Rapid Methods to Assess the Potential Impact of Digital Health Interventions, and their Application to Low Resource Settings

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The WHO has issued a global "Call to Action" on evaluating eHealth

"To improve health and reduce health inequalities, rigorous evaluation of eHealth is necessary to generate evidence and promote the appropriate integration and use of technologies." *

* Call to Action on Global eHealth Evaluation. 2011. *Consensus Statement of the WHO Global eHealth Evaluation Meeting*. Bellagio.

There are a host of challenges in assessing the impact of *any* health care intervention

developing appropriate evaluative **criteria and metrics**

selecting appropriate assessment **methods**

acquiring **resources** - funding and people - for evaluation

conducting assessments including any necessary fieldwork

disseminating the results

using evaluation findings to influence practice

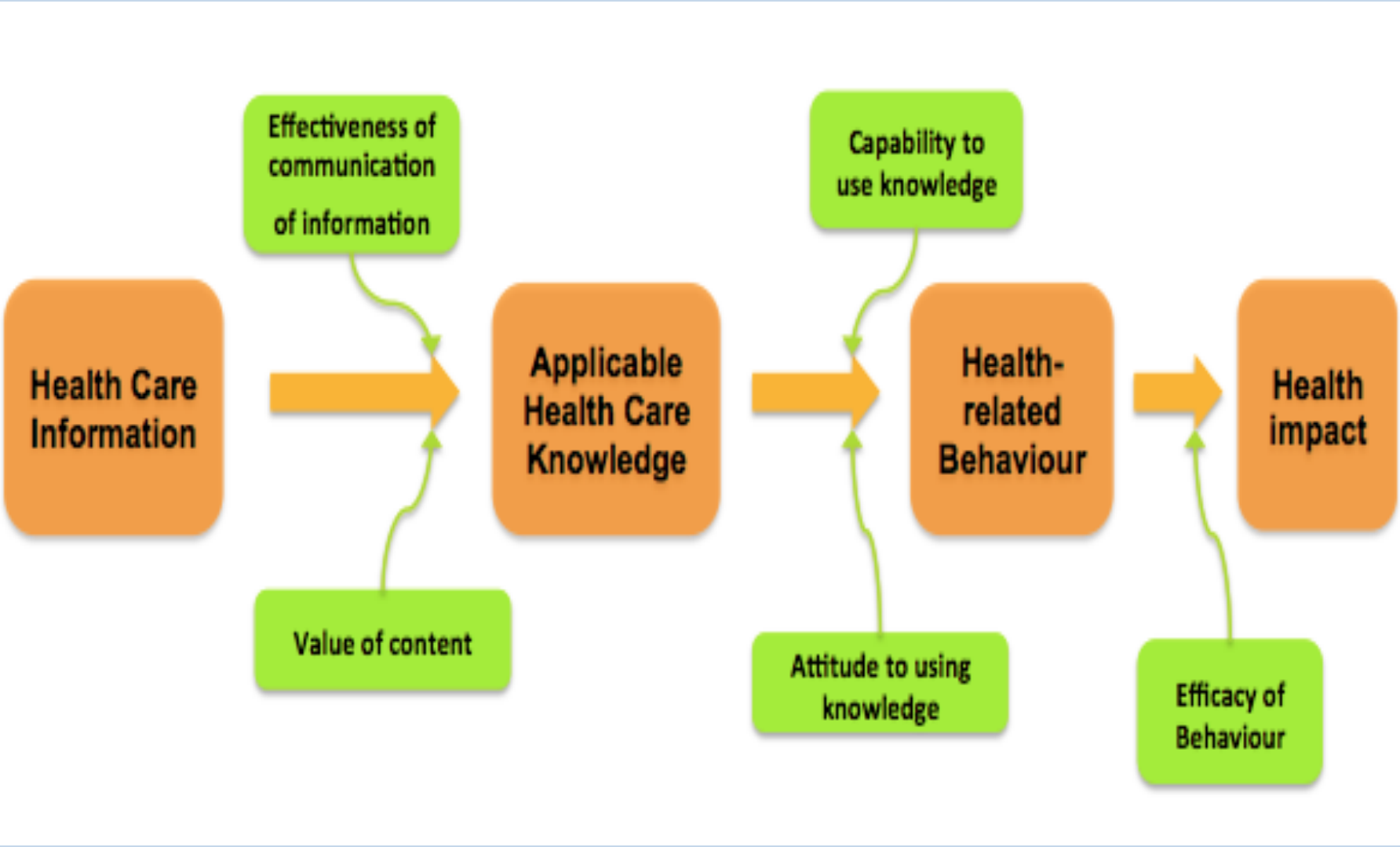
Many of these challenges – e.g. funding, fieldwork - are of course particularly demanding in **low resource settings**

Assessing the impact of digital heath interventions presents additional challenges

