Revisiting Optimal Breast Feeding Durations:

Modelling the impact of maternal ARV use and infant mortality

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Outline

- Roles for model-based analyses in pediatric HIV
- Overview of prior work
- Revised analyses to inform 2015 guidelines

Why Model-based Analyses?

- Decisions must be made before “perfect” information can be obtained
  - Data are incomplete or controversial
  - Trials are infeasible
  - Outcomes are difficult to ascertain for entire cohort
- Integrate existing, varied data to understand a cascade or chain of care/delivery services
- Balance of risks and benefits required
  - Competing events over time (mortality vs. infection)

Goals

- To examine the breastfeeding duration that maximizes HIV-free survival (HFS) for infants of HIV-infected mothers, incorporating:
  - Relative risks of child mortality due to replacement feeding
  - ARV duration during breastfeeding (retention in care)
  - Neonatal/infant/under-5 mortality rates

- To acquire feedback for an online tool that may inform BF recommendations

CEPAC-Pediatric Model

- Monte Carlo simulation model
  - Published data: MTCT risks, HIV disease progression, impact of ART
  - Previously validated against published survival and HFS data

- For this analysis, "simplified" CEPAC-Pediatric model: focus on MTCT and mortality among HIV-exposed infants
  - Infants enter the model at birth as HIV-exposed/uninfected
  - Monthly risks of: HIV infection, all-cause mortality, maternal mortality
    - MTCT risk: Modified by maternal ARV use
    - Infant mortality risk: Modified by feeding modality
      - Replacement feeding → increased all-cause mortality risk
      - Relative risk from replacement feeding: "RR-RF"
    - Maternal mortality → weaning (RR-RF applies, MTCT risk ends)

- Outcome of interest: HIV-free survival (HFS) at 24 months

Ciaranello et al, PLoS ONE 2013; AIDS 2014; AIDS 2015

Optimal BF durations: Existing Models

Ciaranello *et al.*, *AIDS 2014*

Maternal CD4/μL, ARV availability	24-month HIV-free survival (%)[a]						
	Breastfeeding duration (months)						
	0[b]	3	6	9	12	18	24[c]
RR-RF 1.0							
CD4≤350, no ARVs	93.0	90.9	89.0	85.8	82.8	77.4	72.7
CD4>350, no ARVs	93.0	92.3	91.7	90.6	89.6	87.5	85.6
CD4≤350, maternal ART	93.0	92.1	91.2	90.3	89.4	87.7	86.0
CD4>350, infant NVP	93.0	92.4	91.8	91.2	90.6	89.5	88.3
CD4>350, maternal ART	93.0	92.5	92.0	91.5	91.0	90.0	89.0
RR-RF 2.0							
CD4≤350, no ARVs	86.5	87.1	86.3	83.9	81.6	76.8	72.3
CD4>350, no ARVs	86.5	88.5	89.0	88.7	88.4	87.1	85.4
CD4≤350, maternal ART	86.5	88.3	88.5	88.4	88.2	87.2	85.9
CD4>350, infant NVP	86.5	88.5	89.1	89.2	89.4	89.0	88.2
CD4>350, maternal ART	86.5	88.7	89.3	89.5	89.8	89.6	88.9
RR-RF 3.0							
CD4≤350, no ARVs	80.4	83.5	83.7	82.0	80.4	76.2	72.0
CD4>350, no ARVs	80.4	84.9	86.4	86.8	87.2	86.6	85.3
CD4≤350, maternal ART	80.4	84.6	85.9	86.4	87.1	86.8	85.8
CD4>350, infant NVP	80.4	84.9	86.4	87.3	88.2	88.5	88.1
CD4>350, maternal ART	80.4	85.0	86.7	87.6	88.6	89.1	88.9

Limitations:

1. Unable to capture adherence or variations in durations of ARV use
   -- E.g. continued BF after discontinuing ART

2. RR-RF values are difficult to know for any given setting or individual

3. Relationship between RR-RF and underlying infant mortality rates is not clear

4. Other published models: 0, 6, 24 months, pre-ARV data

Optimal BF durations: New Assumptions

- Maternal ART use
  - Categories of ART duration: 0, 3, 6, 9, 12, 15, 18, 24 months
    - MTCT risk after ART discontinuation assumed equal to MTCT risk with no ART use

Carter et al 2010, JAIDS

Inputs: Postnatal Infection Risks

Maternal status	Exclusive BF risk/month	Mixed BF risk/month	Sources
No ART			
CD4 >350/µL	0.0024	0.0040 *Spectrum: 0.0051*	ZEBS; ZVITAMBO, Coutsoudis 01, Leroy 98
CD4 ≤350/µL	0.0076	0.0128 *Spectrum: 0.0157*	ZEBS; ZVITAMBO, Coutsoudis 01, Leroy 98
Maternal ART			
Any CD4	0.0019	0.0019 *Spectrum: 0.02*	KiBS, AMATA, Mitra Plus, DREAM, BAN, MASHI, Kesho Bora, Mma Bana

Assumptions:

1. CD4 distribution among women not on ART from MTCT-Plus cohort (new)
2. MTCT on ART does not depend on maternal CD4 (new)
3. Risk is constant over time for infants who continue to breastfeed (unchanged)

Carter et al 2010, JAIDS, Ciaranello et al, AIDS 2014

Inputs: Mortality Risks (HEU at birth, BF)

- Mortality rates for HIV- exposed/infants derived from 21 Global Plan countries[1]
  - Assumed that HIV-exposed/uninfected infants experience the same mortality risks as infants in the general population

	Neonatal Mortality (per 1000)	Infant Mortality (per 1000)	Under - 5 Mortality (per 1000)
Moderate Mortality (Base Case)	**30**	**55**	**85**
Low Mortality	20	45	65
High Mortality	45	80	120

Comparing Prior and New Inputs

Age (months)	Mortality risk (%/month) Prior analysis: Becquet and Marston	Monthly risk (%/month) Current analysis: U5 mortality rates
0-2	1.01 (0.91-1.15)	1.16 (0.76-1.72)
3-5	0.41 (0.38-0.45)	0.24 (0.14-0.34)
6-11	0.28 (0.28-0.30)	0.24 (0.14-0.34)
12-17	0.14 (0.12-0.14)	0.07 (0.02-0.09)
18-23	0.07 (0.05-0.09)	0.07 (0.02-0.09)

Becquet, PLoS Med 2012; Marston, IJE 2011; Ciaranello et al, AIDS 2014, World Bank 2014

Relative Risk of Mortality due to Replacement Feeding (RR-RF)

Reported values	Setting and sources
1.0	Kenya, Côte d'Ivoire, South Africa Nduati 2000; Peltier 2009; Rollins 2008
2.0	Botswana, Malawi MASHI, 2006
1.8-3.3	Malawi Taha, 2006
2.6-4.2	Zambia Kuhn, 2008
6.0	Uganda Kagaayi, 2008; Homsy 2010

- Derived from studies of HIV-exposed breastfed and replacement fed infants
- Base case: RR-RF assumed constant from cessation of breastfeeding until the age of the outcome of interest (24 months)

Becquet, PLoS Med 2012; Marston, IJE 2011; Ciaranello et al, AIDS 2014

Results: HIV-free Survival

- Impact of RR-RF
- Impact of ARV duration (retention in care)
- Impact of neonatal/infant/U5 mortality rates

Carter et al 2010, JAIDS

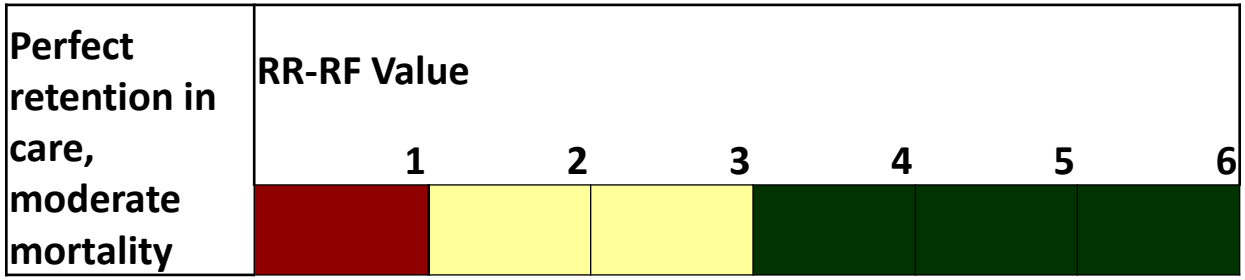
Impact of RR-RF

	24-month HIV-free survival (%)		
Perfect retention in care, moderate mortality	**RR-RF=1**	**RR-RF=3**	**RR-RF=6**
BF 0 mo	93.759	83.098	69.325
BF 3 mo	93.257	88.260	81.283
BF 6 mo	92.724	88.674	82.922
BF 9 mo	92.186	89.428	85.426
BF 12 mo	91.724	90.205	88.003
BF 15 mo	91.212	90.073	88.376
BF 18 mo	90.706	89.928	88.791
BF 21 mo	90.220	89.780	89.185
BF 24 mo	89.708	89.671	89.589

