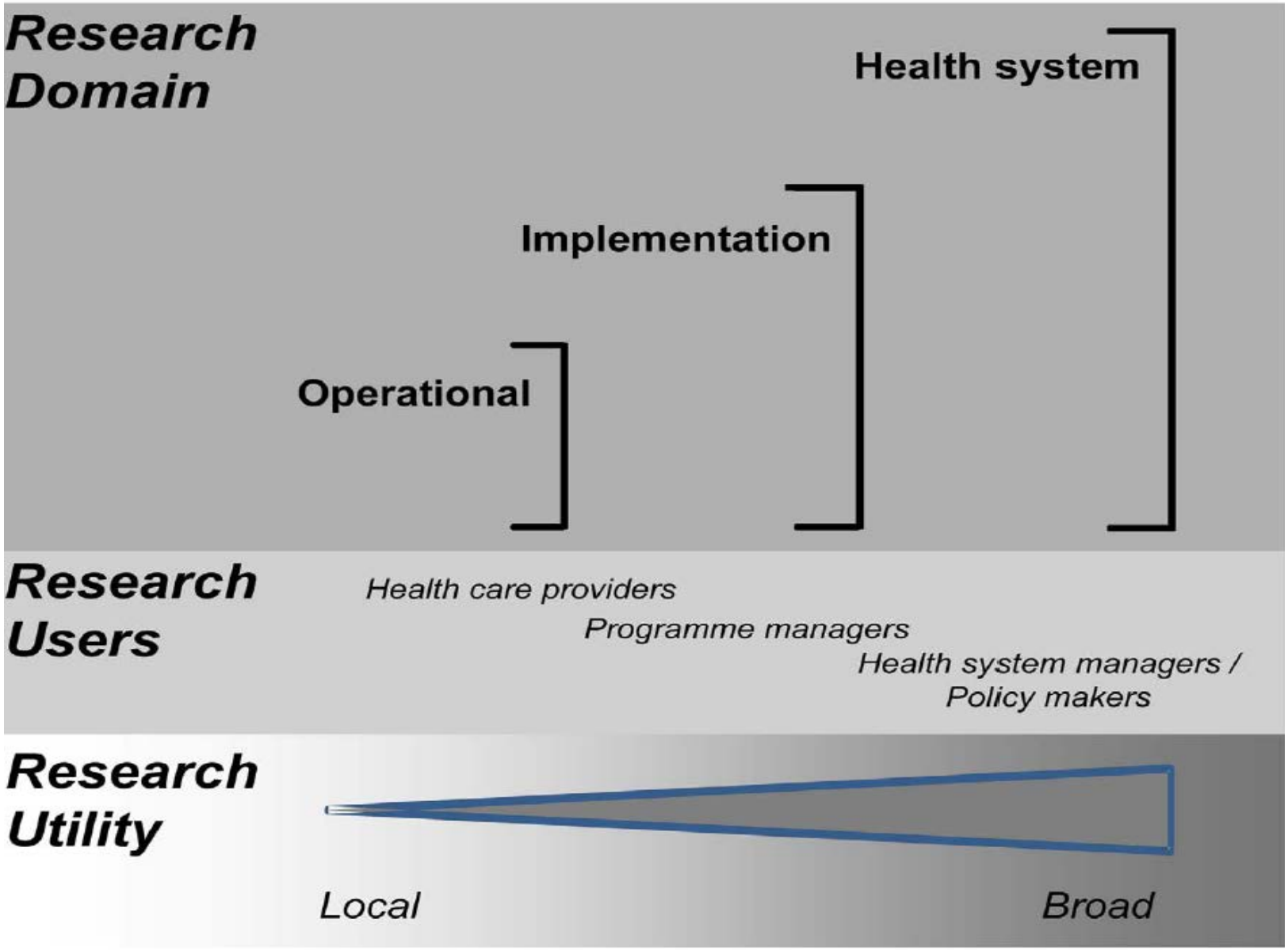
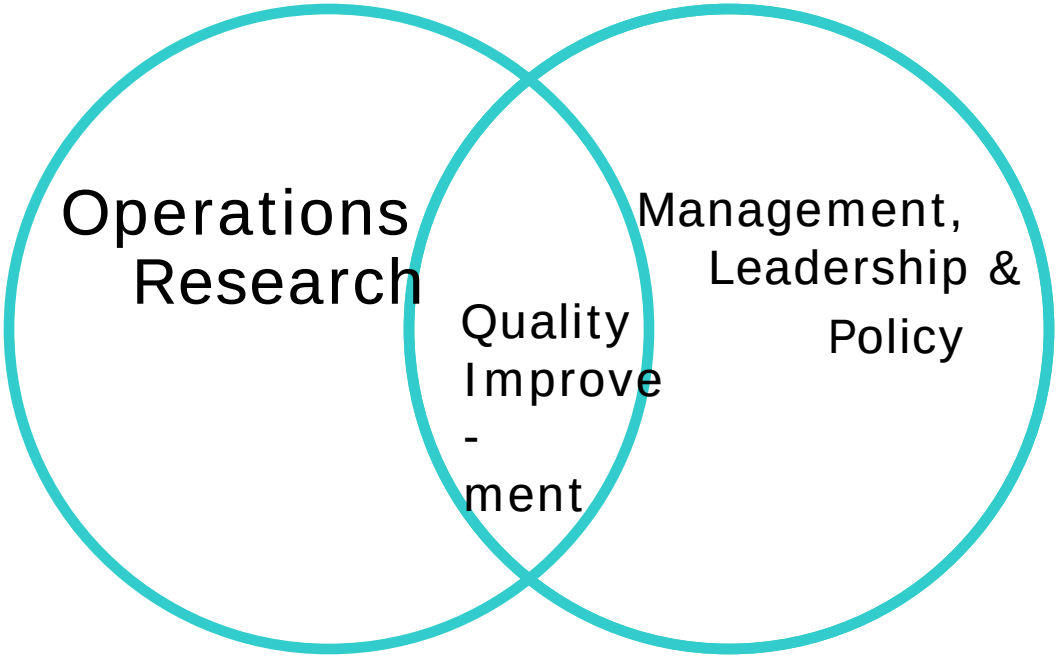
Defining research to improve health systems, Remme et al, PLoS Medicine Nov 2010



'Implementation Science' in Health

Umbrella concept for rigorous approaches to improving health care delivery (Gloyd 2009)



Critical elements:

Information technology, financing, human resources, logistics, anthropology, clinical science

Operations research - HAI/UW model

Problem identification

1. Validate data/indicators
2. Identify variability in performance (disaggregate!)
3. Map steps/identify bottlenecks – compare high and low performers – plus other studies (qualitative or quantitative) as necessary

Intervention & assessment

4. Make changes to address bottlenecks
5. Measure impact of changes
6. Expand changes, impact policy

Operations research - HAI/UW model

Today's course

Problem identification

1. Validate data/indicators *(Gloyd)*
2. Identify variability in performance (disaggregate!) *(Micek)*
3. Map steps/identify bottlenecks – compare high and low performers – plus other studies (qualitative or quantitative) as necessary *(Micek, Gimbel Pfeiffer)*

Intervention & assessment

4. Make changes to address bottlenecks *(Micek, Gimbel, Hughes)*
5. Measure impact of changes *(Micek, Gimbel, Ghate, Hughes)*
6. Expand changes, impact policy *(Sherr)*

WHAT ARE INDICATORS?

