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Save the Children
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Jeevan Ashram Sanstha

CHILDHOOD INFECTIONS AND POLLUTION (CHIP) CONSORTIUM

06-09 MAY 2019
JAIPUR CITY OF RAJASTHAN, INDIA





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Funders

UCL Knowledge Exchange and Innovation Fund

UCL Grand Challenges

UCL-HKU Strategic Partnership Fund

For further details and opportunities to collaborate please visit <https://www.acesoghc.com/chip-project> or email ysabelle.booc@acesoghc.com

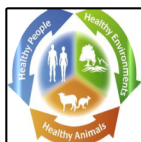
INTRODUCTION

To congregate the Childhood Infections & Pollution (CHIP) consortium and its members, a joint UCL-SCI workshop in Jaipur was organised from 6th to 9th of May 2019. With multiple disciplines across Global North and South – different cultures, organisations, perspectives and ways of working have worked together to begin co-developing, standardising and refining the multi-country CHIP research programme.

ORIGINS AND GUIDING PRINCIPLE

The Childhood Infection and Pollution (CHIP) consortium is a multi-country endeavour that aims to reduce the infection and antimicrobial resistance (AMR) burden in children under-five (U5) living in peri-urban slums using co-produced behaviour change and slum upgrading interventions. It is currently being operationalised across three countries and is guided by the following research methodologies: (1) One Health & (2) technology enabled citizen science.

Inspirations for CHIP were drawn from the recently completed Medical Research Council Global Challenges Research Fund funded Participatory Approach for Nutrition in Children: Strengthening Health, Education and Engineering Linkage (PANChSHEEEL) study in India alongside expertise from CHIP Co-Investigators globally. Since October 2018, work related to the CHIP research programme has commenced in India with activities in Indonesia & Chile to soon follow.



One Health

- CHIP recognizes that the health of slum-dwellers, animals and the environment are interconnected.
- We believe that infection & AMR mitigation can be achieved through the promotion of a One Health “whole of society” approach.



Citizen Science

- Citizen Science approaches enable communities to participate in research in a meaningful way whilst empowering communities to change behaviours.
- CHIP aims to engage with slum dwellers from the outset across all stages including implementation with technology where possible.



Infections & Antimicrobial Resistance

- Antimicrobial resistance has steadily emerged as one of the key global health challenges of the 21st century.
- CHIP aims to identify infections & AMR pathways in children U5 & subsequently address them using co-produced behaviour change & slum-upgrading interventions.

PROJECT OVERVIEW

The five phases of the CHIP research programme are outlined in the diagram below – (1) study setup, (2) formative research, (3) intervention development, (4) pilot testing and feasibility, and (5) cluster randomised controlled trials & process evaluation. The formative research phase consists of six interlocking projects designed to assess One Health infection & AMR determinants influencing infections & AMR in children U5 at individual, household and slum level. These will in turn pave the way to co-development, feasibility and pilot testing of interventions to address this infection & AMR burden in children U5. Following a cluster randomised controlled trial and process evaluation, if our interventions are proven to be effective in reducing this burden, scale-up activities will commence in each partner country.