Optimal BF duration (duration at which HFS is maximized): here, 0, 12, or 24m

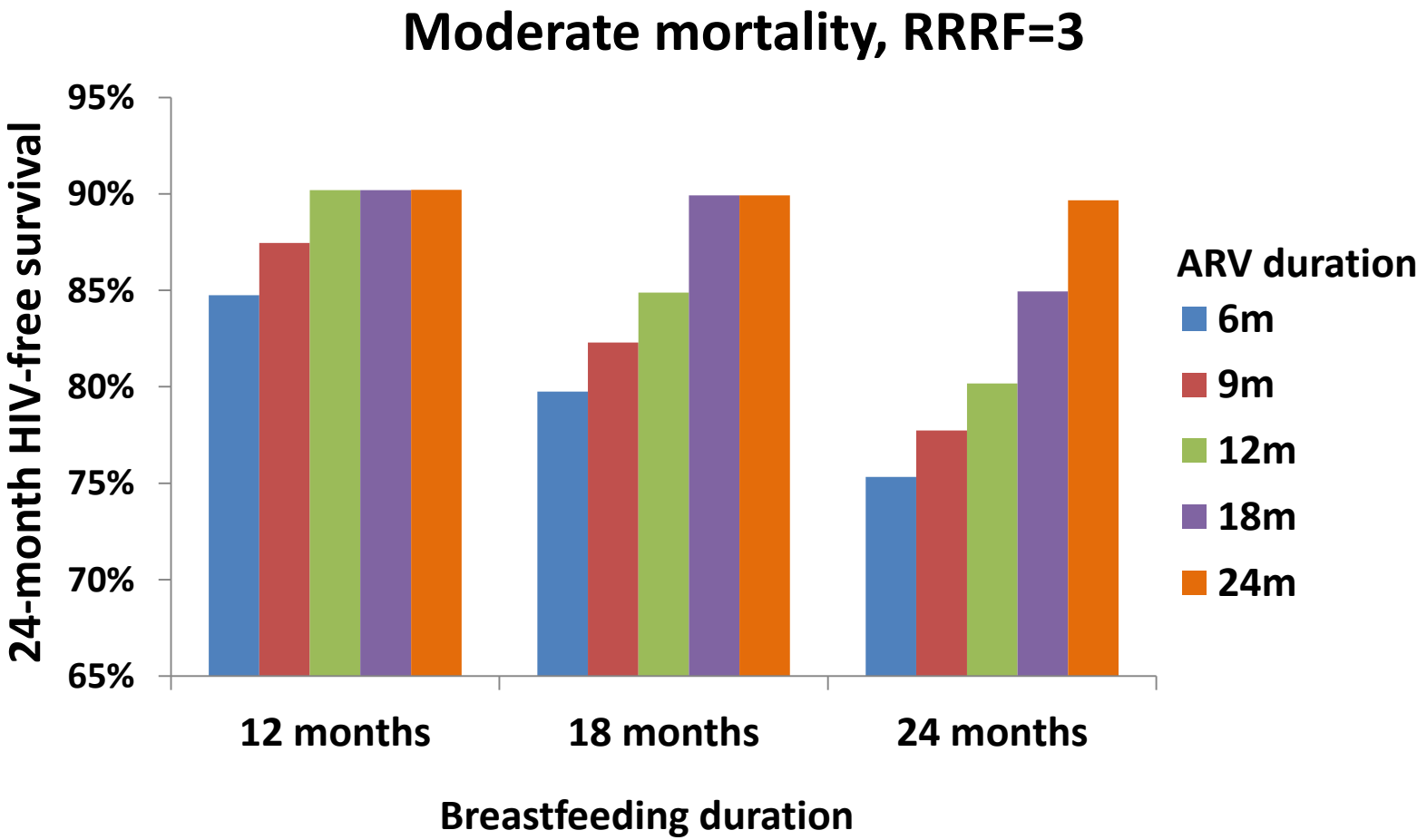
Optimal BF Duration: Impact of RR-RF

Optimal BF duration: Duration at which HFS is maximized

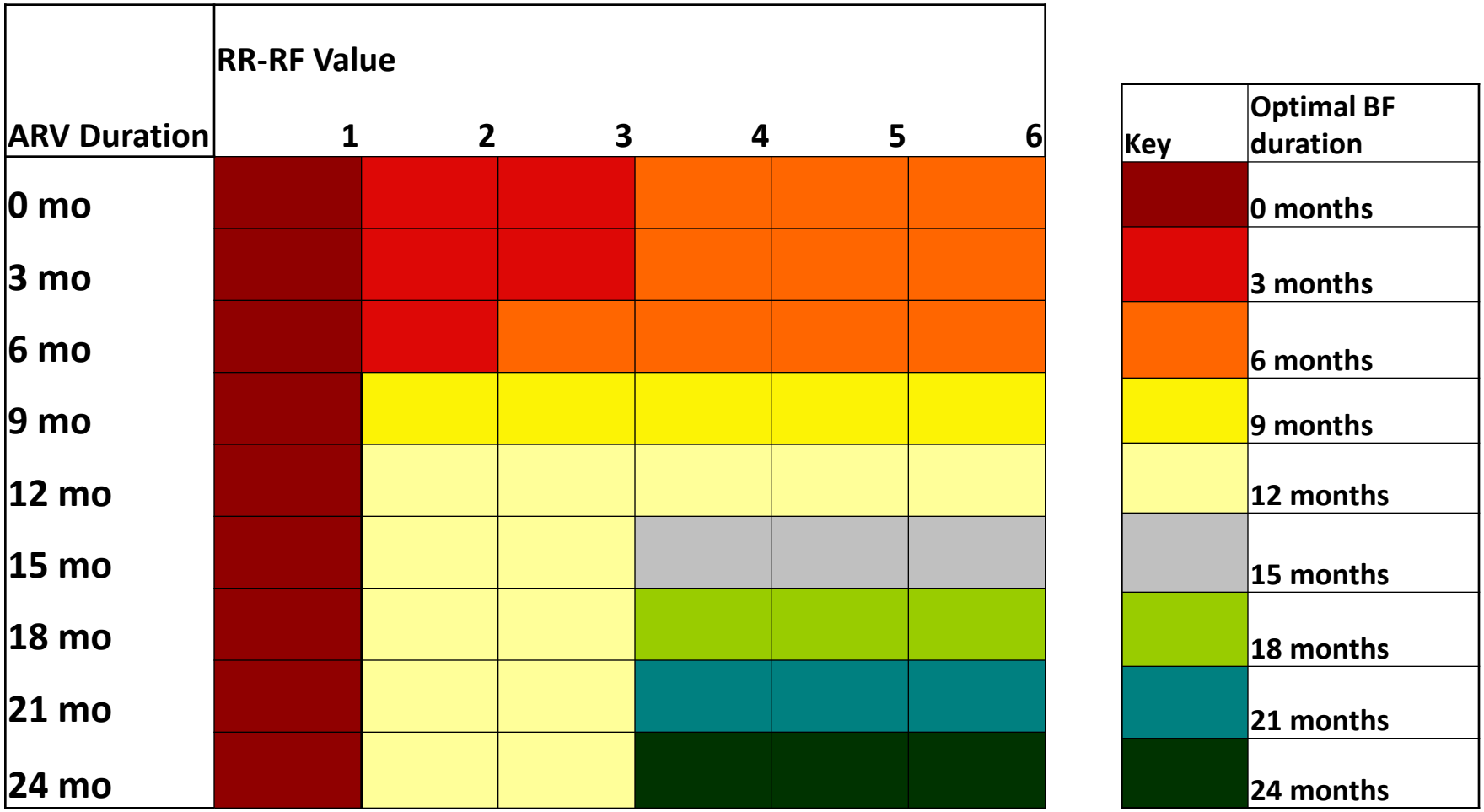


Key	Optimal BF duration
	0 months
	3 months
	6 months
	9 months
	12 months
	15 months
	18 months
	21 months
	24 months

HFS: Impact of ARV Duration (Retention in Care)



Optimal BF Duration: Impact of ARV Duration and RR-RF



Impact of Mortality: RR-RF=3

	24-month HIV-free survival (%)		
Perfect retention in care, RR-RF=3	Low mortality	Moderate mortality	High mortality
BF 0 mo	86.224	83.098	76.292
BF 3 mo	89.830	88.260	83.754
BF 6 mo	90.379	88.674	84.492
BF 9 mo	91.132	89.428	85.786
BF 12 mo	91.911	90.205	87.054
BF 15 mo	91.641	90.073	87.040
BF 18 mo	91.378	89.928	87.032
BF 21 mo	91.114	89.780	87.023
BF 24 mo	90.861	89.671	87.041