- reflection of a given situation (IMR, LE, years of educ)
- variables which help measure changes (% attended births, % immunized)
- indirect and partial measures of a complex situation (IMR, U5MR, BRs)
- often a proxy (LBW, food prod)

USED TO DEMONSTRATE HOW POLICIES CHANGE HEALTH

- yardsticks to measure progress
- measure of quality of life and development

Millennium Development Goals 1-4

Goals and Targets (from the Millennium Declaration)	Indicators for monitoring progress
Goal 1: Eradicate extreme poverty and hunger	
Target 1: Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day	1. Proportion of population below $1 (PPP) per day[a] 2. Poverty gap ratio [incidence x depth of poverty] 3. Share of poorest quintile in national consumption
Target 2: Halve, between 1990 and 2015, the proportion of people who suffer from hunger	4. Prevalence of underweight children under-five years of age 5. Proportion of population below minimum level of dietary energy consumption
Goal 2: Achieve universal primary education	
Target 3: Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling	6. Net enrolment ratio in primary education 7. Proportion of pupils starting grade 1 who reach grade 5[b] 8. Literacy rate of 15-24 year-olds
Goal 3: Promote gender equality and empower women	
Target 4: Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015	9. Ratios of girls to boys in primary, secondary and tertiary education 10. Ratio of literate women to men, 15-24 years old 11. Share of women in wage employment in the non-agricultural sector 12. Proportion of seats held by women in national parliament
Goal 4: Reduce child mortality	
Target 5: Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate	13. Under-five mortality rate 14. Infant mortality rate 15. Proportion of 1 year-old children immunised against measles

Note: Goals, targets and indicators effective 8 September 2003.

[a] For monitoring country poverty trends, indicators based on national poverty lines should be used, where available.

[b] An alternative indicator under development is “primary completion rate”.

Millennium Development Goals 5-6

Goal 5: Improve maternal health	
Target 6: Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio	16. Maternal mortality ratio 17. Proportion of births attended by skilled health personnel
Goal 6: Combat HIV/AIDS, malaria and other diseases	
Target 7: Have halted by 2015 and begun to reverse the spread of HIV/AIDS	18. HIV prevalence among pregnant women aged 15-24 years 19. Condom use rate of the contraceptive prevalence rate[a] 19a. Condom use at last high-risk sex 19b. Percentage of population aged 15-24 years with comprehensive correct knowledge of HIV/AIDS[b] 19c. Contraceptive prevalence rate 20. Ratio of school attendance of orphans to school attendance of non-orphans aged 10-14 years
Target 8: Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases	21. Prevalence and death rates associated with malaria 22. Proportion of population in malaria-risk areas using effective malaria prevention and treatment measures[c] 23. Prevalence and death rates associated with tuberculosis 24. Proportion of tuberculosis cases detected and cured under directly observed treatment short course DOTS (Internationally recommended TB control strategy)

[a] Amongst contraceptive methods, only condoms are effective in preventing HIV transmission. Since the condom use rate is only measured among women in union, it is supplemented by an indicator on condom use in high-risk situations (indicator 19a) and an indicator on HIV/AIDS knowledge (indicator 19b). Indicator 19c (contraceptive prevalence rate) is also useful in tracking progress in other health, gender and poverty goals.

[b] This indicator is defined as the percentage of population aged 15-24 who correctly identify the two major ways of preventing the sexual transmission of HIV (using condoms and limiting sex to one faithful, uninfected partner), who reject the two most common local misconceptions about HIV transmission, and who know that a healthy-looking person can transmit HIV. However, since there are currently not a sufficient number of surveys to be able to calculate the indicator as defined above, UNICEF, in collaboration with UNAIDS and WHO, produced two proxy indicators that represent two components of the actual indicator. They are the following: a) percentage of women and men 15-24 who know that a person can protect herself/himself from HIV infection by "consistent use of condom"; b) percentage of women and men 15-24 who know a healthy-looking person can transmit HIV.

[c] Prevention to be measured by the percentage of children under 5 sleeping under insecticide-treated bednets; treatment to be measured by percentage of children under 5 who are appropriately treated.

IDEAL CHARACTERISTICS of Data/Indicators

valid: actually measure what supposed to

objective: same answer if measured by different people in similar circumstances

sensitive: sensitive to changes in the situation

specific: reflect changes only in the situation concerned

In real life, few indicators comply with these criteria

Decisive factor: Feasibility (organizational, technical, and financial) of collecting and analyzing the information

Data trade-Offs

Between what is relatively simple and cheap to collect and the degree of precision of the information and its validity.

Remembering, the countries that most need information are usually those that are least able to obtain the information precisely

Thus, a balance has to be struck between

- the allocation of resources to information collection for making priority decisions about alternative strategies and action
- and the allocation of resources to the programmes themselves.

Common Sources of Data

- Available data (routine)
  - Health system (administrative)
    - Health facility data
    - Disease registries
    - Sentinel surveillance systems
  - Community surveys
    - Research Demographic Surveillance Sites (DSS)
    - Multinational health surveys (WHO WHS, DHS, MICS)
  - Other
    - Census (every 10 years)
    - Vital registers, sample vital registration
- Not routine
  - New data creation

World Health Survey (WHO)

70 countries

HH, SES, Health status, Health Systems utilization information

- Pros: Standardized methods, many indicators, data available (STATA)
- Cons: Expensive, analyzable at national/subnational levels

DHS Surveys – Demographic & Health Survey (MeasureDHS.com - USAID)

- Focus on MCH, HIV, KAP, SES
- 70 countries – (USAID Countries) rounds every 5 years
- Over 200 surveys done
- Newer surveys
  - SPA – service provision assessment
  - AIS – AIDS indicator surveys
  - Qualitative surveys
- Same pros & cons
- Data available in reports & data files for SPSS, STATA

Routine Health System Data

Purpose: to plan, evaluate (programs and personnel)

Characteristics:

- cheap, easy to collect
- utilization dependent
- big variation between facilities
- disease specific (diarrhea vs. malaria)

Characteristics and concerns re Health Systems Information

- training, motivation dependent - importance of supervision, feedback, relevance
- personnel changes, time limitation
- gaps in collection, aggregation, forwarding
- numerator-denominator mismatch
- under-reports morbidity and mortality
- over-reports health service activities
- differences between govt/private/NGO/traditional sectors
- referral - double counting, where to list people

Routine vs. “New” data

- Balance availability vs. accuracy vs. cost
  - Does routine data have relevant indicators?
  - Is routine data collected at appropriate time-points for study?
  - Is routine data accurate enough to make decisions?
  - Is need for “new” data justified by cost/time?