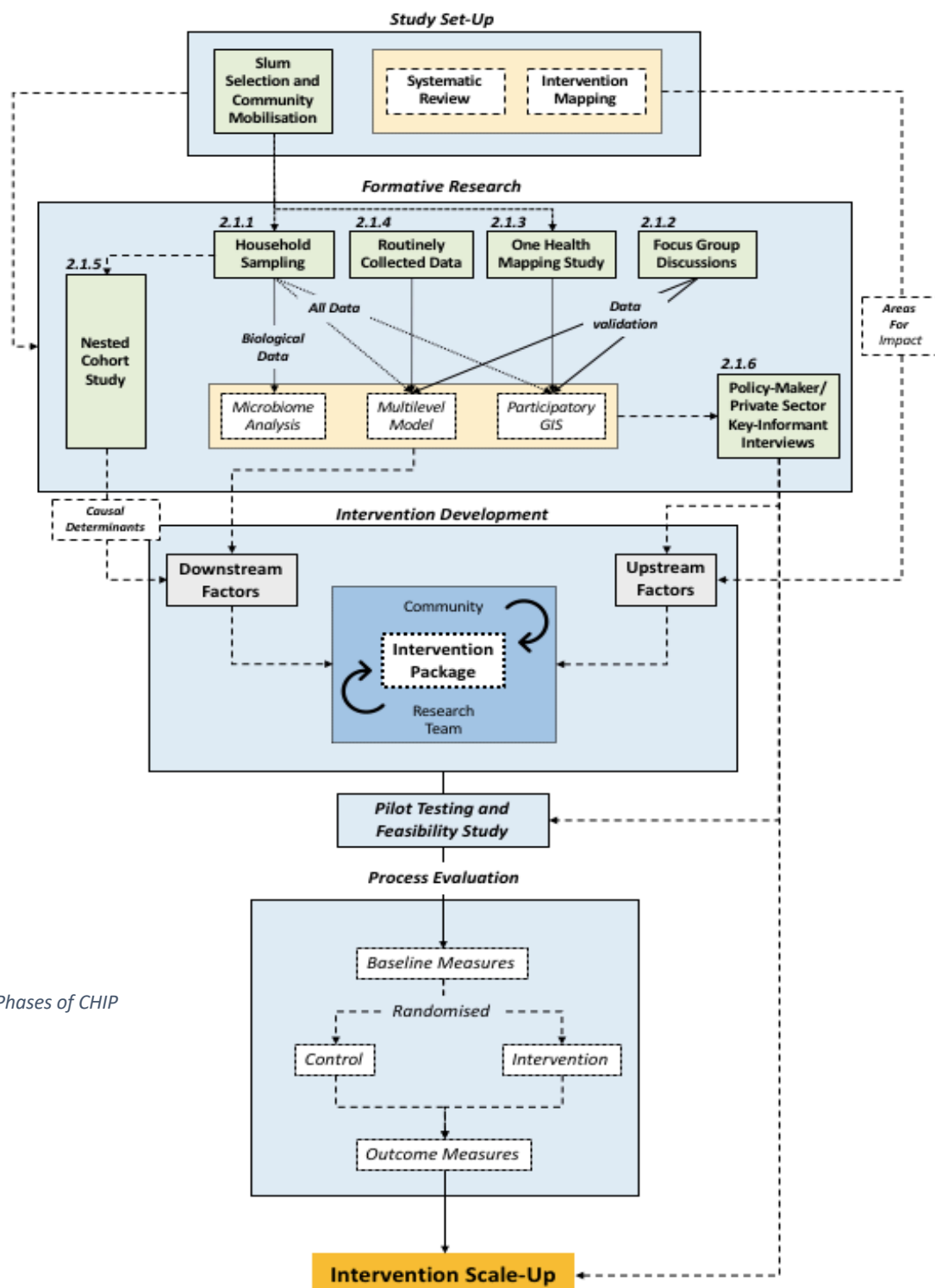


Figure 1. Five Phases of CHIP

INFECTION & AMR DETERMINANTS

Previous research has recognised that infections & AMR in children U5 are influenced by a complex set of factors across individual, household and slum level. The CHIP programme aims to identify these factors using a One Health (human, animal, environmental) approach. By consulting with our consortia, as well as undertaking a systematic literature review, the following components were hypothesised to be contributing to infections in children U5 with peri-urban slums.

Individual-level	Household-level	Slum-level
Previous antibiotic use	Livestock/companion animals	Solid waste management
Nutrition (incl. wasting/stunting)	Water quality (e.g. household taps)	Water, Sanitation & Hygiene (WASH) infrastructure
Previous infections	Milk quality	Healthcare facilities & services
Pathogen & AMR colonisation	Indoor air quality	Built environment (i.e. roads/electricity)
Vaccination status	Larval density	Community animals
Vitamin A status	Animal husbandry practices	Seasonal crop-burning practices
Acute/Chronic stress (i.e. cortisol)	Built environment (i.e. housing durability)	Water quality (e.g. community taps)
Co-morbidities (e.g. anaemia, HIV)	Infant and young child feeding practices	Outdoor air quality
Prematurity	Sociodemographics	Food availability & security

Figure 2. One Health infection determinants to be investigated in the CHIP programme

By breaking discipline silos to pool research expertise, the CHIP programme will work to collectively undertake methodologically rigorous studies to assess and subsequently address as many of these One Health factors as possible using co-develop complex interventions.