At RR-RF of 3 or less, infant/child mortality rates have minimal impact

Impact of Mortality: RR-RF=6

	24-month HIV-free survival (%)		
ARVs throughout BF, RR-RF=6	Low mortality	Moderate mortality	High mortality
BF 0 mo	74.525	69.325	58.566
BF 3 mo	83.303	81.283	74.497
BF 6 mo	85.241	82.922	76.891
BF 9 mo	87.812	85.426	80.441
BF 12 mo	90.414	88.003	84.116
BF 15 mo	90.515	88.376	84.828
BF 18 mo	90.605	88.791	85.505
BF 21 mo	90.693	89.185	86.205
BF 24 mo	90.797	89.589	86.922

At RR-RF of 6 or greater, infant/child mortality rates have minimal impact

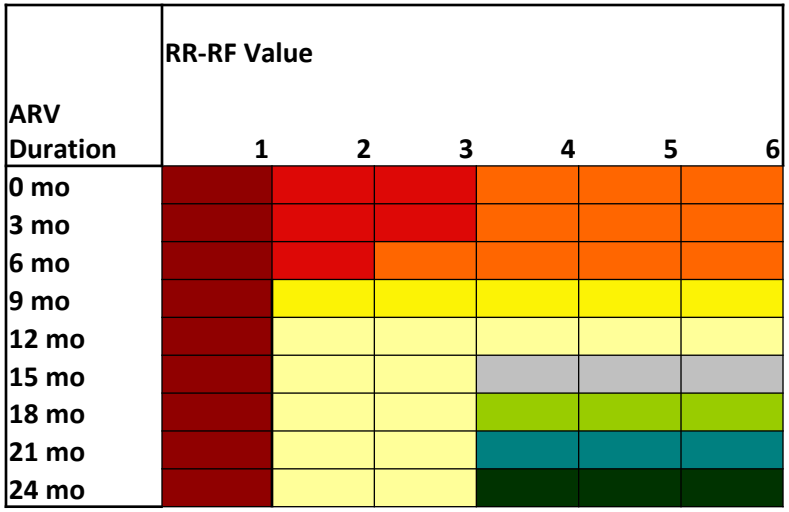
Impact of Mortality: RR-RF = 4

	24-month HIV-free survival (%)		
ARVs throughout BF, RR-RF=6	Low mortality	Moderate mortality	High mortality
BF 0 mo	82.135	78.248	69.854
BF 3 mo	87.621	85.872	80.551
BF 6 mo	88.626	86.717	81.885
BF 9 mo	90.007	88.066	83.945
BF 12 mo	91.410	89.463	86.063
BF 15 mo	91.254	89.528	86.275
BF 18 mo	91.114	89.548	86.525
BF 21 mo	90.974	89.615	86.720
BF 24 mo	90.845	89.642	86.993

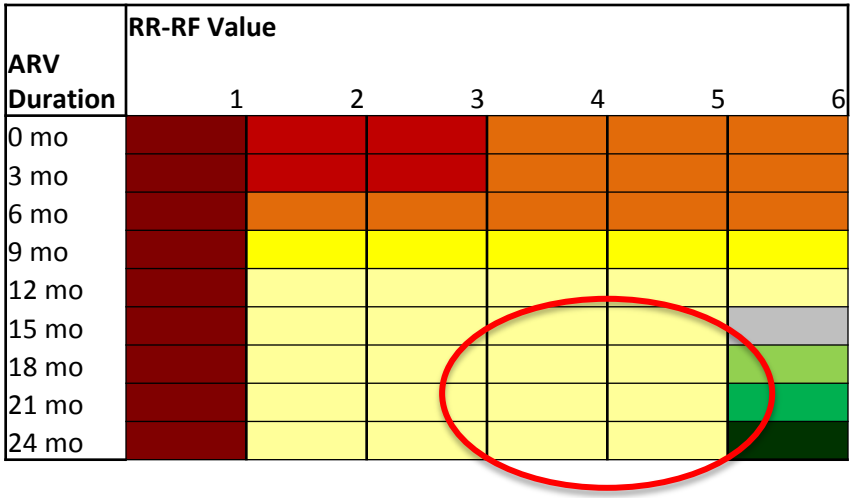
At RR-RF of 4 or 5, higher mortality → longer BF duration

Optimal BF Duration: Impact of RR-RF, ARV Duration, and Mortality Rates

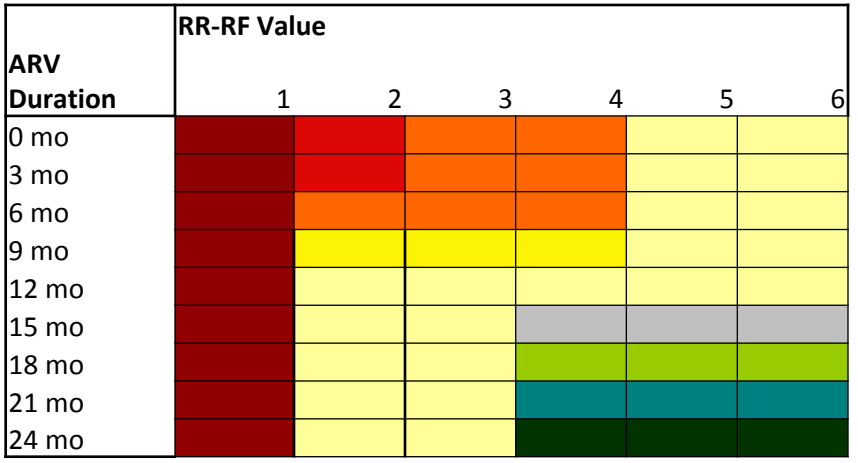
Moderate Mortality



Low Mortality



High Mortality



Key	Ideal BF duration
	0 months
	3 months
	6 months
	9 months
	12 months
	15 months
	18 months
	21 months
	24 months

Comparing the Model to Studies

Study	RR-RF/Mortality Comparison	Outcome	Study HFS	Model HFS
Thakwalakwa 2014 (Malawi)	3/Low BF: 6 mo + ART	HFS at 12 mo	BF: 90%	BF: 91.8%
Rollins 2008 (KZN, SA)	1/Low BF: 6 mo + sdNVP FF: sdNVP	HFS at 18 mo among 6m survivors	BF: 75% FF: 80% *includes IU/IP	BF: 92.9% FF: 95.3%
Peltier 2009 (Rwanda)	1/Low BF: 6mo +ART 7 mo	HFS at 9 mo	BF: 95.1% FF: 94%	BF: 95.1% FF: 96.2 %

WHO GRADE tables: 24m HFS 86%-92% (95% CI range 82-93%)

Limitations

- Simplifies many complex biologic processes
- Excludes benefits of breastfeeding not related to mortality among HEU infants:
  - Nonfatal morbidity, growth and development
  - Benefits of BF for HIV-infected infants
  - Maternal health
- Relies on outcome of HIV-free survival, which gives equal weight to infant HIV infection and death
- Excludes costs related to replacement feeding or morbidity/mortality averted

Key Conclusions

- In settings with low mortality risks or low to moderate RR-RF, the maximum BF duration rarely exceeds the 2010 recommendation of 12 months
- When both mortality and RR-RF are high, HFS is maximized by longer BF durations (often 24 months)
- ART use throughout the entire breastfeeding period is critical both for the mother and for the infant; loss to follow-up during BF leads to large reductions in HFS

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Additional Slides

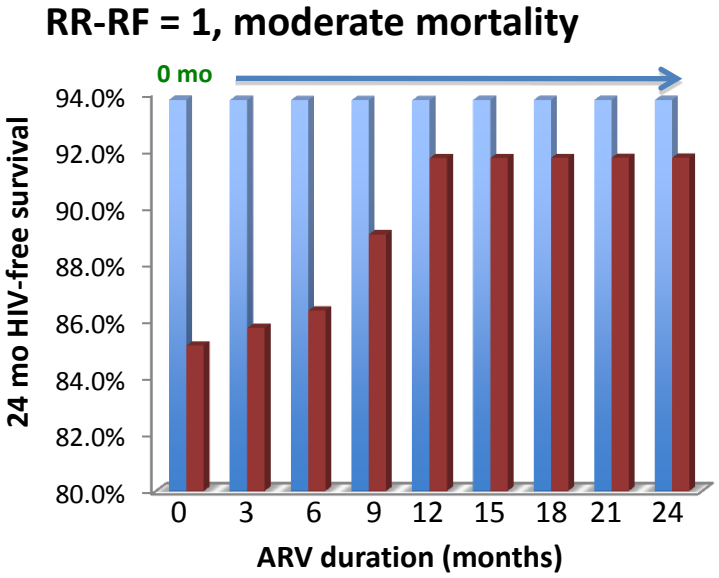
Setting-specific vs. Public Health Approach