- Remember:
  - Strengthening routine data systems always an option
    - Can be followed over time and used for variety of purposes
  - Information is rarely “perfect”
    - Avoid paralysis by analysis

Using routine data (1)

- Disaggregate
  - Identify trends (all facilities or just a few)
  - Look for outliers and missing data
- Clarify and validate denominators
  - 1st Prenatal visit – vs registries
  - Identify community based denominators (e.g., EPI)
- Cross check
  - e.g., births & LBW, health cards & prenatal care registers

Example: ANC and pMTCT coverage 2 districts in Northern Cote d'Ivoire

	Beoumi	Dabakala
% ANC coverage	95%	96%
% pMTCT	88%	103%

ANC and pMTCT results by health facility

REGION	DISTRICT	2010	Health Facility	Number of pregnant women attending at least the first ANC (ANC1)													Tot pregnancies	% coverage	received HIV results	% HIV results
				Jan	Fev	Mars	Avril	Mai	Juin	Juli	Aout	Sept	Oct	Nov	Dec	TOTAL				
	Beoumi	28298	HG Beoumi	79	76	78	61	77	68	72	101	52	85	68	98	**915**	**1273**	**72%**	**801**	**88%**
		5676	CSR Afotobo	38	39	42	31	49	37	30	30	31	29	26	22	**404**	**255**	**158%**	**431**	**107%**
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		3399	CSR N'guessankro			26	19	20	19	22	17	20	22	25	21	**211**	**153**	**138%**	**204**	**97%**
		6031	CSU Andokekren-	36	27	36	23	43	26	36	14	23	0	0	0	**264**	**271**	**97%**	**129**	**49%**
		4027	CSR Lolobo				24	12	11	15	15	9	29	11	8	**134**	**181**	**74%**	**153**	**114%**
		3967	CSU Bodokro			18	29	30	10	30	23	31	29	29	17	**246**	**179**	**138%**	**280**	**114%**
		60600	**TOT Beomi**	**202**	**174**	**238**	**216**	**271**	**210**	**234**	**223**	**198**	**224**	**183**	**205**	**2578**	**2727**	**95%**	**2485**	**96%**
	Dabakala	31425	HG Dabakala	60	55	115	81	94	87	48	90	67	40	54	45	**836**	**1414**	**59%**	**950**	**114%**
		11966	CSU Bonieré	80	62	77	61	52	43	54	57	39	42	41	36	**644**	**538**	**120%**	**690**	**107%**
		2304	CSU Satama	53	41	52	59	43	33	49	49	39	54	48	25	**545**	**104**	**526%**	**519**	**95%**
		10544	CSU Satama	37	22	35	25	34	21	24	20	13	24	22	23	**300**	**474**	**63%**	**285**	**95%**
		13658	CSU Foumbolo	55	69	72	59	71	38	38	68	37	49	48	46	**650**	**615**	**106%**	**674**	**104%**
		13891	CSU Bassawa	36	41	44	36	38	30	29	16	20	21	4	37	**352**	**625**	**56%**	**311**	**88%**
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		87923	**Tot Dabakala**	**361**	**302**	**404**	**332**	**349**	**262**	**258**	**311**	**223**	**241**	**217**	**212**	**3472**	**3957**	**88%**	**3568**	**103%**
		528337	**Total 2 Districts**	**672**	**613**	**715**	**643**	**660**	**573**	**569**	**622**	**534**	**552**	**528**	**523**	**3783**	**4268**	**89%**	**3879**	**103%**

Using routine data (2)

- Compare with usually reliable data
  - Institutional births, deaths
  - DHS, WHO, special studies
- Look for inconsistencies, surprises
  - Usually related to data collection
  - Don’t invoke unusual theories without checking validity
- Avoid missed counts, double counting
  - Sequential annual reports help
  - Record % monthly reports received

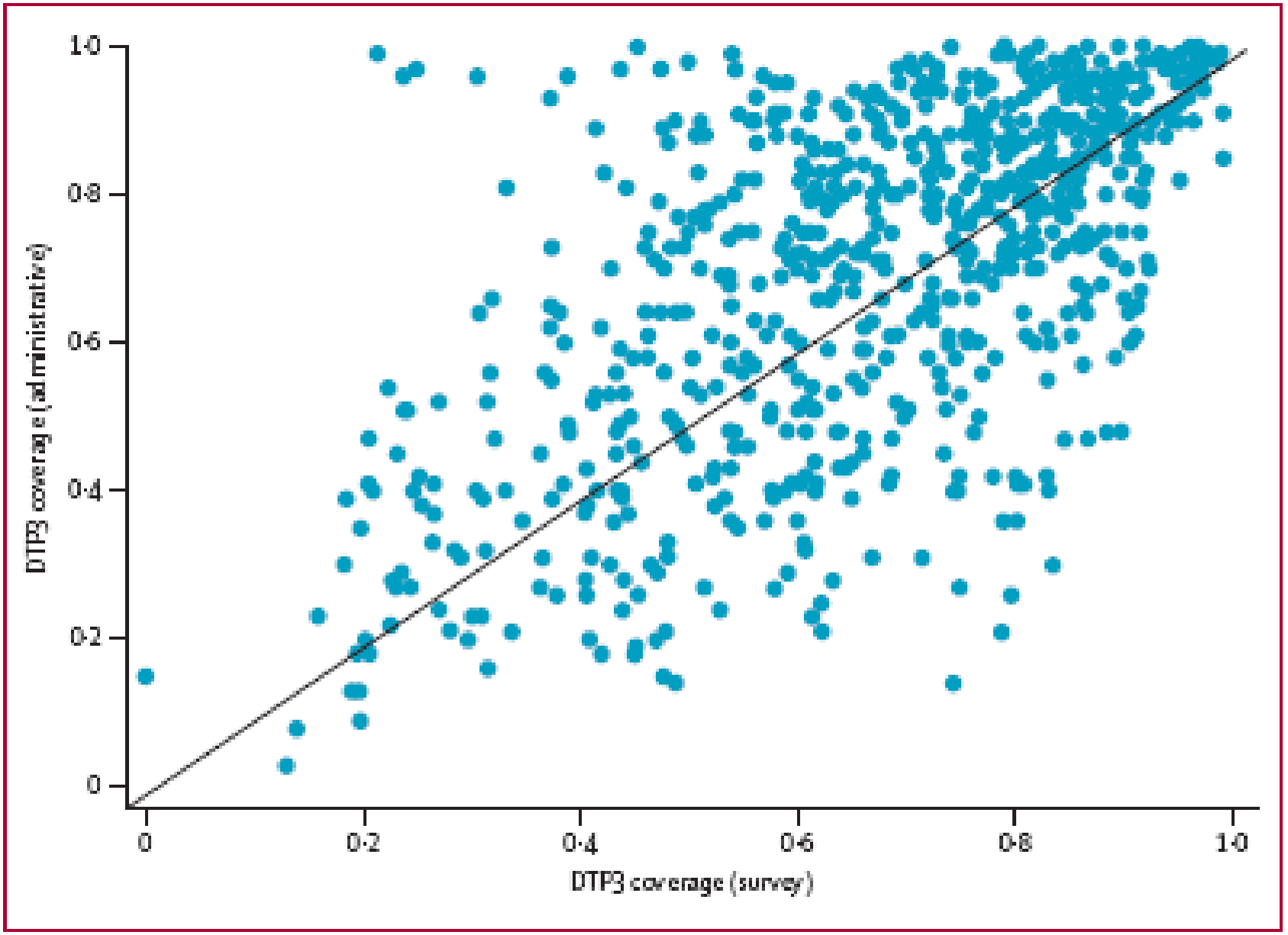
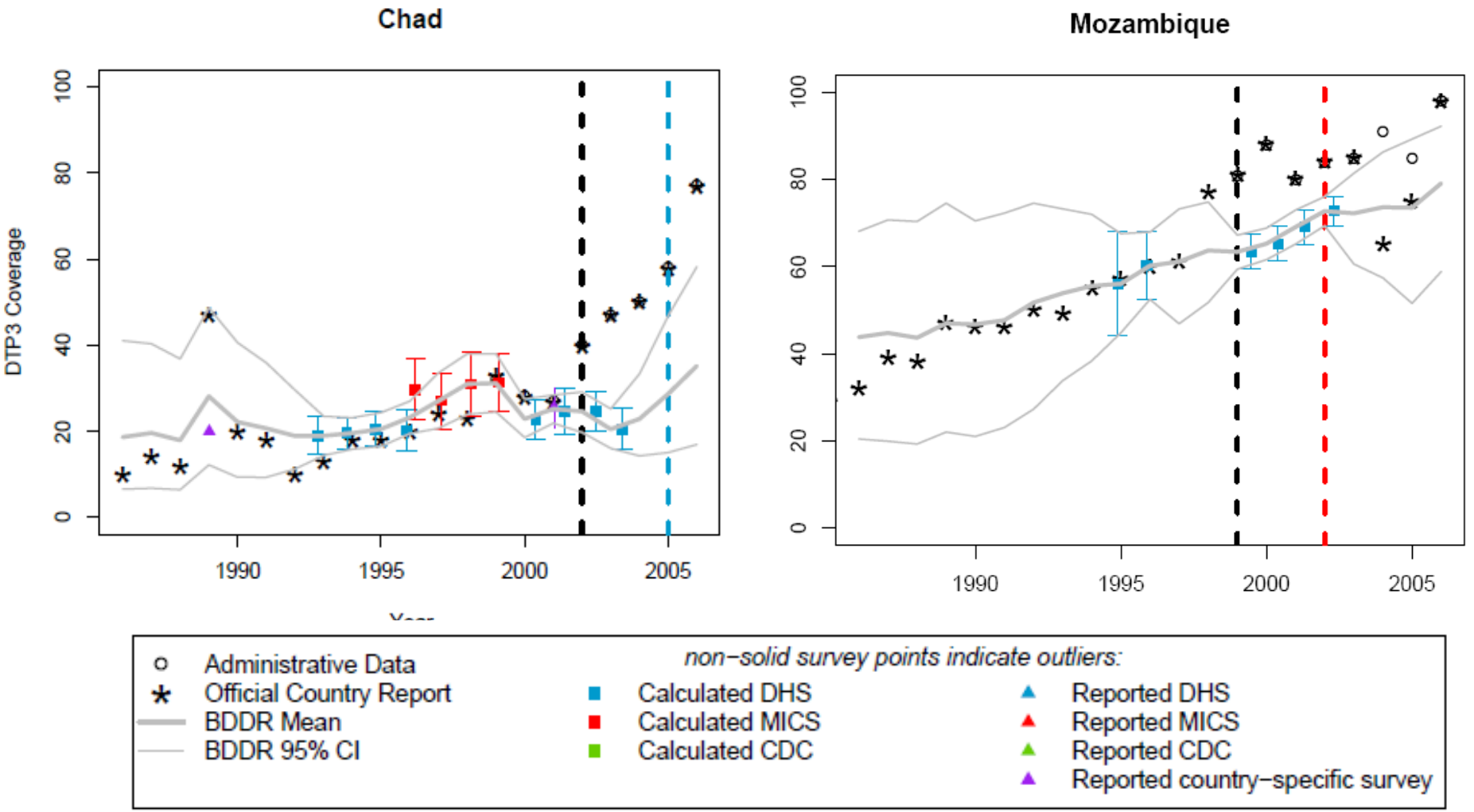