BACKGROUND OF CHIP CONSORTIUM

The first CHIP consortium workshop was held in Jaipur, India to celebrate the launch of the CHIP programme alongside achieving the following objectives:

- To network amongst India implementing partners (SCI) & consortia members
- To take stock of feasibility work findings undertaken in October 2018 @ Jaipur
- To refine the CHIP programme methodology for subsequent feasibility work across India, Chile & Indonesia
- To plan the next CHIP workshop in either Indonesia or Chile
- To identify follow-on grants alongside opportunities to garner impact

The workshop was held between 6th to 9th May 2019 at Hotel Clarks Amer, Jaipur City of Rajasthan, India. There were 21 participants and 14 speakers.

The workshop was organised in sessions per subject that opened with a presentation followed by an open discussion. The following subjects were discussed:

- Setting the context: Infections and slums in India
- Visualising research goals and engaging local communities
- CHIP's predecessor: PANChSHEEEL
- Water, sanitation & hygiene (WASH) in slums
- Slum Case Studies: Delhi, Bangladesh, Indonesia and Chile
- Slum Visit: site visits and transect walks
- Extreme Citizen Science and its applications
- Technical Research Methods
- CHIP Protocol Review

Summary slide decks are available to download here: <https://www.acesoghc.com/chip-project>



Prior to the workshop, all participants received the prevailing version of the CHIP protocol to review. This detailed all methodology & tools alongside country and city-specific information, data protection & sharing measures, impact activities and ethical procedures. This was presented & refined during the workshop in great detail (e.g. local laboratories, slum-sites descriptions and healthcare providers).

During the workshop, technical experts across numerous fields gave presentations on metagenomics, built environment, participatory-action-research, infectious diseases epidemiology and neurodevelopmental outcomes. Whilst engaging in brainstorming activities and networking opportunities, participants benefited from this wealth of information. They were further provided the opportunity to undertake transect walks in slum sites in Jaipur courtesy of SCI and Jeevan Ashram Sanstha (JAS; a local partner charity) to explore One Health infection determinants alongside local customs, perceptions & community initiatives.

In addition to above, key topics that were discussed included ways of engaging community members to become active contributors using art and citizen science & practicalities of operationalising the CHIP programme across three countries.

Overall, the workshop was an excellent example of a North-South collaboration undertaking multi-sectoral One Health action to address infections & AMR in children U5. A second workshop to review findings from the proposed projects across the 3 countries is currently being planned for Chile in 2020.

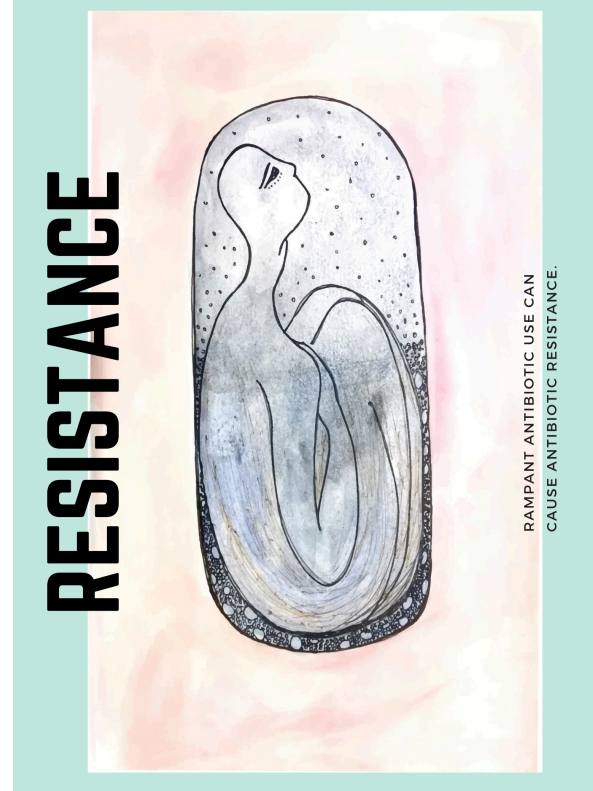
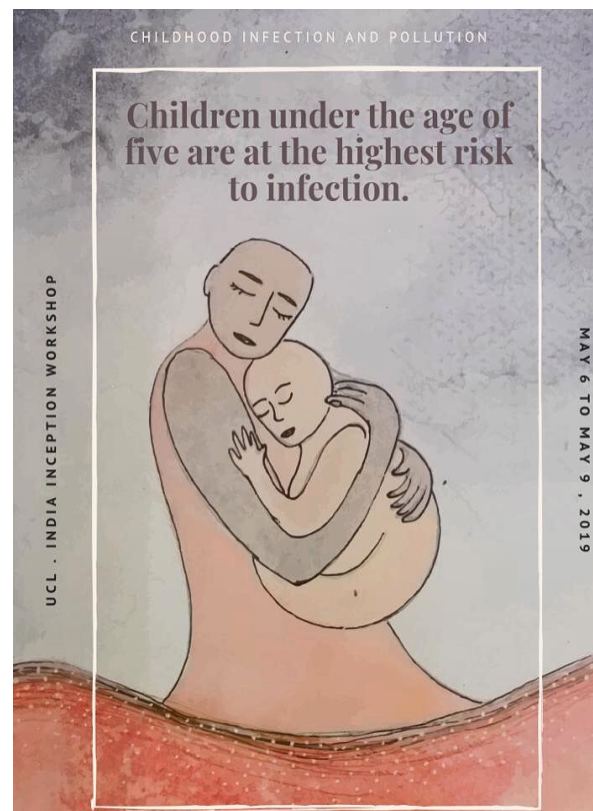