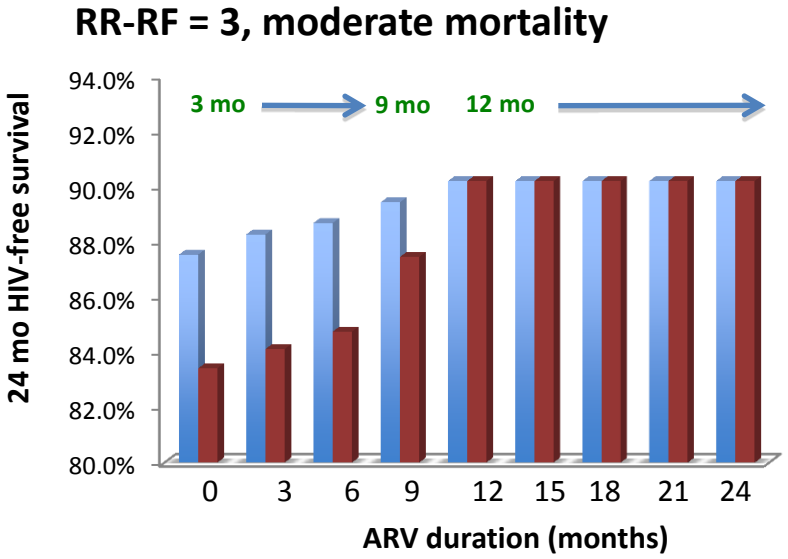
- Setting-specific approach: HFS at "optimal duration," based on combinations of availability and duration of ARVs and safety of replacement feeding

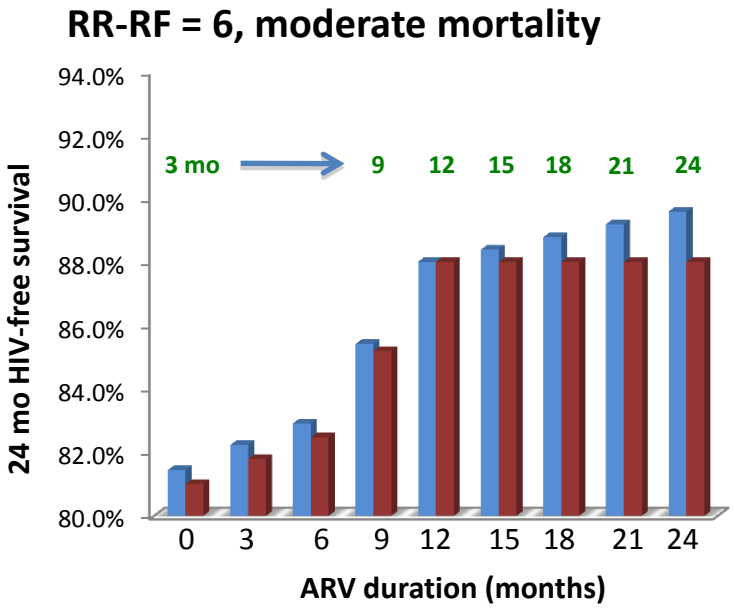
- Public health approach: HFS with 12 months of breastfeeding for all HIV-infected women

Carter, JAIDS 2010; Ciaranello et al, AIDS 2014

Setting-specific vs. Public Health Approach







HFS with optimal BF duration (setting-specific approach)
Green: optimal BF duration in months

HFS with recommended duration of 12 months (public health approach)

Impact of ARV Duration: RR-RF=1

RR-RF = 1	24-month HIV-free survival (%)								
ARV Duration →	0	3	6	9	12	15	18	21	24
BF 0 mo	93.771	93.758	93.754	93.755	93.755	93.758	93.759	93.759	93.759
BF 3 mo	92.562	93.252	93.254	93.248	93.252	93.254	93.255	93.256	93.257
BF 6 mo	91.405	92.068	92.712	92.720	92.720	92.722	92.722	92.723	92.724
BF 9 mo	88.163	88.793	89.409	92.190	92.187	92.187	92.186	92.184	92.186
BF 12 mo	85.118	85.734	86.343	89.029	91.716	91.717	91.720	91.723	91.724
BF 15 mo	82.261	82.859	83.448	86.038	88.630	91.206	91.206	91.209	91.212
BF 18 mo	79.564	80.133	80.700	83.220	85.723	88.225	90.702	90.703	90.706
BF 21 mo	77.017	77.581	78.129	80.572	83.005	85.433	87.830	90.221	90.220
BF 24 mo	74.652	75.196	75.724	78.067	80.417	82.764	85.098	87.408	89.708

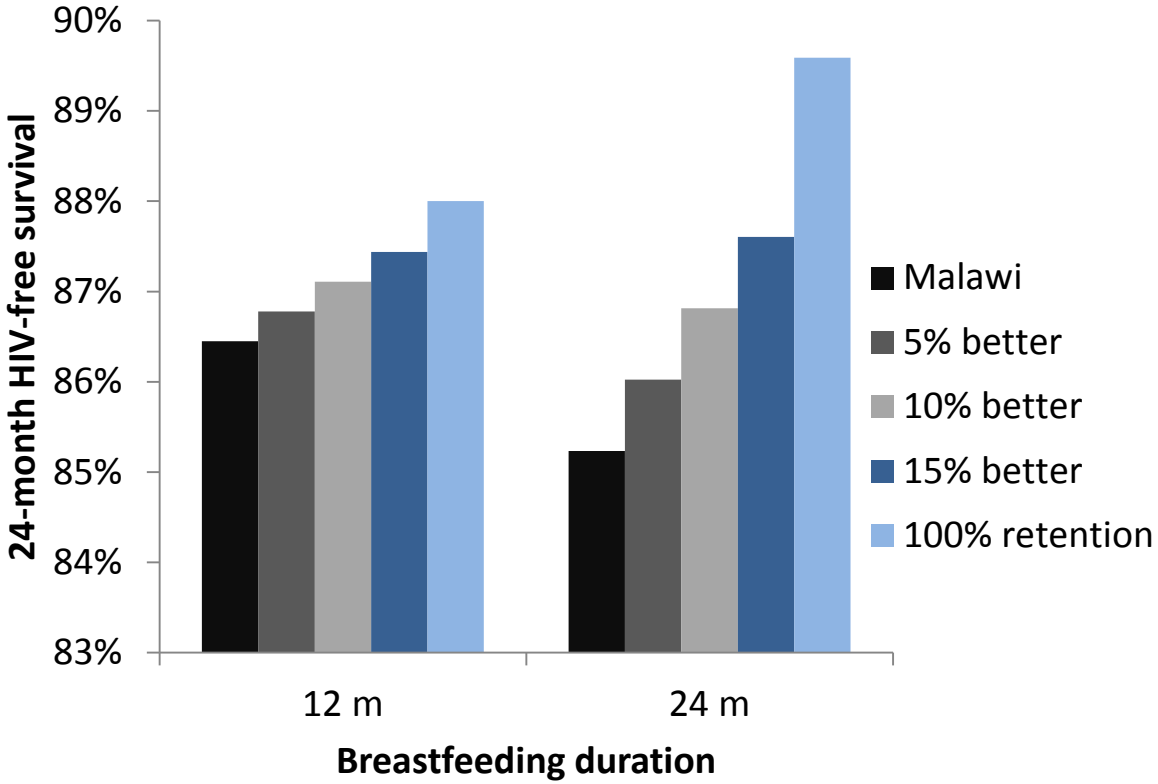
Impact of ARV Duration: RR-RF=3

RR-RF=3	24-month HIV-free survival (%)								
ARV Duration -->	0	3	6	9	12	15	18	21	24
BF 0m	83.112	83.089	83.097	83.100	83.092	83.093	83.098	83.100	83.098
BF 3m	87.532	88.263	88.265	88.277	88.261	88.268	88.261	88.260	88.260
BF 6m	87.277	88.018	88.678	88.681	88.681	88.681	88.682	88.678	88.674
BF 9m	85.295	85.994	86.650	89.426	89.428	89.429	89.427	89.427	89.428
BF 12m	83.411	84.111	84.745	87.449	90.196	90.194	90.195	90.201	90.205
BF 15m	80.892	81.573	82.187	84.810	87.467	90.068	90.068	90.073	90.073
BF 18m	78.521	79.155	79.751	82.292	84.873	87.401	89.927	89.925	89.928
BF 21m	76.242	76.875	77.443	79.913	82.420	84.871	87.335	89.776	89.780
BF 24m	74.136	74.763	75.321	77.729	80.168	82.551	84.935	87.303	89.671