Figure 2: Comparison of three doses of diphtheria, tetanus, and pertussis (DTP3) immunisation coverage estimated from administrative data and estimated from surveys

From: Lim SS, et al, Lancet 2008; 372:2031-46

Routine Data Comparisons – DPT3 Coverage and GAVI



From: Lim SS, et al, Lancet 2008; 372:2031-46

Using routine data (3)

Perform data audits (facilities to combined report)

When reporting

- Identify sources of data
  - nutritional assessment – Wt/Ht vs MUAC
  - “access to health care”
- Explain your assessment of validity (accuracy and reliablity)

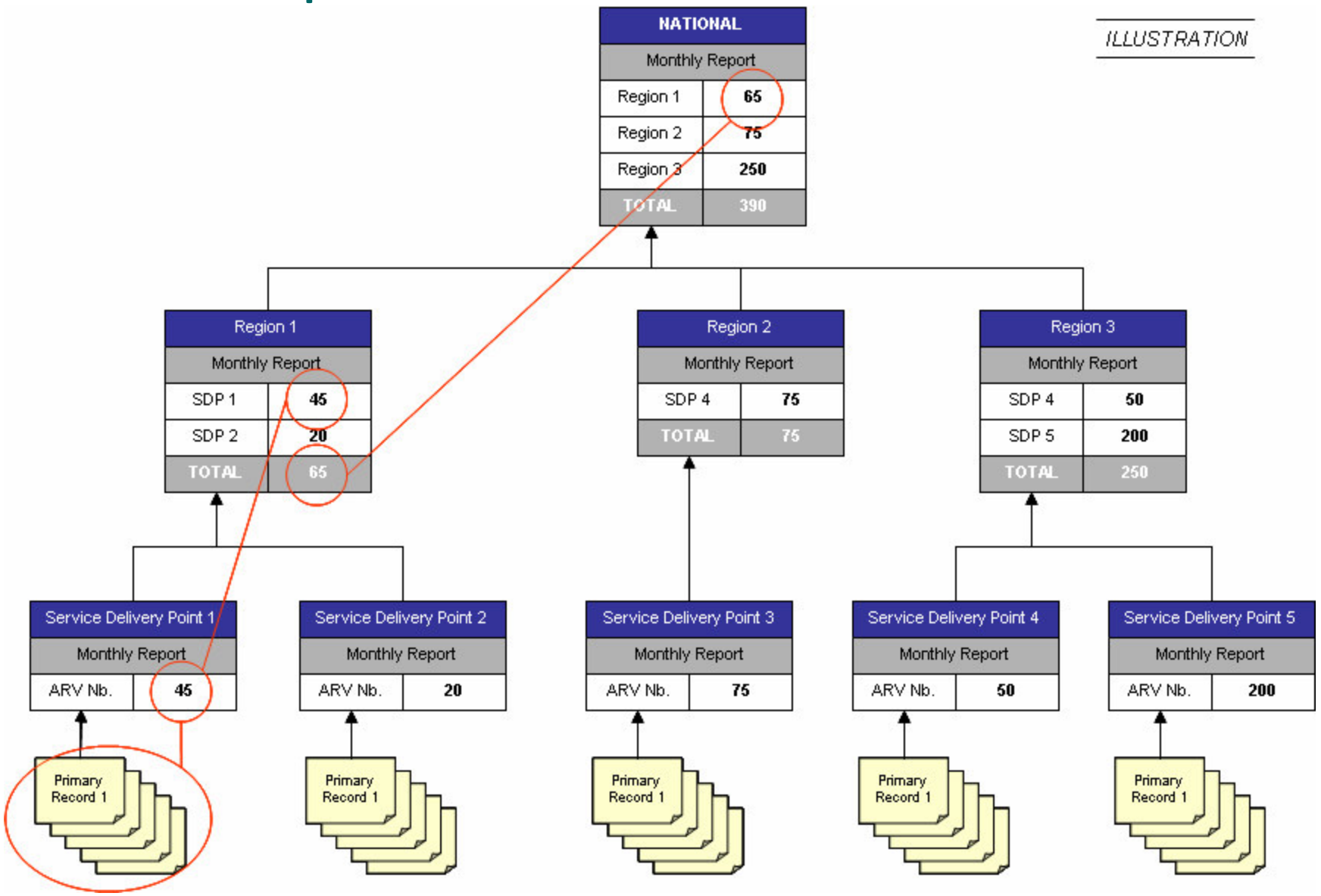
Bottom-up data audit in Mozambique*

(Pilot sample of PHC from 9 health facilities across 3 districts)