Figure 3. Art works created by Ishita Mehra

DAY 1

SESSION 1: INTRODUCTION

Setting the context – Infections and slums in India

The inaugural CHIP Consortia workshop was officially opened by Dr Logan Manikam of UCL and AGHC. He gave a warm welcome to the participants, outlined the strengths of working across disciplines & the origins and guiding principles of the CHIP research programme: (1) One Health and (2) technology enabled citizen science. This included plans to scaling-up interventions through innovative public and private-sector partnerships. He closed his presentation by outlining short, medium- and long-term goals of the programme & inviting participants to make the most of the workshop through the wealth of knowledge contextualised locality.

Following Dr Manikam, Spencer Rutherford of UCL & AGHC, gave a detailed overview of feasibility work findings undertaken by Ms Meghan Cupp of AGHC, SCI and JAS in Jaipur in October 2018.

SPEAKERS



DR LOGAN MANIKAM



SPENCER RUTHERFORD



HOUSEHOLD SURVEY OVERVIEW

Spencer Rutherford explained that a One Health focused household survey was undertaken in 15 households consisting of 25 children. The survey consisted of a 140-point questionnaire divided into 6 sections. Section 1, 2 & 3 relates to demographic and illness history whereas section 4, 5 & 6 relates to One Health determinants.

SECTION 1: HOUSEHOLD DETAILS

- Consists of 12 questions related to household sociodemographic details
- Covers number of household members, Aadhaar card presence and number, age & sex of children U5
- Answered by household heads

SECTION 2: MEDICINE AND CARE FOR CHILDREN U5

- Consists of 28 questions related to U5 children illness history over the past 30 days alongside care and medicine-seeking behaviours.
- This included illness symptoms (fever, diarrhoea, cough), if treatment seeking advice was sought, where was this sought & cost of travel, investigations & treatments
- Answered by U5 children primary caregivers

SECTION 3: HOUSEHOLD SOCIO-ECONOMIC STATUS

- Consists of 22 questions related to household socio-economic status.
- This includes literacy, education, religion, caste, occupations & household earnings.
- Answered by household heads

SECTION 4: BUILT ENVIRONMENT

Consists of 55 questions related to fuel use, electricity, air quality, WASH infrastructure, housing materials & mobile technology (to facilitate citizen science methods)
Answered by household heads

SECTION 5: ANIMALS

- Consists of 7 questions related to household livestock and companion animals (including pests).
- Answered by household heads

SECTION 6: HEALTH BEHAVIOURS

Consists of 16 questions related to household health behaviours.
This included questions on feeding, WASH, cooking and vaccination behaviours. Answered by U5 primary caregivers

PILOT STUDY: FINDINGS

In summary, this pilot study identified a high 30-day infection prevalence (40% of 25 U5 children) in those residing in Jaipur's urban slums. This is in contrast to lower figures identified from previous research studies. One possible explanation is the use of parental self-reports rather than more robust doctor reported diagnosis.