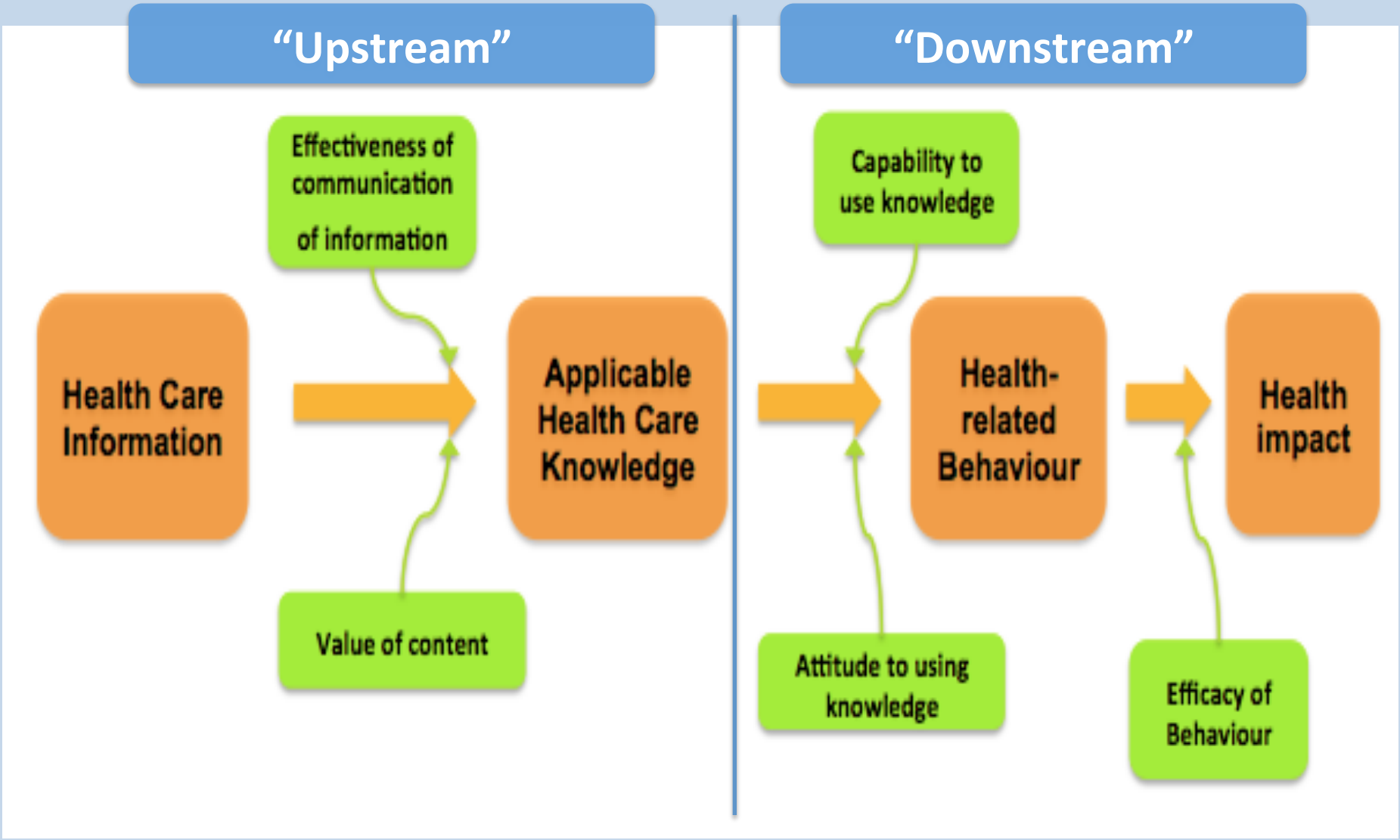
- the element of *technology* can add a layer of complexity
- the central role of *information* adds an intangible component

Producing an impact on health can involve a complex chain or network of interacting elements, for example between health information and health outcomes

A simple logic model for the health impact of healthcare information



It is useful to distinguish “upstream” and “downstream” factors…….