- Determine the availability of monthly facility reports at the health facility and district (12 months)
  - Presence/absence of reports for (1) institutional births and (2) DPT3
- Determine the reliability (concordance) of monthly statistics obtained from facility clinical registries, monthly facility reports and the MOH electronic database (6 months)
  - Proportion of months where data were identical
  - Calculate % difference for months where data not identical
  - 5 key indicators: 1ANC, Institutional birth, DPT3, HIV testing, Outpatient Consults

* Gimbel S et al, Strengthening primary health care through routine health information system assessment in Sofala Province, Mozambique. Presentation at The First Global Symposium on Health Systems Research. Montreux, Switzerland.

Bottom-up audit trail



Indicators that I like

- % of (estimated) pregnant women attending prenatal care
- % births attended by trained personnel (institutional births)
- % children 12-24 mo immunized against measles/DPT3
- % children < -2z Wt/Age, Ht/Age, Wt/Ht
- % women of married women aged 15-49 currently using modern contraception
- % TB patients who complete treatment
- % children enrolled in primary (secondary) school (net or gross)

Thank you!

				L2: Number of pregnant women attending at least the first ANC (ANC1)												
				Nombre de CPN 1 effectuées												
REGION	DISTRICT	2010	Health Facility	Jan	Fev	Mars	Avril	Mai	Juin	Juli	Aout	Sept	Oct	Nov	Dec	TOTAL
VALLEE DU BANDAMA	Bouake Nord-Est	94185	Kotiakoffikro	127	104	65	59	132	103	99	86	61	80	61	64	**1041**
		56686	CSU Belleville	129	103	101	62	63	50	48	67	66	63	69	**50**	**871**
		54899	CSU Sokoura	129	124	130	104	125	98	90	72	94	114	112	87	**1279**
		~~29180~~	~~PMI Sokoura~~	~~62~~	~~47~~	~~72~~	~~54~~	~~43~~	~~56~~	~~56~~	~~56~~	~~47~~	~~66~~	~~70~~	~~57~~	~~**686**~~
		12803	CSU Brobo	62	43	63	69	60	56	52	62	44	61	60	45	**677**
		5149	CSR Bamoro	24	28	25	17	20	27	23	37	23	29	37	22	**312**
		2681	CSR Bounda				21	13	22	20	25	14	15	20	10	**160**
		2476	CSR Langbassou	29	33	29	21	14	28	31	37	18	25	43	64	**372**
	Bouake Sud	80176	PMI Koko	318	238	310	258	263	232	224	226	190	251	215	237	**2962**
		25621	CSU Nimbo	175	126	166	178	178	149	146	152	161	160	181	124	**1896**
		8980	CSU Djebonoua	26	30	35	39	43	35	36	36	36	40	31	35	**422**
			CC Djebonoua	18	27	34	41						38	15	18	**191**
		2807	CSR Assouakro	6	2	6	6	12	6	10	13	18	0	0	0	**79**
		4171	CSR Lengbre	19	11	6	18	11	9	10	8	8	2	7	2	**111**
	Bke NW		CSU Dar Es Salam										71	87	63	**221**
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	Subtot VDB	**528337**		**1687**	**1392**	**1684**	**1495**	**1597**	**1343**	**1337**	**1411**	**1201**	**1480**	**1408**	**1295**	**17330**

ANC and pMTCT in 2 districts of Northern Cote d'Ivoire

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Subtot VDB	**528337**		**1687**	**1392**	**1684**	**1495**	**1597**	**1343**	**1337**	**1411**	**1201**	**1480**	**1408**	**1295**	**17330**	**23775**	**73%**	**20526**	**118%**

WHAT DATA CAN YOU TRUST?

Some characteristics which increase validity:

-based on 2 or more well-conducted studies

- big demographic studies (fertility studies are good and often available)
- published research

-consistent with generally accepted data

- IMR, U5MR, Birth Rates
- Nutrition data (not easy to get)

-consistency between routine service data and community collected data

Other data characteristics

Doesn't help much

-consistent over time

-formally presented

Should make you suspicious

-substantial differences from other published data

-inconsistencies (time, between collectors, units)

-sensitive information (regarding sexuality, religion, etc)

-data from which someone may benefit

Measuring indicators

- Multiple measurement methods usually available
- Choosing method is a balance between:
  - Validity
  - Cost (allocation of resources for research vs. service delivery)
  - Study design issues
    - Sample size
    - Sensitivity to change
    - Frequency of measurements required

Health facility data

- Clinical registers and individual patient charts, and resultant compiled monthly/annual reports
- Routine
- Indicators
  - Workload: outpatient visits, hospitalizations
  - Diagnoses, treatment
  - In-hospital morbidity/mortality
  - Coverage & utilization: ANC visits, facility births, vaccinations, HIV testing (ANC, in-patient, TB), TB registration & outcomes
  - Quality of care: patient chart review
  - Pharmacy records: malaria treatment, ART
- Pros:
  - Cheap, large coverage (depending on health service coverage)
- Cons:
  - Validity concerns
  - Only records facility-based events
  - Denominators (for coverage) based on census data
  - Usually does not include HR, lab/pharmacy measures (but could!)

New data creation

- Collecting new data to determine information "more accurately" or "more completely"
  - Questionnaires, direct observation, blood samples
- Added procedures (not routine)
- Indicators: variable / infinite
- Pros:
  - Can often obtain more accurate data, data otherwise not available, or data not from appropriate time-frame
- Cons:
  - Expensive, time consuming, suffers from biases and limitations in generalizability of study

Routine vs. “New” data

- Balance availability vs. accuracy vs. cost
  - Does routine data have relevant indicators?
  - Is routine data collected at appropriate time-points for study?
  - Is routine data accurate enough to make decisions?
  - Is need for “new” data justified by cost/time?

- Remember:
  - Strengthening routine data systems always an option
    - Can be followed over time and used for variety of purposes
  - Information is rarely “perfect”
    - Avoid paralysis by analysis

Can health systems data be used?