Impact of ARV Duration: RR-RF=6

RR-RF = 6	24-month HIV-free survival (%)								
ARV Duration →	0	3	6	9	12	15	18	21	24
BF 0 mo	69.359	69.338	69.340	69.344	69.340	69.334	69.327	69.326	69.325
BF 3 mo	80.487	81.264	81.276	81.281	81.278	81.277	81.290	81.286	81.283
BF 6 mo	81.438	82.229	82.910	82.922	82.918	82.920	82.923	82.923	82.922
BF 9 mo	81.195	81.993	82.673	85.413	85.432	85.430	85.430	85.426	85.426
BF 12 mo	81.005	81.794	82.469	85.193	88.007	87.998	87.994	87.998	88.003
BF 15 mo	78.954	79.722	80.374	83.038	85.772	88.384	88.383	88.376	88.376
BF 18 mo	76.999	77.743	78.388	80.986	83.660	86.201	88.780	88.790	88.791
BF 21 mo	75.146	75.873	76.495	79.036	81.656	84.149	86.657	89.189	89.185
BF 24 mo	73.431	74.139	74.752	77.233	79.795	82.221	84.666	87.123	89.589

ARV Duration/Retention: Realistic Scenario vs. 100% Retention



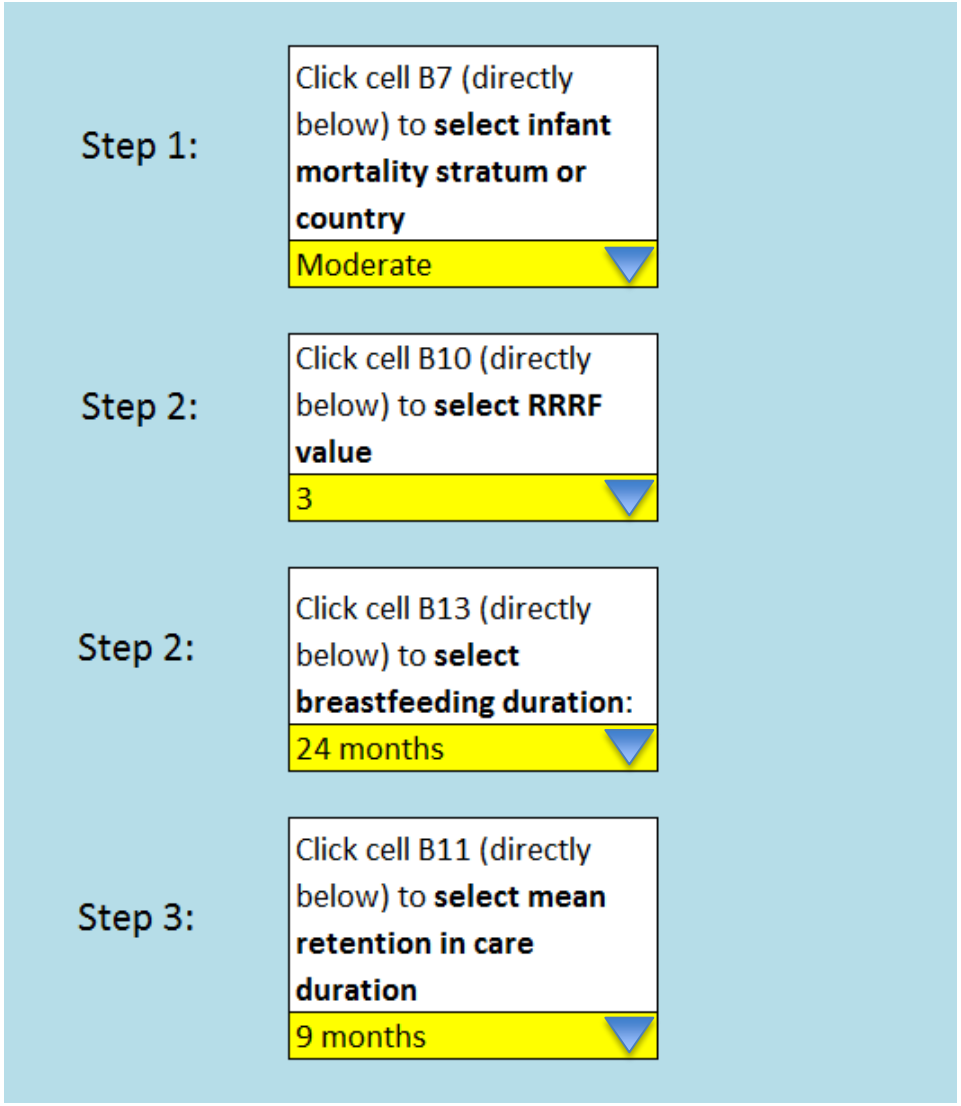
- Malawi data are from retrospective cohort study of women in Malawi's Option B+ PMTCT program

% Retained in care at each time point for each scenario

Month	Malawi	5% better	10% better	15% better	100% retention
6	0.79	0.84	0.89	0.94	1
12	0.75	0.8	0.85	0.9	1
24	0.67	0.72	0.77	0.82	1

Sources: Tenthani et al. 2014, AIDS; Tweya et al. 2014, Trop Med and Intl Health; Haas et al. 2015, IAS Conference abstract

Developing a Practical Tool: Interface



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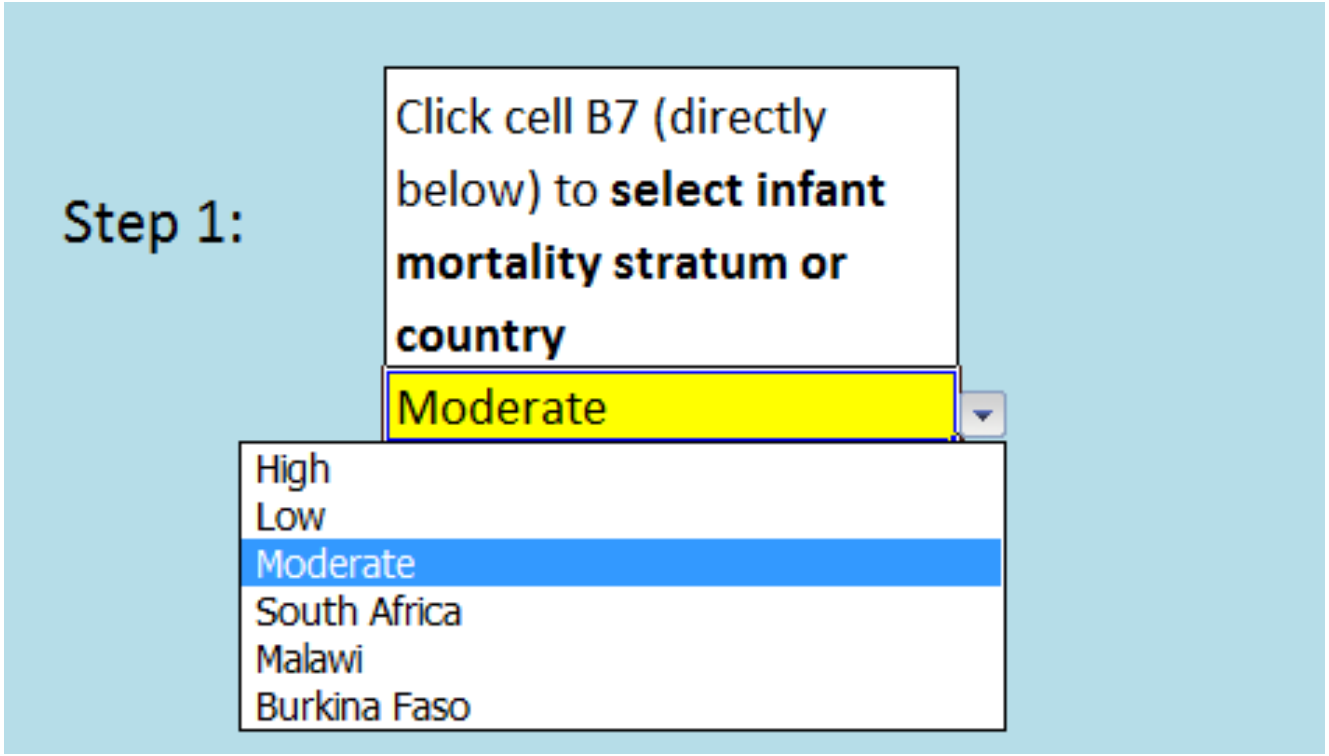