…..as this points to three rapid assessment approaches

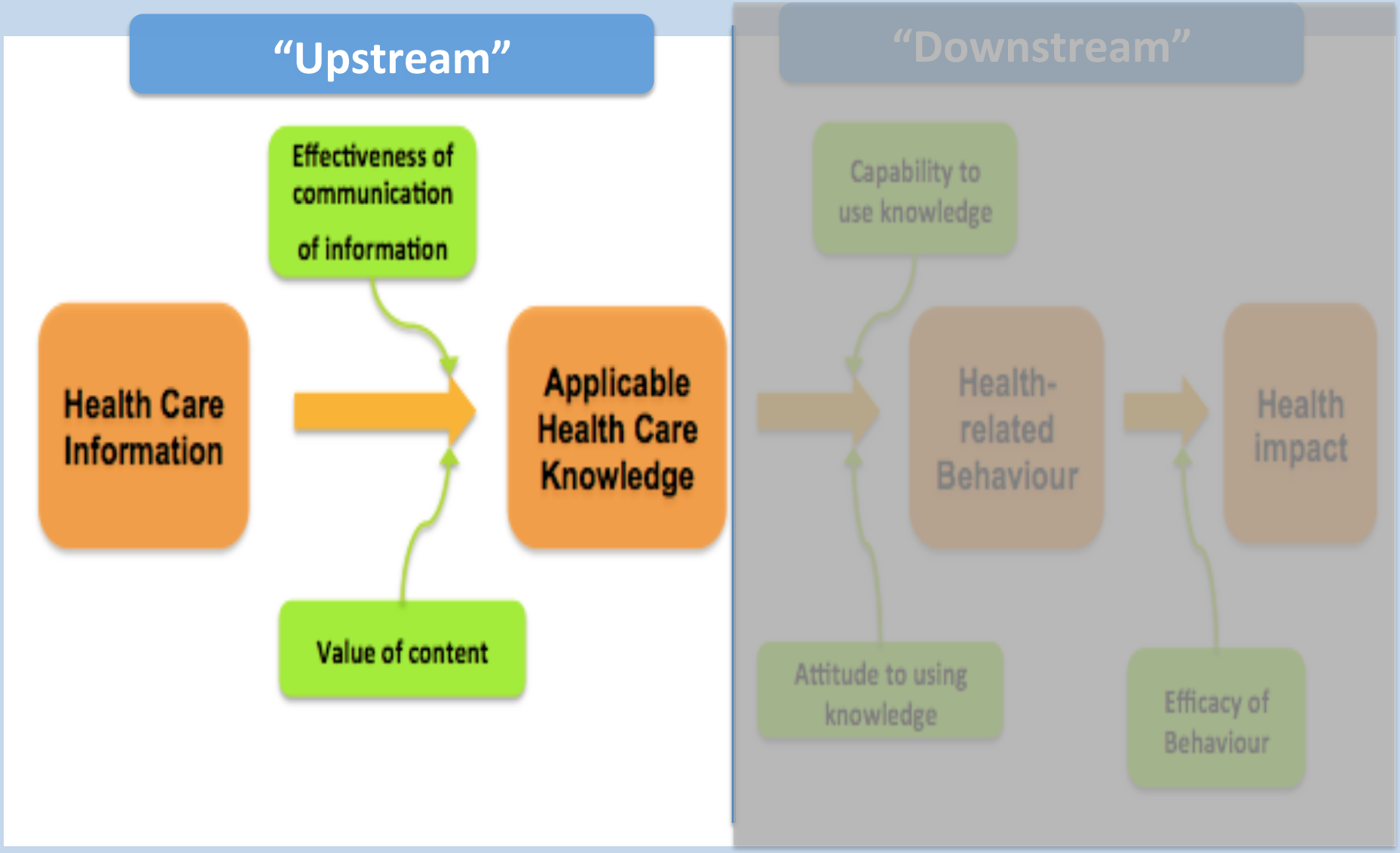
- **Identification of *"upstream"* obstacles** – this alone can sometimes be sufficient to indicate the potential impact of an intervention.

- **Utilisation of existing *"downstream"* knowledge** – can speed initial evaluation and reduce the immediate need for an "end-to end" evaluation.

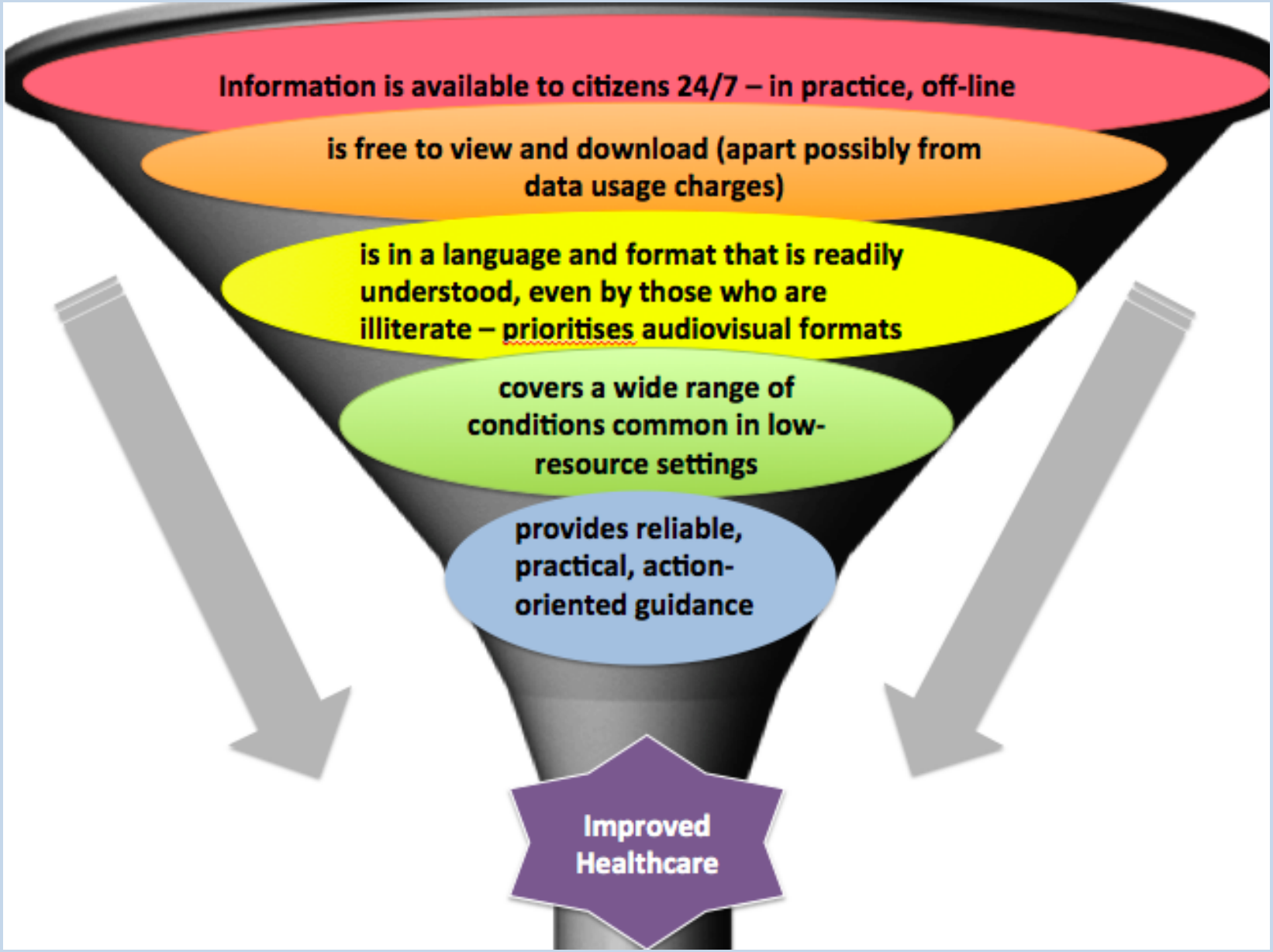
- ***Fermi* estimation*** – identifying a detailed logic model and combining estimates of its individual components can provide valuable initial "ballpark" estimates of impact.