- Some concerns about validity

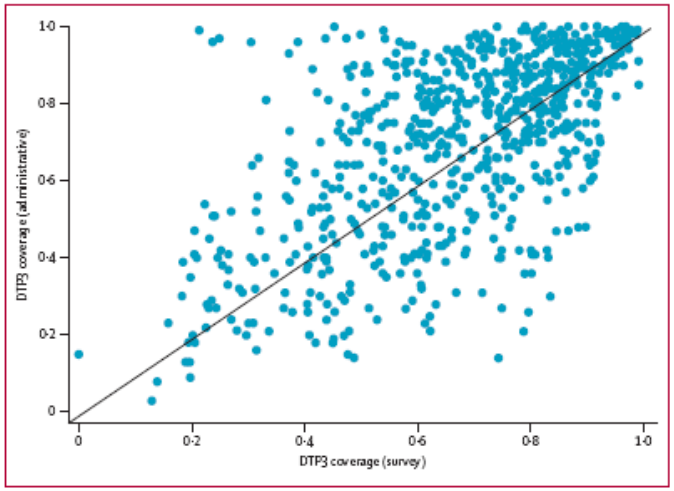
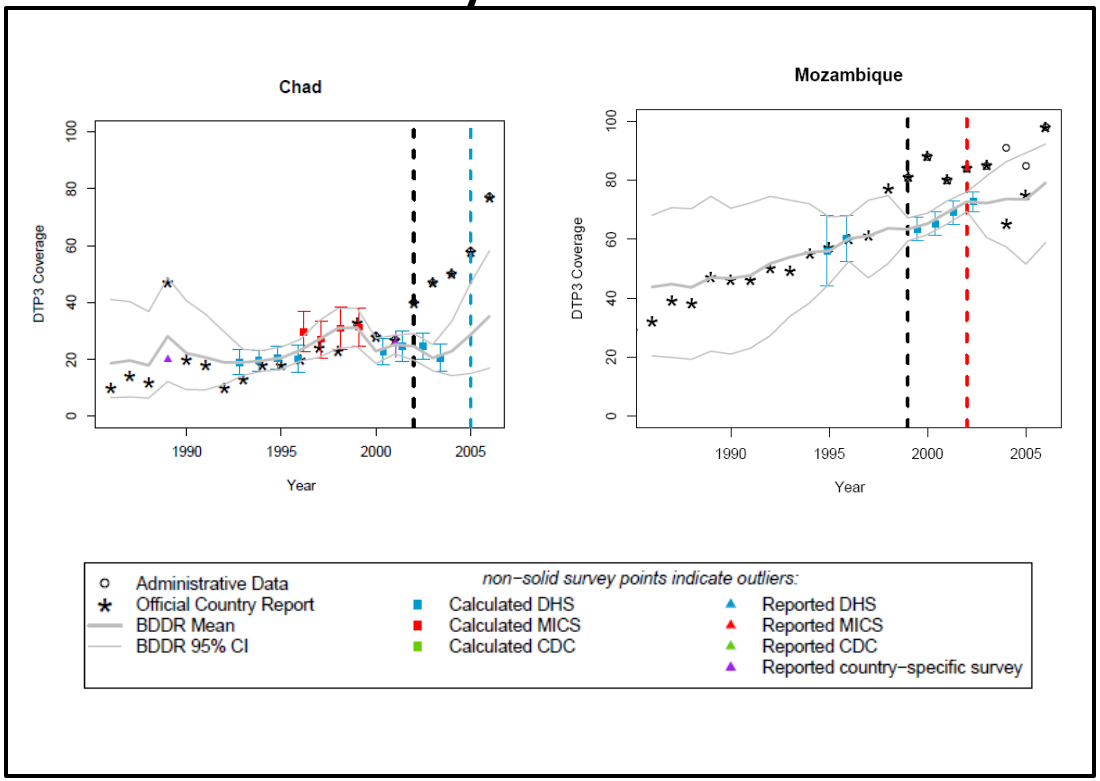


Figure 2: Comparison of three doses of diphtheria, tetanus, and pertussis (DTP3) immunisation coverage estimated from administrative data and estimated from surveys



From: Lim SS, et al, Lancet 2008; 372:2031-46

Measuring indicators

- Multiple measurement methods usually available
- Choosing method is a balance between:
  - Validity
  - Cost (allocation of resources for research vs. service delivery)
  - Study design issues
    - Sample size
    - Sensitivity to change
    - Frequency of measurements required

Health facility data

- Clinical registers and individual patient charts, and resultant compiled monthly/annual reports
- Routine
- Indicators
  - Workload: outpatient visits, hospitalizations
  - Diagnoses, treatment
  - In-hospital morbidity/mortality
  - Coverage & utilization: ANC visits, facility births, vaccinations, HIV testing (ANC, in-patient, TB), TB registration & outcomes
  - Quality of care: patient chart review
  - Pharmacy records: malaria treatment, ART
- Pros:
  - Cheap, large coverage (depending on health service coverage)
- Cons:
  - Validity concerns
  - Only records facility-based events
  - Denominators (for coverage) based on census data
  - Usually does not include HR, lab/pharmacy measures (but could!)

New data creation

- Collecting new data to determine information "more accurately" or "more completely"
  - Questionnaires, direct observation, blood samples
- Added procedures (not routine)
- Indicators: variable / infinite
- Pros:
  - Can often obtain more accurate data, data otherwise not available, or data not from appropriate time-frame
- Cons:
  - Expensive, time consuming, suffers from biases and limitations in generalizability of study

Methods-Part 2, Comparisons with DHS/MICS

- Examine the validity of HIS data by comparison with population-level surveys
  - 3 key indicators: 1ANC, institutional birth, DPT3
  - Compared statistics from the provincial health department's annual reports (derived from MOH electronic database) with those obtained from the 1997 and 2003 DHS and 2008 MICS.

Summary of results

- Availability of monthly reports: 98.1% at health facility, 98.6% at district health department
- Concordance between monthly facility reports and MOH electronic databases = 98.0%
- Weaker concordance between monthly facility registers and facility reports = 80%
  - Clustered around 2 main facilities
  - 86% of differences were <10%