Strong correlation was noted between infection prevalence & monthly household expenditure and access to sanitary facilities. Treatment seeking behaviour was primarily from private facilities. Low vaccination rates (<40%) were observed. This reflects the marked dependence of slum dwellers on the private health system and the intrinsic weakness of the public health care system in ensuring high immunisation rates and providing access to high quality WASH facilities.



DISCUSSIONS & QUESTIONS

Following Spencer Rutherford's presentation, a lively discussion followed with several points raised:

Point 1: "If interviews are conducted with the household heads (e.g. generally men) on some sections & primary caregivers (e.g. generally women) on others, wouldn't there be bias/mis-reporting on different sections?"

It is acknowledged that joint interviews for certain sections may produce more robust findings. Upcoming work for the CHIP programme includes 1-1 interviews with slum-dwellers to ascertain feasibility and practicalities of joint interviews.

Point 2: "There was no single case of diarrhoea reported despite significant issues identified with WASH"

It is suspected that there may be issues as to how survey questioning was framed. Upcoming work that includes 1-1 interviews on community perceptions of infections will shed further light on diarrhoeal disease (Alongside more robust surveyor training in subsequent household surveys).

Point 3: "Survey answers may be biased due to pre-existing relationships between households & surveyors."

The pilot survey was undertaken by a 2-person team consisting of a local community champions from JAS & an AGHC staff member. A subsequent household survey with human, animal, water & environmental sampling is planned and will be undertaken by a 3/4-person India based team supported by local community champions to reduce bias.

Point 4. "Women may be apprehensive to use shared toilets."

It's acknowledged that the presence of household toilets may not be a sufficiently sensitive indicator as toilets may be shared by multiple households. Upcoming work including community mapping and transect walks across India, Indonesia & Chile will further shed clarity on these complex behaviours.

OVERVIEW OF INDIAN SLUMS

Dr Kaushik Sarkar of AGHC, Dr Rajesh Khanna and Sanjay Sharma of SCI subsequently followed with presentations that provided a detailed overview of child health and slums in India.

Sanjay Sharma opened with stark figures on the emerging realities in India's urban deprived children; 47% of urban poor children under five are chronically malnourished. With an exponentially rising population in India's urban slum (50-70% increase) alongside a rising proportion of children (50% increase), the double burden of infections & malnutrition is only set to rise in India.

Dr Khanna continued by highlighting the experiences of SCI in undertaking interventions to improve child health and well-being across India. This included tackling malnutrition and pursuing Street to School initiatives for homeless children.

Access to Services

- 8.1 million children 0-6 live in urban slums
- 90% migrant children do not have access to Anganwadi & Integrated Child Development Services
- 15.3% of the homelessness population in India consists of 0-6 children

Health and Nutrition

1 in 20 children do not live past their first year of life
47% of U5 children are chronically malnourished.
About 1.2 lakh children U5 die to diarrhoea annually.
India has the second highest number of obese children in the world after China.

WASH

- 10.1% of <15 children years practice open defecation
- Only 36% of <2 children stools are disposed off safely

Crime

- 7.8% of 5-14 children have lost their life due to motor vehicle accidents.
- 10.1 million children 5-14 work full-time
- Most recorded crimes against children are kidnapping (52.3%) and sexual offences (34.4%).

Education

- Only 77% of urban children 5-18 have access to education
- 23% of female children drop out due to lack of school toilets
- 34% of children 5-18 year with disabilities have no access to education.

India's Children's Rights and Protection Constitutional Provisions

21. (a) Right to free and compulsory elementary education for all children 6–14 years old

23. Right to being protected from being trafficked and forced into bonded labour

24. Right to be protected from any hazardous employment till the age of 14 years

39. (e) Right to be protected from being abused and forced by economic necessity to enter occupations unsuited to their age or strength