*after the Nobel laureate physicist Enrico Fermi who was renowned for using this approach

Identification of “Upstream” obstacles



Successive “upstream” filters need to be navigated



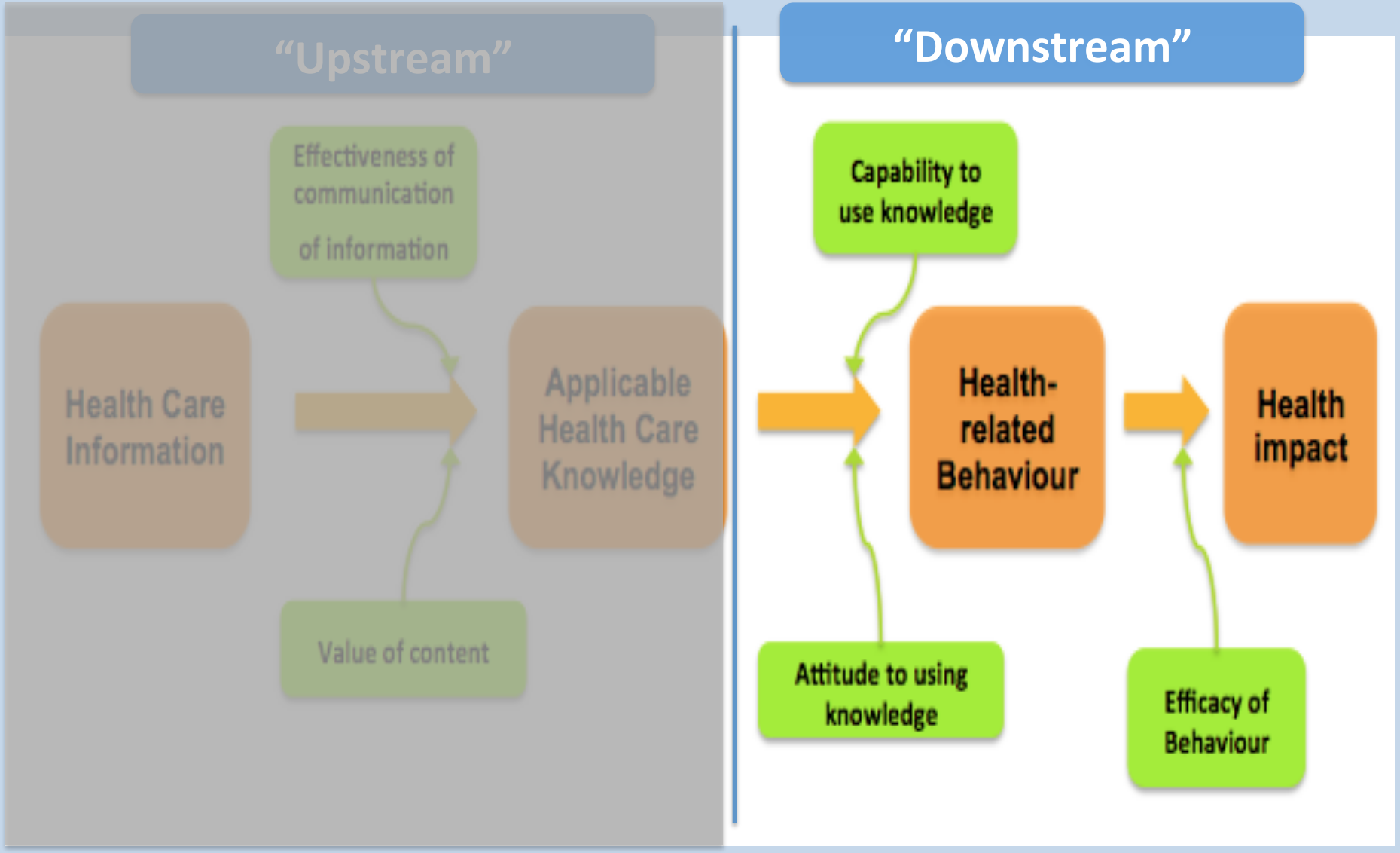
“Traffic Light” rating tool for assessing mobile health information applications