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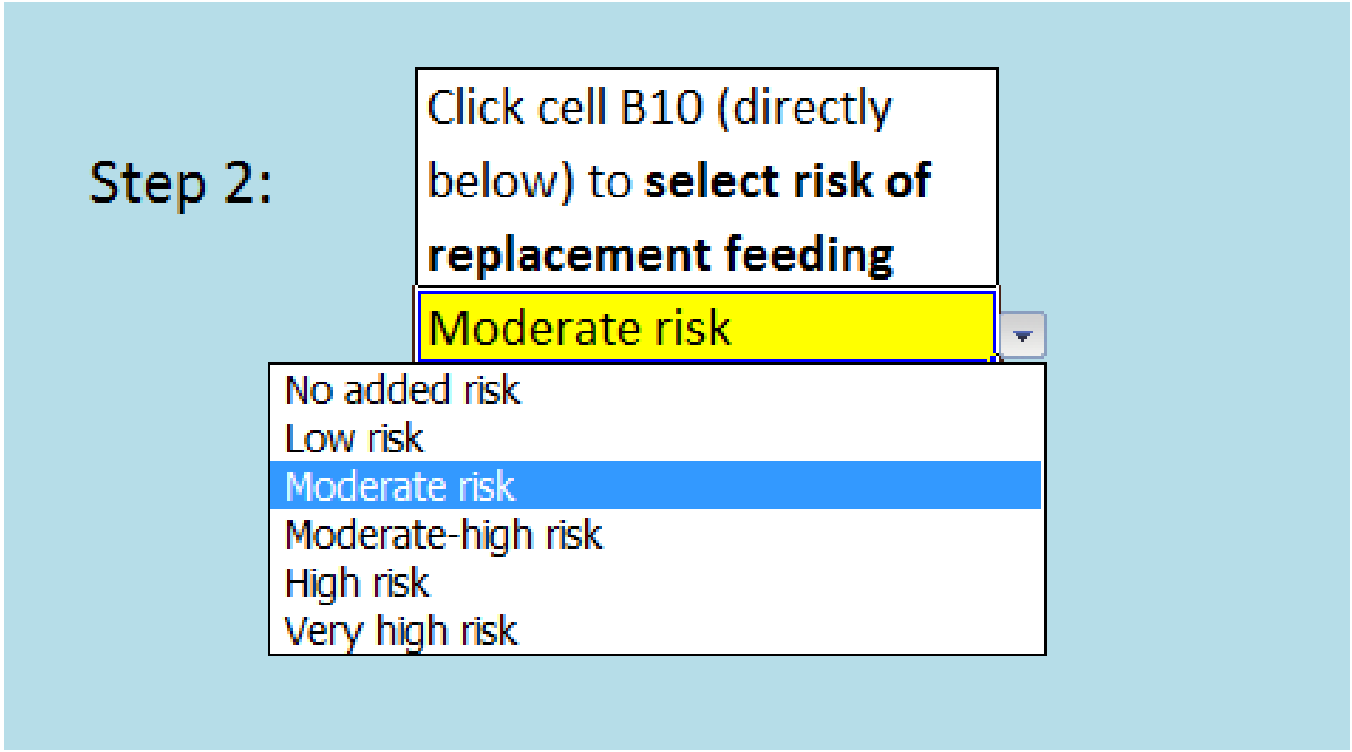
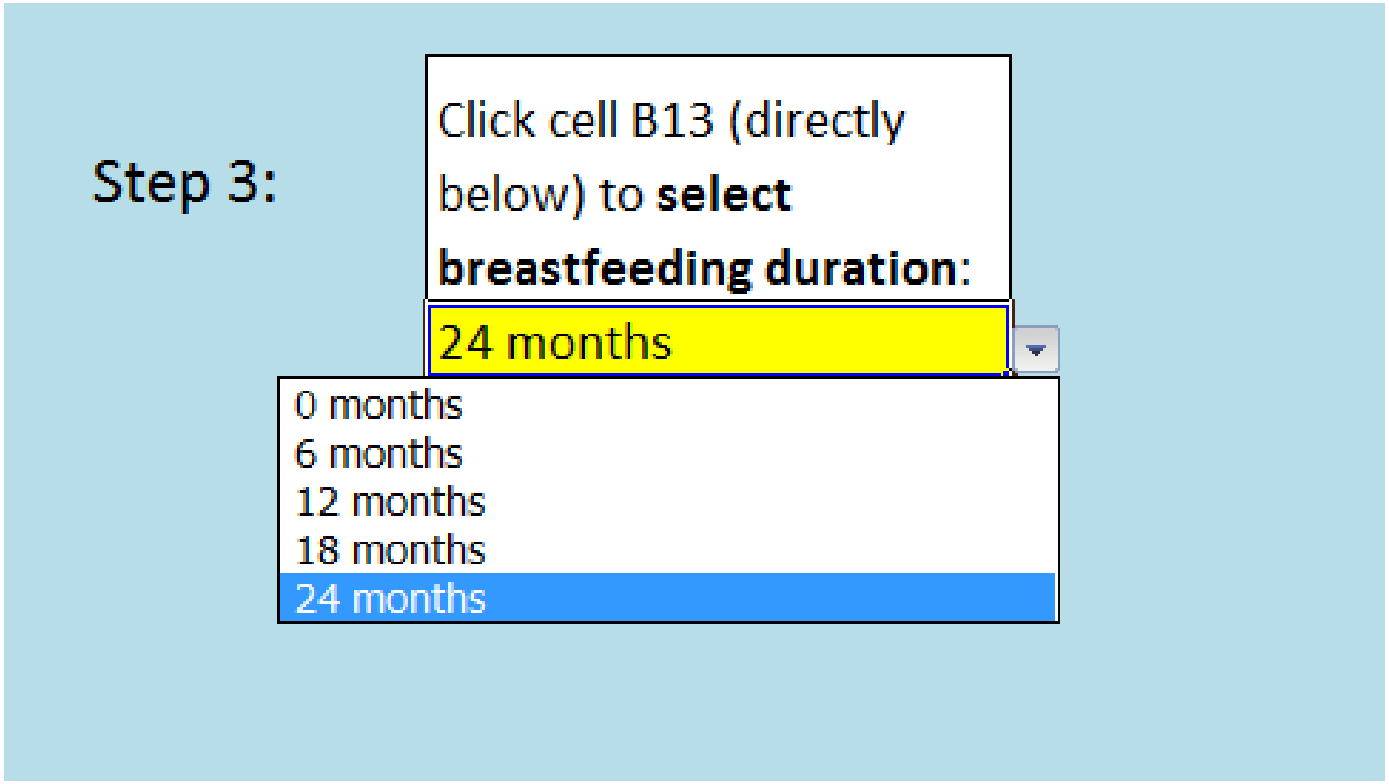
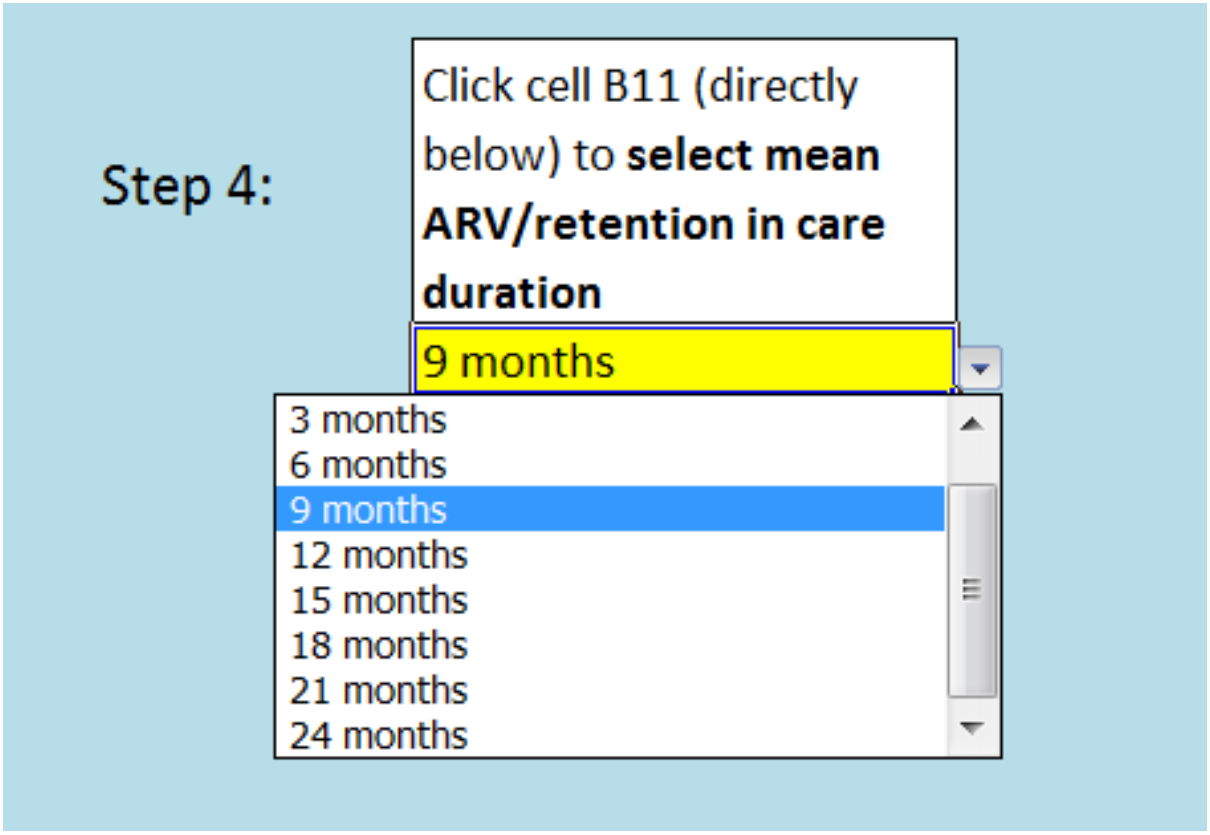