45. Provide early childhood care and education to all children until they are 6 six years old

47. Right to nutrition and standard of living and improved public health

SPEAKERS



Dr Rajesh Khanna



Dr Kaushik Sarkar

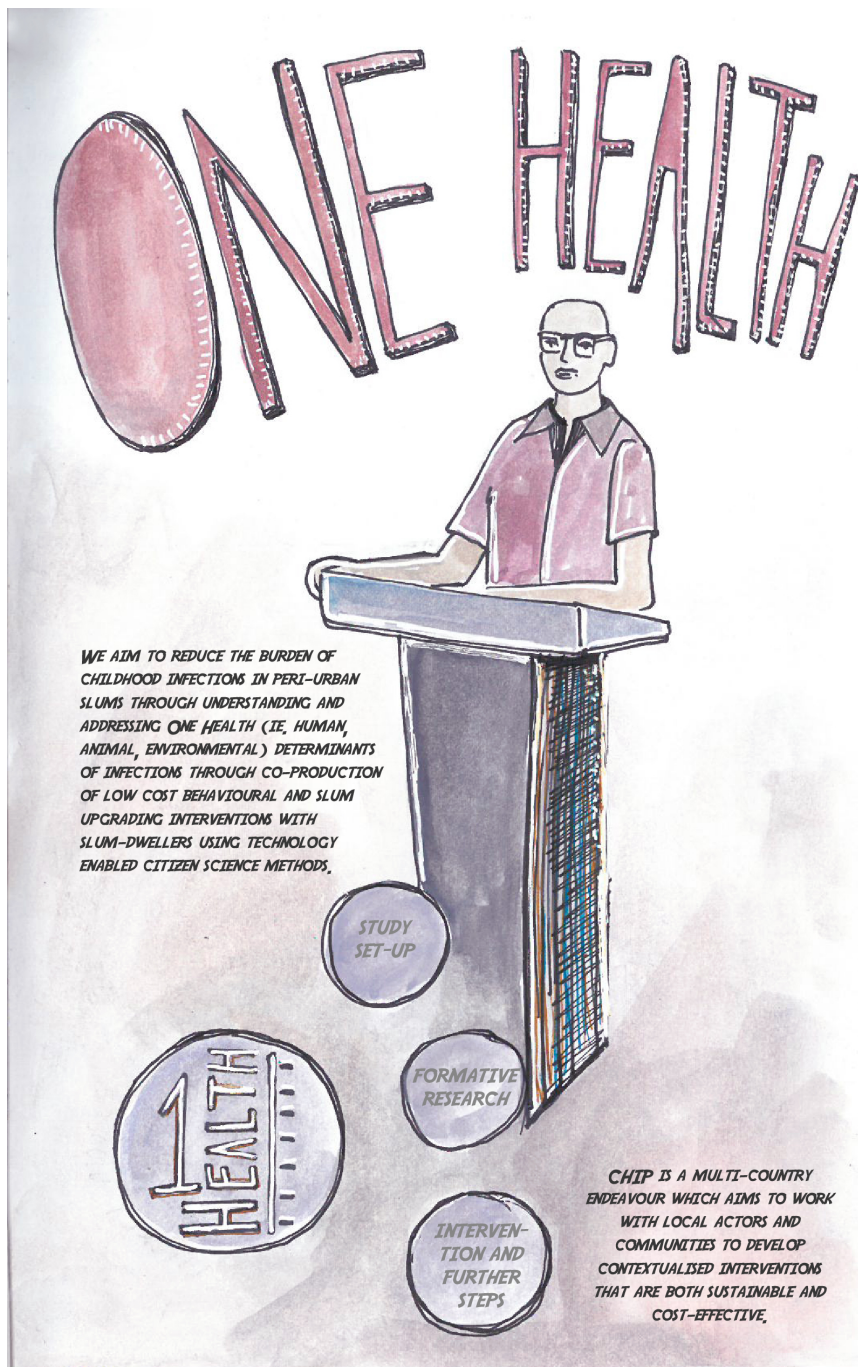


Sanjay Sharma

DAY 1 SESSION 2:

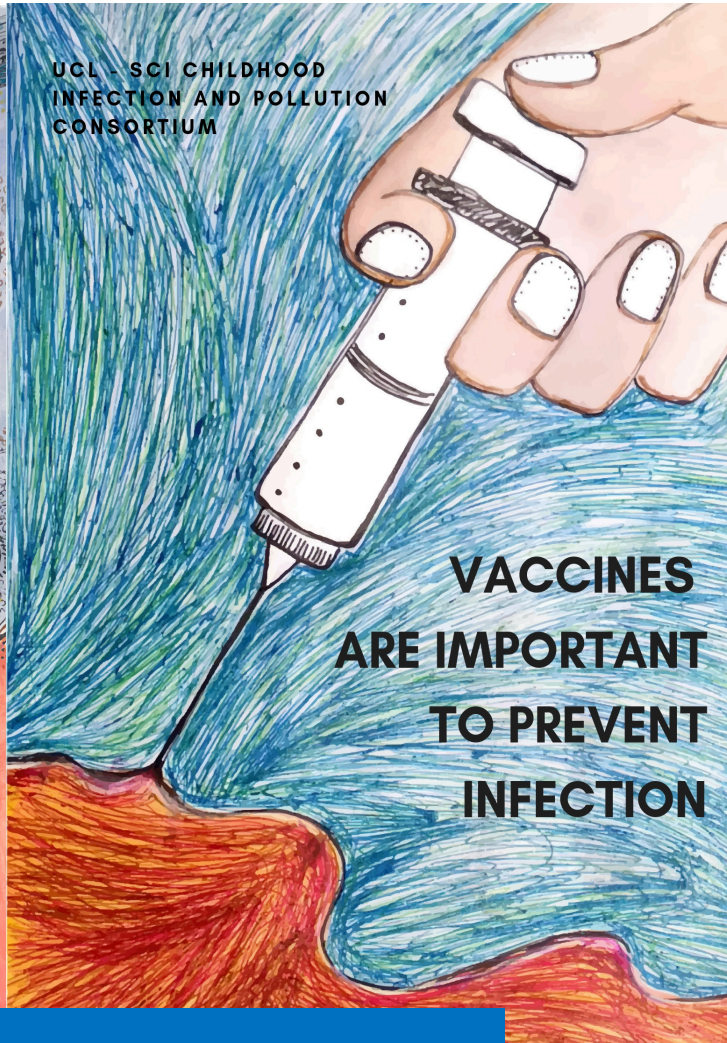
Engaging local communities using art & visualisations

Ishita Mehra, a visualisation artist commissioned by AGHC presented her CHIP-related artworks; an important method in facilitating citizen science in communities where literacy is poor (74% illiteracy noted from the 2018 Jaipur pilot study) & linguistic barriers are common.





UCL - SCI CHILDHOOD
INFECTION AND POLLUTION
CONSORTIUM



**VACCINES
ARE IMPORTANT
TO PREVENT
INFECTION**

DAY 1 SESSION 3: CHIP's Predecessor –PANChSHEEL study (Part 1)

Professor Monica Lakhanpaul, UCL's Pro-Vice-Provost (South Asia) & principal investigator of the MRC funded PANChSHEEL study gave an overview of the study's key aim (addressing gaps in infant and young child feeding and child care practices in rural Rajasthan), findings and learnings. Further information on the study is continued on day 3 (page 21)

SPEAKER
Prof Monica Lakhanpaul



DAY 1 SESSION 4:

WASH in Slums

The last presentation on day 1 was given by Dr Priti Parikh of UCL who explained the importance of delivering high quality WASH services in slums whilst also promoting “green infrastructure”. She added that the highest reductions in mortality rates were due to provision of safe water and piped sewerage, yet, 1/3rd of the urban slum population globally remain without adequate WASH services.

Beyond health, WASH access has a direct impact on achieving at least 132 out of the 169 SDG targets. Further investment in sanitation will therefore lead to knock-on positive impacts on all these other goals.



Figure 4. Sustainable Development Goal (SDG) Targets

IMPORTANT MESSAGES ON WASH

Increasing provision of integrated WASH infrastructure can alleviate poverty whilst improving health, education, income and housing

WASH investment can have multiplier effects & untap latent wealth to overcome the 'poverty syndrome'

Community priorities should be a key consideration in WASH infrastructure provision

Gender-sensitive infrastructure such as public toilets require great care and planning

Significant opportunities for community-private sector partnership exists in slum networking



data

globe as the head!