CRITERION	COMPONENTS	ATTRIBUTES	mHIFA RATING GUIDE
SIGNIFICANCE OF THE HEALTH PROBLEM(S)	URGENCY	Chronic care	
		Acute care	
		Emergency care /first aid	
	SEVERITY	Minor health or healthcare problems	
		Moderate health or healthcare problems	
		Serious health or healthcare problems	
APPROPRIATENESS OF THE TARGETING	TARGET AUDIENCE	General Public	
		Health workers and educators	
		Carers (mothers, young people) & children	
	COUNTRY(IES) OF USE	High income	
		Medium income	
		Low income	
VALUE OF THE INFORMATION	RELIABILITY	Poor/Unknown	
		Moderately accredited source	
		Well accredited source	
	RELEVANCE TO USERS' NEEDS	Little relevance to users	
		Moderate relevance to users	
		Essential information for users	
	EASE OF RELATING TO ACTION	Little clear linkage to action	
		Moderate linkage to action	
		Strong linkage to action	
EASE OF ASSIMILATION OF THE INFORMATION	INFORMATION FORMAT	Text	
		Audio	
		Picture	
		Video	
	LANGUAGE(S)	English	
		National/Regional	
		Multilingual/various local	
AVAILABILITY OF THE APPLICATION	GEOGRAPHICAL PROVISION	Local regions	
		National	
		Supernational	
	COST TO USER	Full Commercial	
		Subsidised	
		Free	
TECHNOLOGICAL ACCESSIBILITY OF THE APPLICATION	USER INTERFACE	Basic website	
		Website with navigation aids	
		Tailored mobile app	
	COMMUNICATION REQUIREMENTS	2 -way (to and from user)	
		1-way (to user)	
		1-way (from user)	
		None (offline - pre-loaded or microSD)	
	MOBILE PLATFORM	Tablet or PDA	
		Smartphone	
		Feature phone	
		Basic phone	
	OPERATING SYSTEM	iOS	
		Windows	
		Android	
		Multiple	
	ADDITIONAL PHYSICAL MEDIA NEEDS	Special	
		MicroSD card	
		None (material downloadable)	
		None (material preloaded)	

Some results of an “upstream” assessment of mobile health information applications

CRITERION	COMPONENTS	OppiaMobile (Digital Campus)	Rating	First Aid (Red Cross)	Rating	SmartHealth (Mobilium)	Rating
SIGNIFICANCE OF THE HEALTH PROBLEM(S)	URGENCY	Covers many aspects of communicable and non-communcable diseases and care (including antenatal care) and environmental health	2	Focused on emergency care/first aid	2	Mostly focused on acute; not much on emergency	1
	SEVERITY	Broad and deep coverage of many health problems	2	A range of serious problems	2	Focus on just 3 main conditions (HIV, tuberculosis, malaria)	1
APPROPRIATENESS OF THE TARGETING	TARGET AUDIENCE	Health workers - all material is in form of training courses	1	General public, and there is a companion app focused on babies and chidren	2	General Public? Nothing focussed on mother and child	1
	COUNTRY(IES) OF USE	Low and middle income	2	Versons avaialble in over 70 countries including many LMICS	2	Information oriented to low and middle income countries	2
VALUE OF THE INFORMATION	RELIABILITY	Sources appear well accredited	2	Well accredited source	2	Approved in some sense by Global Fund	1
	RELEVANCE TO USERS' NEEDS	Essential information	2	Essential information	2	Information rather general; symptom checker ("isabel") only signposts to elsewhere	0
	EASE OF RELATING TO ACTION	Strong linkage to action	2	Strong linkage to action	2	Material very variable in pointing to action	1
EASE OF ASSIMILATION OF THE INFORMATION	INFORMATION FORMAT	Largely text, but with text to speech conversion facility. Some diagrams. Quizzes. A few videos.	2	Text, with extensive use of diagrams and videos, also quizzes and checklists	2	App is text-heavy; there are links to a few YouTube videos	1
	LANGUAGE(S)	English only?	0	Avaialble in over 30 languages	2	English, French, Portuguese, Swahili	2
AVAILABILITY OF THE APPLICATION	GEOGRAPHICAL PROVISION	Generic, plus Ethiopia	1	National	1	Pan-African	2
	COST TO USER	Free	2	Free (except possible data charge for initial download)	2	App is free (but will be data charges for online use?)	1
TECHNOLOGICAL ACCESSIBILITY OF THE APPLICATION	USER INTERFACE	Tailored moblie app, easy to navigate	2	Tailored mobile app, menu very easy to navigate	2	Mobile app, menu easy to navigate	2
	COMMUNICATION REQUIREMENTS	None(after download) except for progress feedback to trainers	2	None (after download)	2	Videos and symptom checker both require online access	0
	MOBILE PLATFORM	Smartphone or tablet	1	Smartphone or tablet	1	Smartphone or tablet	1
	OPERATING SYSTEM	Android only?	1	Android or iOS	2	Android only?	1
	ADDITIONAL PHYSICAL MEDIA NEEDS	None (material downloadable)	2	None (material downloadable)	1	Preloaded on Samsung phones and tablets in Africa, downloadable elsewhere	2

Utilisation of “Downstream” knowledge



Utilisation of "Downstream" knowledge

e.g. suppose we want to know what might be the **health impact of providing practical information on a mobile phone application to guide citizens and carers on the use of oral rehydration therapy (ORT)?**

- **Control trial with and without mHealth info?** Ideal but time consuming and resource intensive.