Developing a Practical Tool: Interface



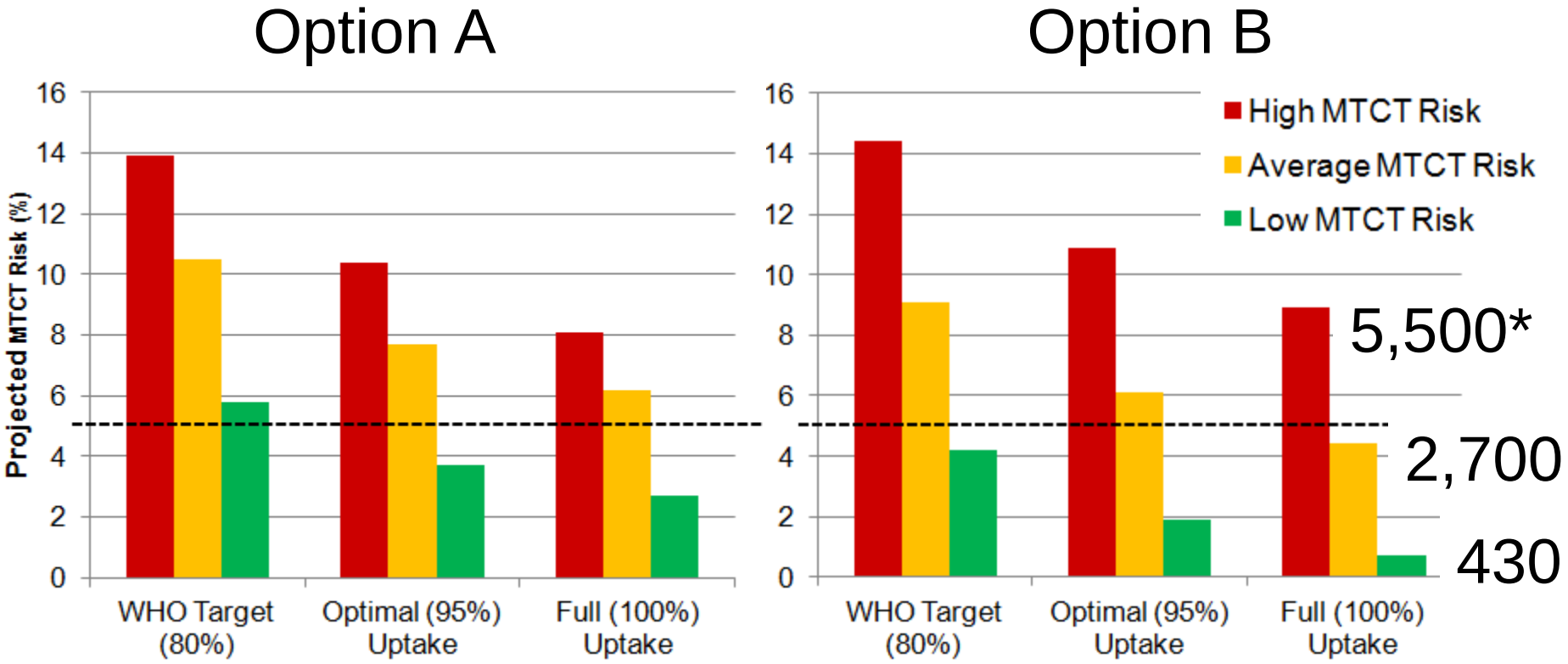
Developing a Practical Tool: Interface



Developing a Practical Tool: Interface

OUTPUT: 24-month HIV-free survival description (estimated percentage of infants alive and HIV-negative)	You have defined your settings as having **moderate infant mortality** with a moderate risk contaminated water sources. You have indicated that women in your specific setting are typically retained in care and on ART for **9 months** and they are expected to BF for **24 months**. Given the characteristics of your specific setting, **78%** of infants born to HIV-positive mothers are expected to be alive and HIV-free by 24 months of age.
	Increased ARV retention: If mothers stayed in care and on ARVs for **3 months longer**, **80%** of infants are expected to reach 24 months of age and be HIV-free. If mothers stayed in care and on ARVs for **6 months longer, 83%** of infants are expected to reach 24 months of age and be HIV-free.
	Modified BF duration: If mothers breastfed for **18 months**, **82%** of infants are expected to reach 24 months of age and be HIV-free. If mothers breastfed for **12 months**, **87%** of infants are expected to reach 24 months of age and be HIV-free.

PMTCT Programs (Zimbabwe): Uptake, Timing, and Adherence



2012 analysis: PROMISE trial comparing Options A and B is ongoing
Current data ranges are overlapping
*Approximate number of children predicted to be born HIV-infected

Ciaranello et al, PLoS Medicine, 2012

What Will It Take to Reach <5%? Multivariate Sensitivity Analyses

Option A

BF Duration	2009 Uptake (56%)			WHO Target (80%)			Optimal (95%) Uptake			Full (100%) Uptake		
18 months	9.4	16.0	23.2	6.4	12.2	16.4	4.2	9.2	12.7	3.1	7.5	9.9
12 months	8.8	14.4	18.5	5.8	10.5	13.9	3.7	7.7	10.4	2.7	6.2	8.1
No BF	7.5	10.8	12.7	4.5	6.8	8.0	2.5	4.3	5.0	1.9	3.4	4.1
Reported MTCT Risk	Low	Avg	High	Low	Avg	High	Low	Avg	High	Low	Avg	High

Option B

BF Duration	2009 Uptake (56%)			WHO Target (80%)			Optimal (95%) Uptake			Full (100%) Uptake		
18 months	8.0	15.0	21.8	4.6	10.8	17.3	2.1	7.5	13.8	0.7	5.7	11.4
12 months	7.6	13.4	19.0	4.2	9.1	14.4	1.9	6.1	10.9	0.7	4.4	8.9
No BF	6.8	9.9	12.3	3.5	5.5	7.3	1.4	2.8	4.3	0.7	1.8	3.3
Reported MTCT Risk	Low	Avg	High	Low	Avg	High	Low	Avg	High	Low	Avg	High

MTCT risk (%):

<5	5-10	>10

Ciaranello et al, PLoS Medicine, 2012

Objective of Prior Work

- To determine the duration of breastfeeding that maximizes HIV-free survival (HFS) among HIV-exposed, uninfected African infants
- Balance risks of postnatal HIV infection from breastfeeding with risks of infant mortality associated with replacement feeding

Ciaranello et al, AIDS 2014

CEPAC Infant Model

- Cost-effectiveness of Preventing AIDS Complications
- Simplified model of HEU infants (distinct model)
- Monthly risks of:
  - HIV infection (stratified by maternal CD4 and ARV use)
  - Infant mortality:
    - Baseline rates observed in HEU infants
    - In months when replacement fed: multiplied by a relative risk of mortality associated with replacement feeding ("RR-RF")
  - Maternal mortality (leading to replacement feeding)

Ciaranello et al, AIDS 2014

Previous Inputs (2014): Postnatal Infection Risks

Maternal status	Exclusive BF Rate/100PY	Mixed BF Rate/100PY	Sources
CD4 >350/µL			
No ARVs	2.9 (1.8-8.8)	4.8 (1.8-8.8)	ZEBS; ZVITAMBO, Coutsoudis 01, Leroy 98
Infant NVP	2.7 (1.4-3.7)	2.7 (1.4-3.7)	SIMBA; BAN
Maternal ART	2.2 (0.0-6.4)	2.2 (0.0-6.4)	KiBS, AMATA, Mitra Plus, DREAM; BAN, MASHI
CD4 ≤350/µL			
No ARVs	9.1 (5.7-28.4)	15.4 (5.7-28.4)	ZEBS; ZVITAMBO, Coutsoudis 01, Leroy 98
Maternal ART	4.0 (0.0-6.4)	4.0 (0.0-6.4)	Kesho Bora, Mma Bana; MASHI