Concordance between health facility registries and monthly facility reports

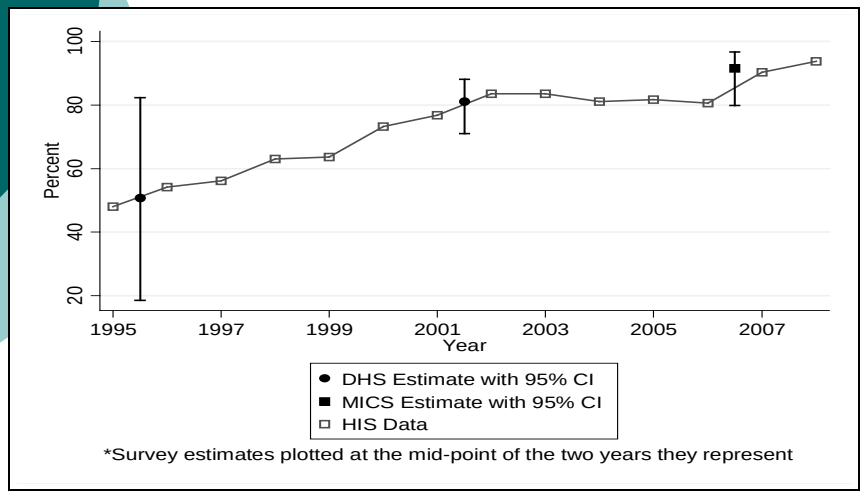
District		Health Facility Type	# months in which figures from facility clinical registers match monthly facility reports, for 6 month period Jun 1, 2008 to Dec 31, 2008, by indicator					TOTAL	Global Fund Rating Grade*
			1st ANC	Institutional Birth	DPT3	HIV Testing	Outpatient Consults		
			N (%)	N (%)	N (%)	N (%)	N (%)		
1	a	Urban	1/6 (17)	2/6 (33)	4/6 (67)	0/6 (0)	4/6 (67)	11/30 (37)	B2
	b	Peri-Urban	5/6 (83)	6/6 (100)	6/6 (100)	NA	6/6 (100)	23/24 (96)	A
	c	Rural	6/6 (100)	6/6 (100)	6/6 (100)	NA	6/6 (100)	24/24 (100)	A
2	a	Urban	2/6 (33)	1/6 (17)	2/6 (33)	3/6 (50)	6/6 (100)	14/30 (47)	B2
	b	Peri-Urban	6/6 (100)	1/6 (17)	6/6 (100)	6/6 (100)	NA	19/24 (79)	B2
	c	Rural	6/6 (100)	4/6 (67)	6/6 (100)	NA	6/6 (100)	22/24 (92)	A
3	a	Urban	6/6 (100)	6/6 (100)	5/6 (83)	6/6 (100)	6/6 (100)	29/30 (97)	A
	b	Urban	4/6 (67)	6/6 (100)	5/6 (83)	6/6 (100)	4/6 (67)	25/30 (83)	B1
	c	Urban	6/6 (100)	6/6 (100)	6/6 (100)	5/6 (83)	6/6 (100)	29/30 (97)	A
TOTAL			42/54 (77)	38/54 (70)	46/54 (85)	26/36 (72)	44/48 (92)	196/246 (80)	B1

NA = not applicable because the service was either not provided at the site (HIV) or not available during the data collection period (outpatient)

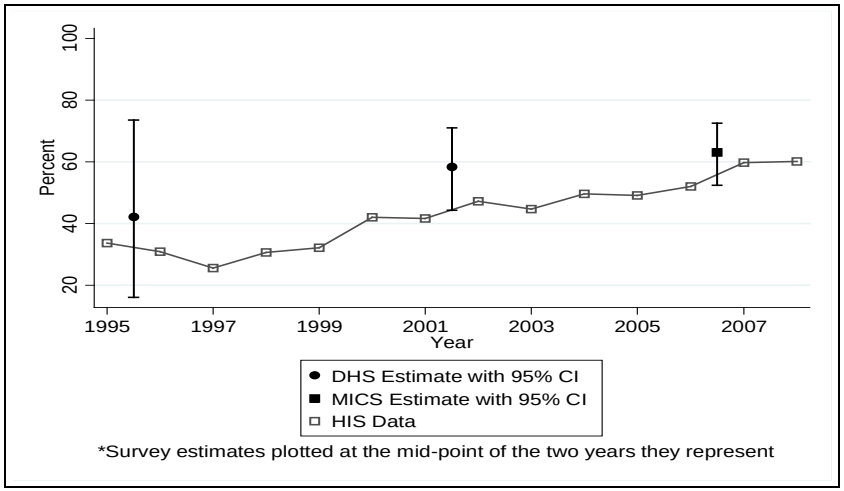
* GF Rating	Metric
A	Less than 10% error margin
B1	Between 10%-20% error margin
B2	Above 20% error margin
C	No systems in place

Comparison with DHS surveys

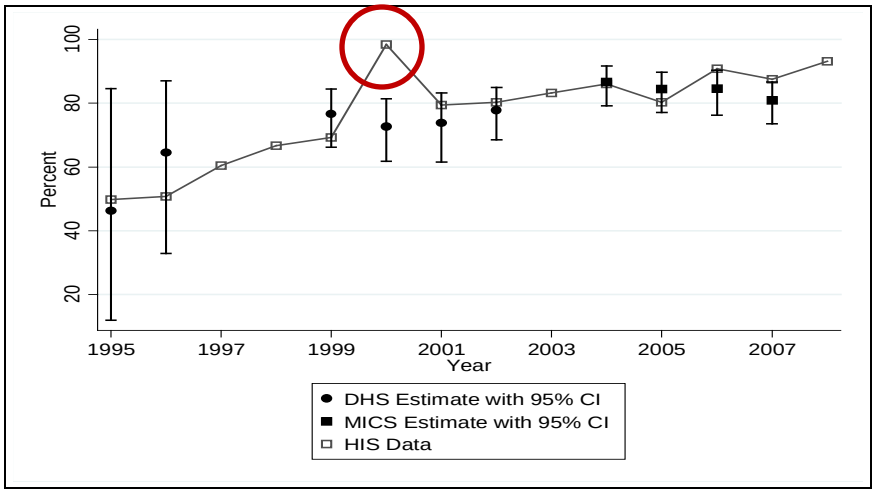
ANC care



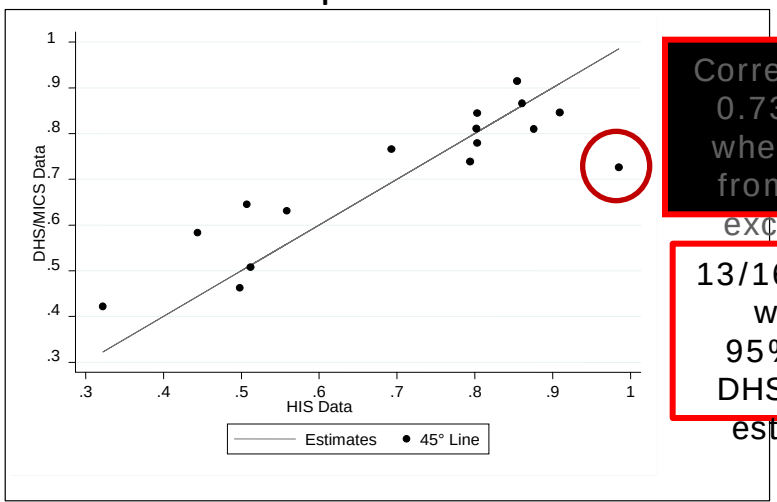
Institutional delivery



DPT3



Statistical comparison



Correlation = 0.73 (0.88 when DPT3 from 2000 excluded)

13/16 (81%) within 95%CI of DHS/MICS estimate

Data transfer from register to report is common problem

- **6 pMTCT data elements (ANC tested for HIV, ANC HIV+, CD4 testing of HIV+ women, NVP to woman, NVP to baby, PCR to baby) from 99 randomly chosen sites**