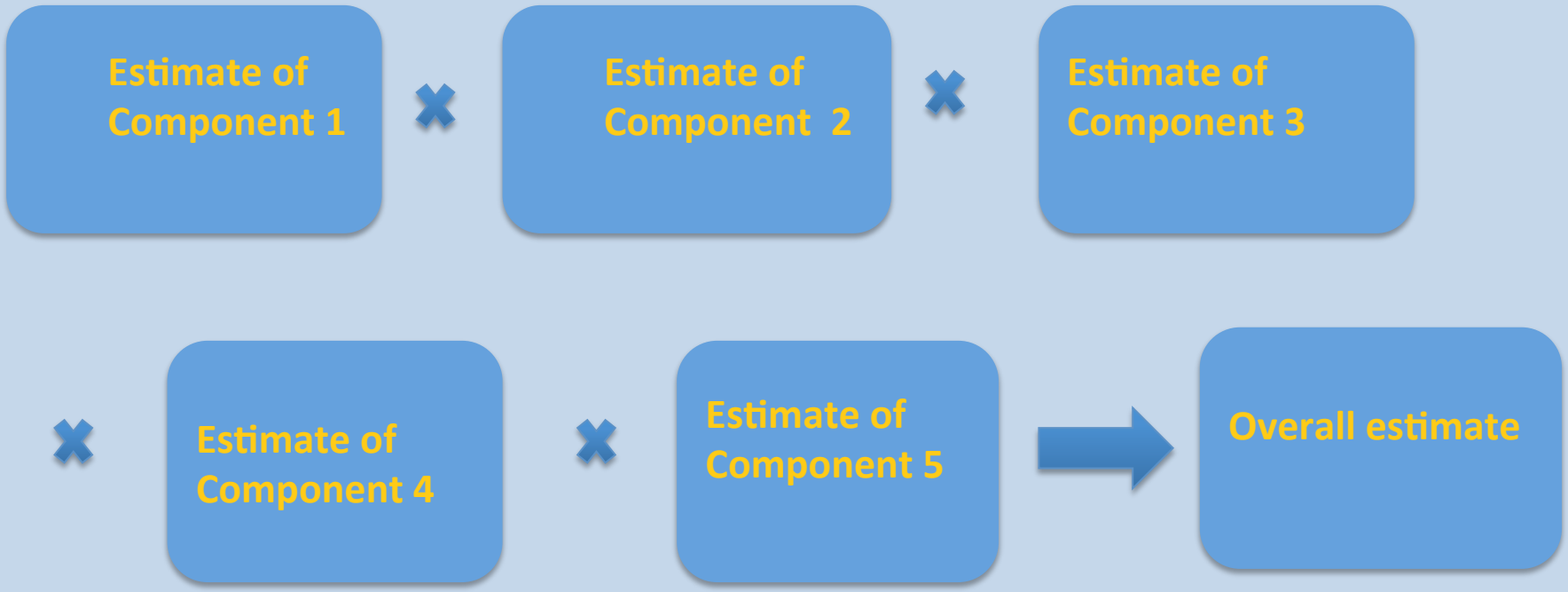
or

- **Use prior knowledge of downstream effects, and supplement with an "upstream" study**? Quick, cheap, and allows a first estimate of health impact.

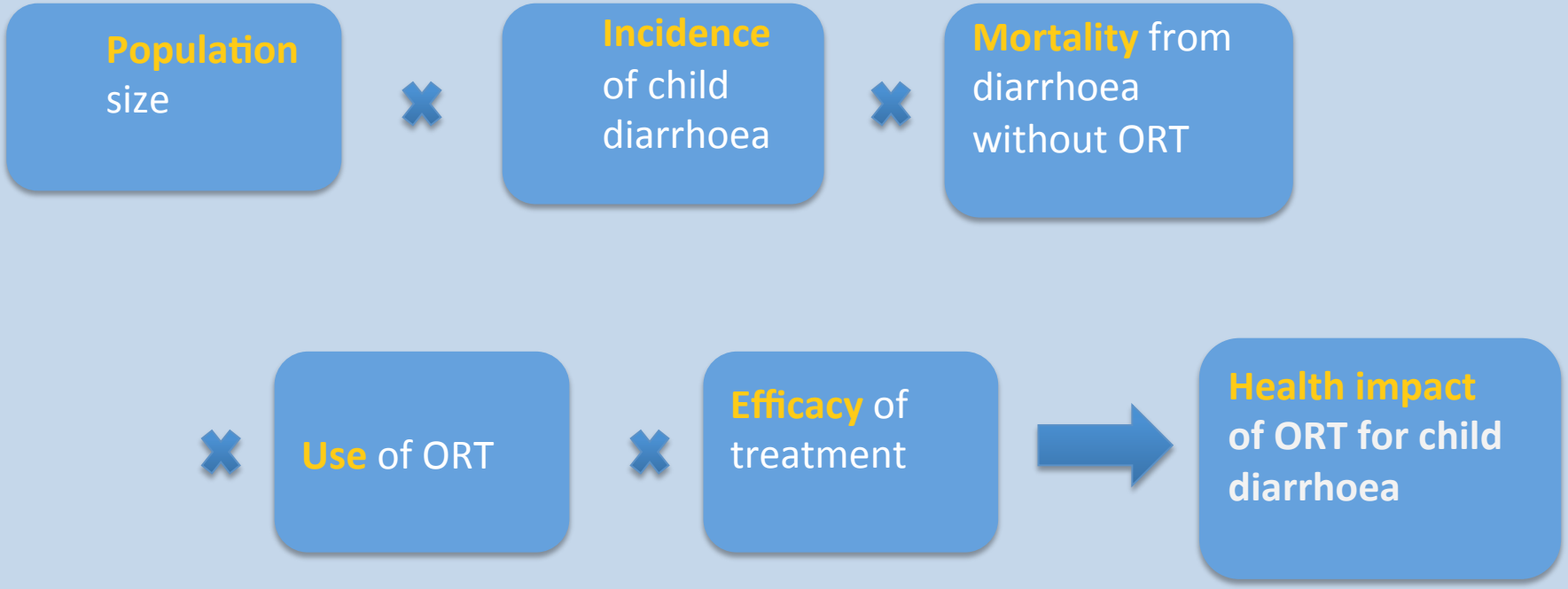
For this presentation the use of downstream knowledge will be illustrated in conjunction with Fermi estimation