Ciaranello et al, AIDS 2014

Summary of Findings

- HFS is maximized by:
  - Shorter breastfeeding when MTCT risks are greater (low CD4, ART unavailable)
  - Longer breastfeeding if replacement feeding is associated with high mortality
- Compared to 12 months of breastfeeding, an individualized approach improves HFS if MTCT risk is very low or very high, or if access to ARVs is limited
  - Limited implementation may reduce population HFS
  - Public health approach beneficial in most settings
- Model can identify settings in which a more individualized approach may be valuable

Ciaranello et al, AIDS 2014

Data Needs

- Data on RR-RF are limited
  - Information on water safety is difficult to obtain, may not predict RR-RF for all infants
  - Unknown if RR-RF varies by age or by duration since weaning
- Data on MTCT risks after 12 months are limited (B/B+)
  - Lower observed risks over time (cessation of breastfeeding?)
  - Pre-delivery ART duration
  - Adherence, retention, suppression over time

Ciaranello et al, AIDS 2014

Validating a New Approach

Comparison to 2014 analysis:

	ARV Duration	RR-RF Value 1	2	3	4	5	6
2014 mortality and 2015 transmission	0 mo						
2014 analysis: <350 no ARVs	0 mo						
2014 analysis: >350 no ARVs	0 mo						
2014 mortality and 2015 transmission	24 mo						
2014 analysis <350 no ARVs	24 mo						

Key	Optimal BF duration
	0 months
	3 months
	6 months
	9 months
	12 months
	15 months
	18 months
	21 months
	24 months

Ciaranello et al, AIDS 2014

Why Model-based Analyses?

- Decisions must be made before “perfect” information can be obtained
  - Data are incomplete or controversial
  - Trials are infeasible
  - Outcomes are difficult to ascertain for entire cohort
- Integrate existing, varied data to understand a cascade or chain of care/delivery services
- Balance of risks and benefits required
  - Competing events over time (mortality vs. infection)

IU/IP transmission		PP transmission	
Spectrum estimates	CEPAC estimates	Spectrum estimates	CEPAC estimates
No ARVs			
CD4<200: 37% Range: 22-54% CD4 200-350: 27% Range: 13.1-32.6%	CD4<350: 27.3% Range: 19.9-32.2%	CD4 <350: 1.57%/m Range: 0.8-2.5%/m	CD4 <350: MBF: 1.28%/m; EBF: 0.76%/m Range:0.5-2.3%/m
CD4>350: 15% Range: 9.7-20.2%	CD4 >350: 17.4% Range: 12.7-20.1%	CD4 >350: 0.51%/m Range: 0.1-0.96%/m	CD4 >350 MBF: 0.40%/m; EBF: 0.24%/m Range:0.15-0.73%/m
sdNVP			
CD4 not specified: 12% Range: 9.4-12.1%	CD4<350: 17.6% Range: 8.1-26.4% CD4>350: 7.2% Range: 3.3-10.9%	Assume = no ARVs	Assume = no ARVs
AZT in pregnancy (Option A)		**Infant NVP in breastfeeding (Option A)**	
CD4 200-350: 4% Range: 2.3-5.3% CD4>350: 2% Range: 1.6-3.3%	CD4 <350: 13.6% Range: 9.1-15.7% CD4 >350: 3.6% Range: 2.4-4.2%	CD4>350: 0.2%/m Range: 0.12-0.31%/m	CD4>350: 0.22%/m Range: 0.12-0.31%/m
ART in pregnancy (Option A/B)			
CD4 <350: 2% Range: 0.6-3.7%	CD4 <350: 3.3% Range: 1.1-4.1%	CD4 <350: 0.2%/m Range: 0-0.42%	CD4 <350: 0.19%/m (was 0.33%) Range: 0-0.53%/m
CD4>350: 2% Range: 0.9-2.9%	CD4 >350: 1.0% Range: 0.4-2.8%	CD4>350: 0.2%/m Range: 0.063-0.53%	CD4 >350: 0.19%/m Range: 0-0.53%/m

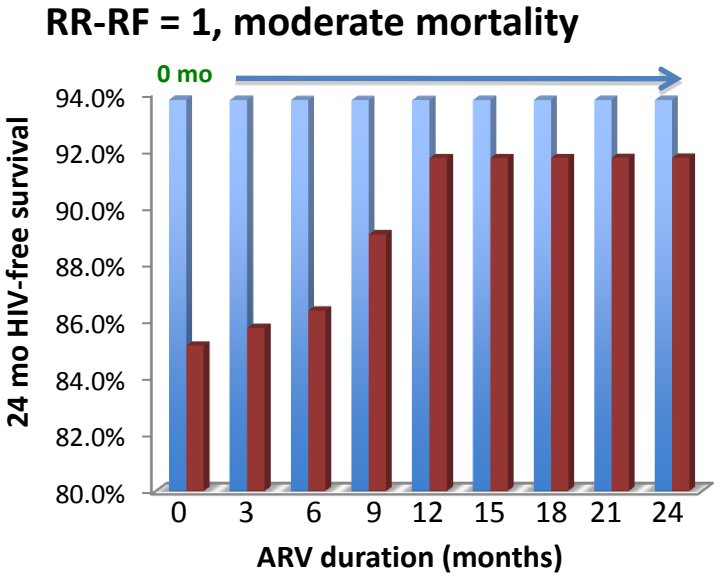
Setting-specific vs. Public Health Approach

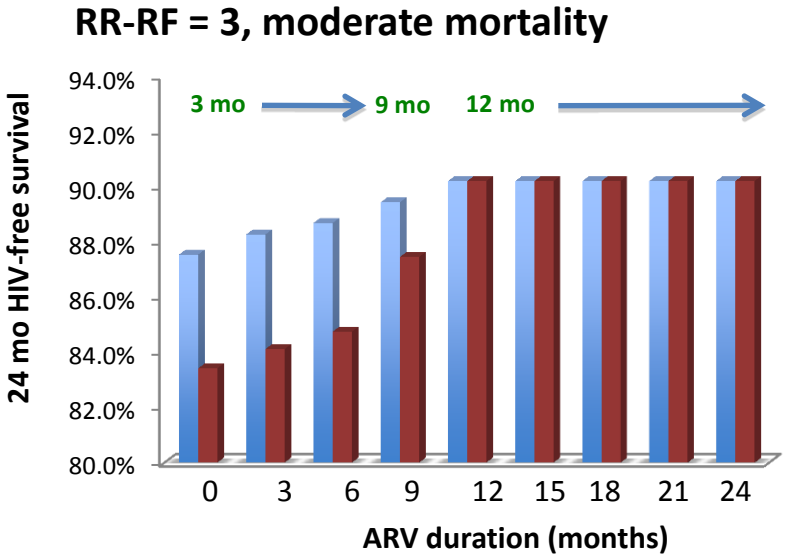
- Setting-specific approach: HFS at "optimal duration," based on combinations of availability and duration of ARVs and safety of replacement feeding

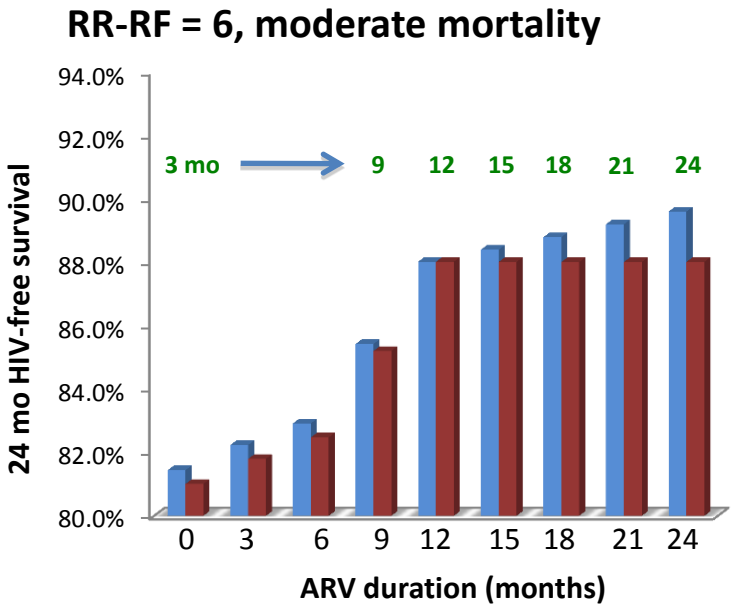
- Public health approach: HFS with 12 months of breastfeeding for all HIV-infected women

Carter, JAIDS 2010; Ciaranello et al, AIDS 2014

Setting-specific vs. Public Health Approach







HFS with optimal BF duration (setting-specific approach)
Green: optimal BF duration in months

HFS with recommended duration of 12 months (public health approach)