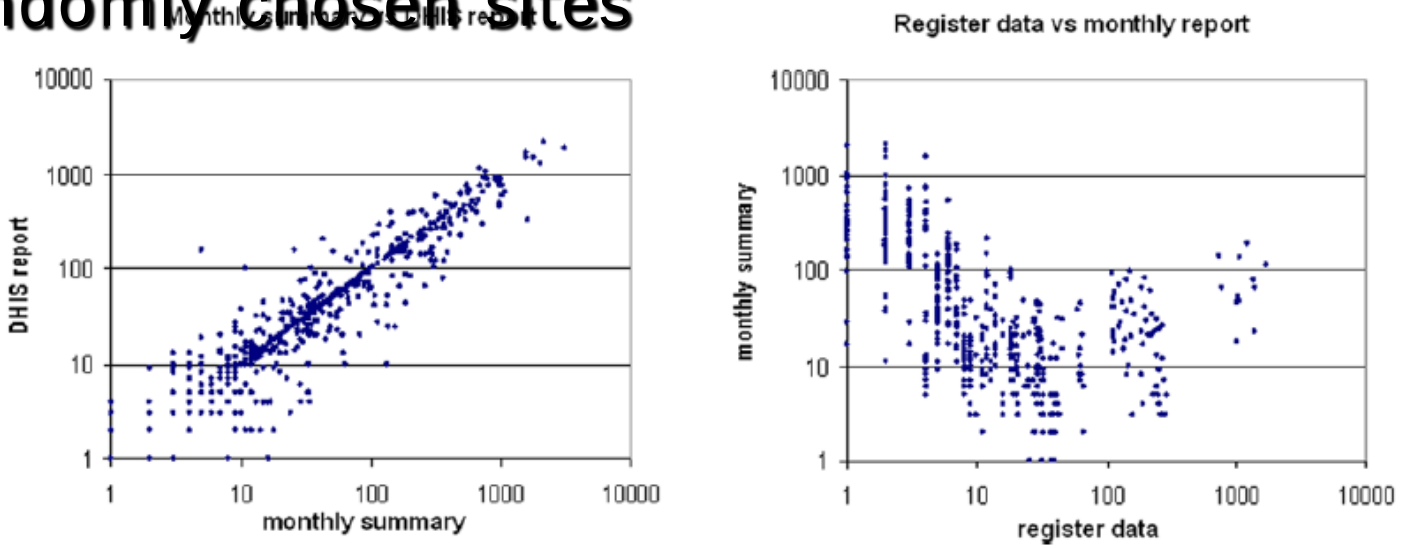
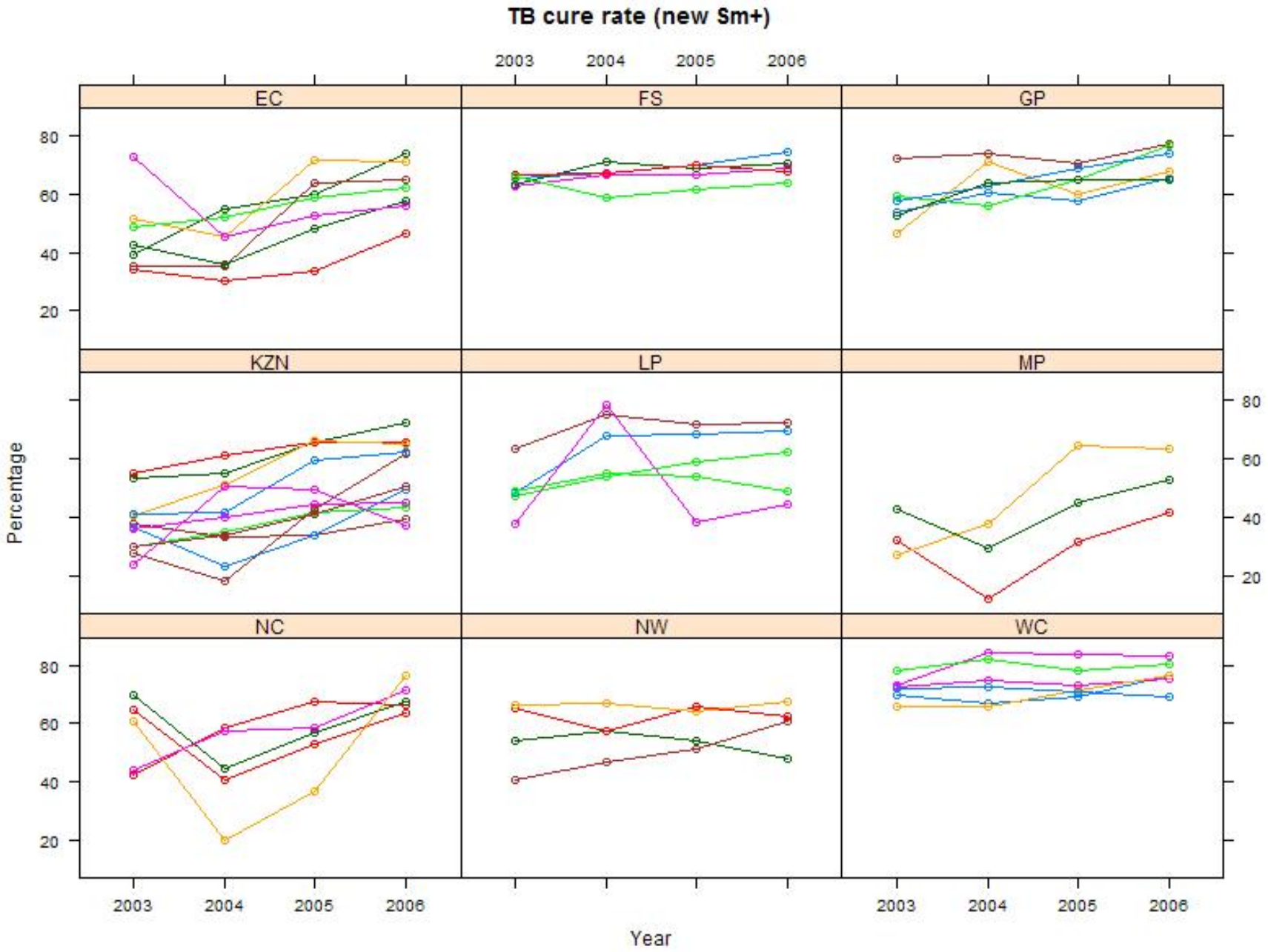


Figure 4. a & b: Data concordance between Clinics' Monthly Summary sheets and DHIS report (Figure 4a) and between Clinics' register data and Monthly Summary sheet (Figure 4b).
doi:10.1371/journal.pone.0005483.g004

- From: Mate KS et al, Challenges for routine health system data management in a large public programme to prevent mother-to-child HIV transmission in South Afirca. PlosOne, 2009; 4(5):e5483.

Time trends: district values, per province (DHB)



Further characteristics of HSR/OR

- Action research
- Involves policy makers, users and providers in design
- Uses standard qualitative and quantitative methods
- Embedded in people's day-to-day practices

Helpful conditions for HSR/OR

- Engagement in service delivery
- Work closely with decision-makers
- Opportunistic research funding
- Reward systems (status, publications, promotion)

Increasing use of HSR/OR

- WHO - Real Time Interactive OR (RTIOR)
- Doris Duke Foundation - OR grants
- PEPFAR -Technical Evaluations, Public Health Evaluations

Implementation science at the UW

- Operations research in several courses (Micek, Dept of Industrial & Systems Engineering)
- Health Systems and Strategies Research CFAR (Gloyd-Micek)
- Implementation science course in 2010 (Sherr)
- MPH in leadership, policy, and management (Katz)
- Global Health Leadership Program (Katz)
- Potential PhD in Global Health Implementation Science (Departments of Global Health, Health Services, Schools of Business, Engineering, Public Affairs)

WHAT DEGREE OF PRECISION IS NECESSARY?

varies by the indicator:

examples

- IMR - general magnitude
- Vaccine rates - to measure change (+/- 10%?)
- HIV-TB - measure changes and service burden