Fermi estimation

- decomposes a relevant logic model,
- estimates magnitudes of its components,
- re-assembles them to give the required overall estimate.



A Fermi estimation for the health impact of Oral Rehydration Therapy (ORT)



Fermi estimation - illustrative calculation for baseline* health impact of ORT (in India)

* "baseline" here means the impact *without* the use of relevant mobile phone information

The corresponding figures (for India circa 2010, see conference proceedings paper for sources) are:

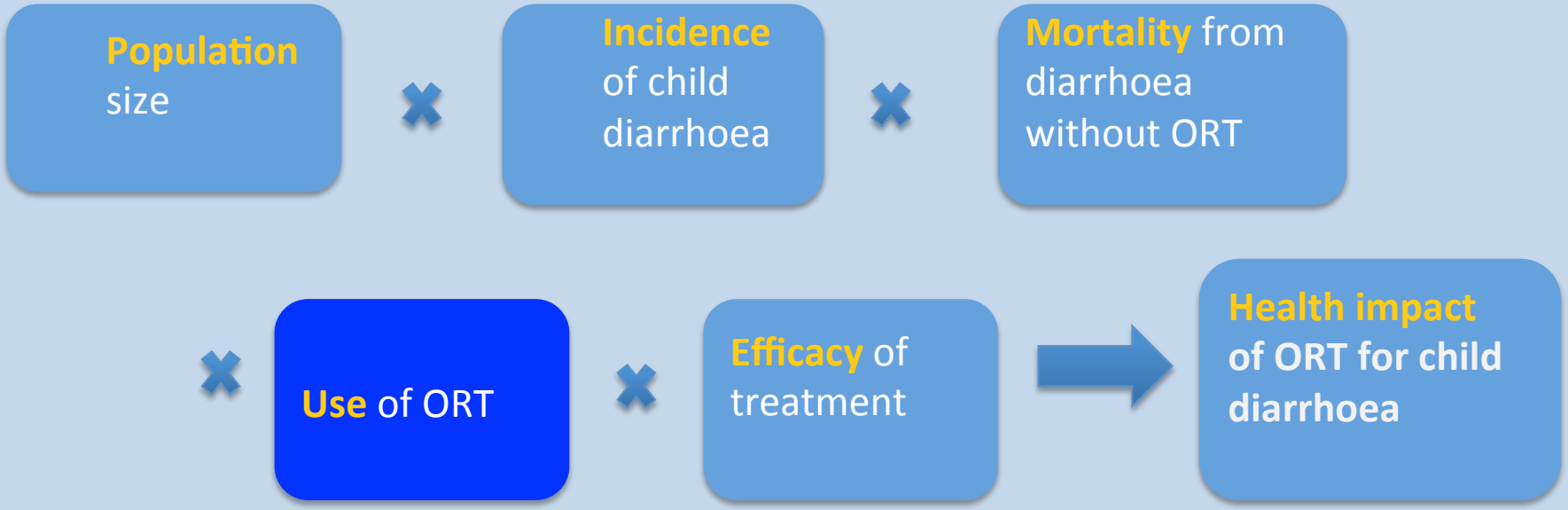
- Population size (children 0-4 years): 113m
- Incidence of child diarrhoea: Average of 2.4 episodes annually per child
- Mortality rate of diarrhoea without ORT: 1.34 deaths per 1000 episodes
- Use of ORT: 45% of carers of those afflicted
- Efficacy of ORT in "real world" conditions (% episodic mortality reduction) : 50%

Hence a Fermi estimate of lives amongst children aged under 5 saved annually by ORT in India is :

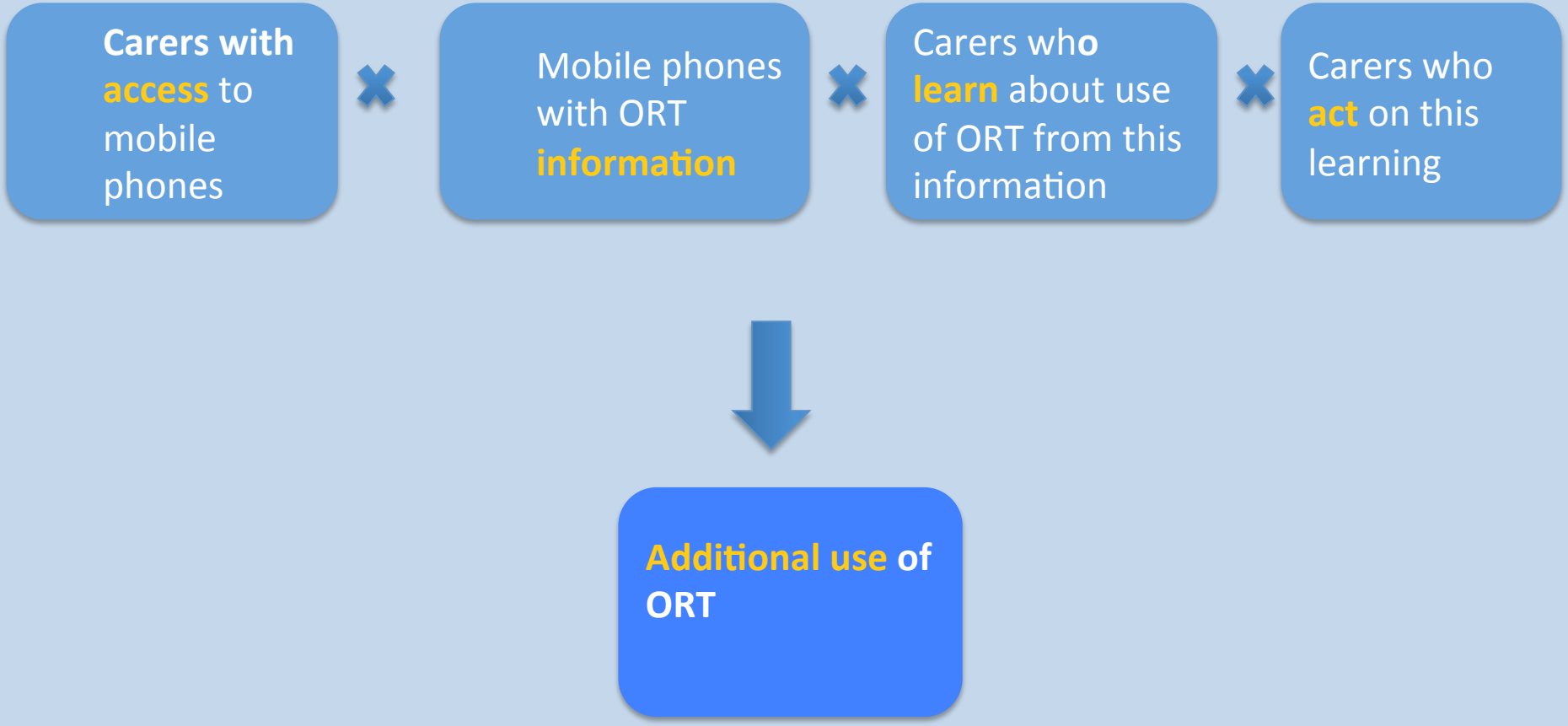
113m x 2.4 x (1.34 /1000) x 0.45 x 0.5 = **82 thousand lives**

How might this baseline figure be enhanced through information on mobile phones about using ORT?

The main Fermi factor that could be influenced by this provision is the ***proportion of carers using ORT.***



This factor can *itself* can be estimated by the Fermi method!



Estimating these sub-components- illustrative calculation

Estimates of these sub-components are as follows for India (see conference proceedings paper for sources):

- Proportion of carers with access to mobile phones (0.80 using lowest income quintile)
- Proportion of these mobile phones with practical information on using ORT (assume here that this is a major nation-wide programme, so say 0.95)
- Proportion of carers utilising phone information to learn how to use ORT (assume 0.20, with the proportion of carers that *already* knew how to use ORT being 0.70).
- Proportion of carers acting on this knowledge to use ORT (0.65)

The above figures give a Fermi estimate that **the proportion of carers in India using ORT, if information on it was widely available on mobile phones, would increase from 0.45 to 0.55**

This now allows a Fermi estimate of the health impact of digital information about ORT

The corresponding Fermi estimate of annual child mortality reduction for India, if information on ORT was widely available on mobile phones, is therefore:
113m x 2.4 x (1.34 /1000) x 0.55 x 0.5 = **100 thousand lives**

This compares with the baseline (i.e. without mHealth information about using ORT) estimate of 82 thousand lives saved by ORT.

So, wide availability in India of practical information on mobile phones about use of ORT might therefore result in increased use leading to an **additional 18 thousand children's lives saved** (and more if this information also led to improvements in the in-use *efficacy* of ORT)

Conclusions

- This work aims to support evaluation of eHealth interventions through initial approaches which are quick and simple.
- Rapid assessment approaches will not generally be a substitute for more thorough and rigorous evaluation, but they can provide useful early indications of strengths and weaknesses and ensure that further evaluative efforts in digital health are focused on key uncertainties, are not wasted on unpromising interventions, and make the most of what is already known.
- This should be valuable in any setting, and is crucial in settings where time and resources are tightly limited.
- The approaches can also assist at a key earlier stage - the *design* of digital health interventions - by assisting a sharper focus on areas of an intervention needing design improvements and by highlighting designs, e.g. of mobile phone applications, that look to have the best chance of success.

Acknowledgements

The work on assessment of mHealth information applications for low resource settings was carried out for the Healthcare Information for All (HIFA) network and the assistance and support from colleagues in the mHIFA Working Group is gratefully acknowledged.

See www.hifa.org/projects/mobile-hifa-mhifa