SPEAKER

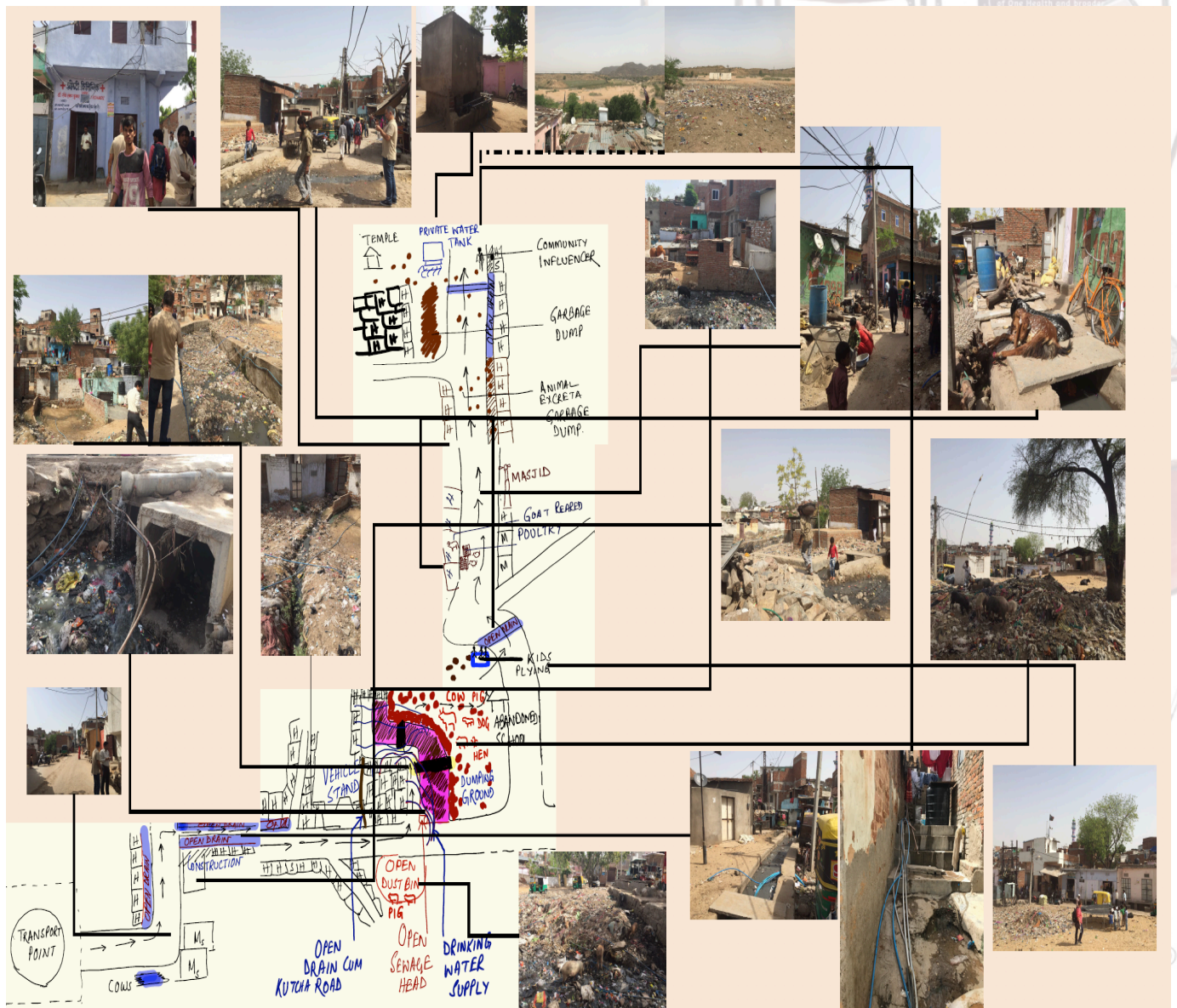
Dr Priti Parikh



DAY 2

SESSION 5: Slum Visits Site visits and transect walks

Day 2 started with transect walks across slum sites organised by SCI and JAS. Facilitated by local community champions, workshop participants were introduced to numerous community members. Summary findings from the transect walks were subsequently presented by Dr Sarkar on Day 3 as a virtual transect walk for dissemination to the rest of the consortia.



The afternoon of D2 was followed by Professor Muki Haklay of UCL who presented (remotely) an overview of citizen science and its typology. One successful examples of citizen science undertaken by his ExcITES team was mapping Kibera using OpenStreetMap (with far more detail than Google Maps).

DAY 2 SESSION 6: Extreme Citizen Science

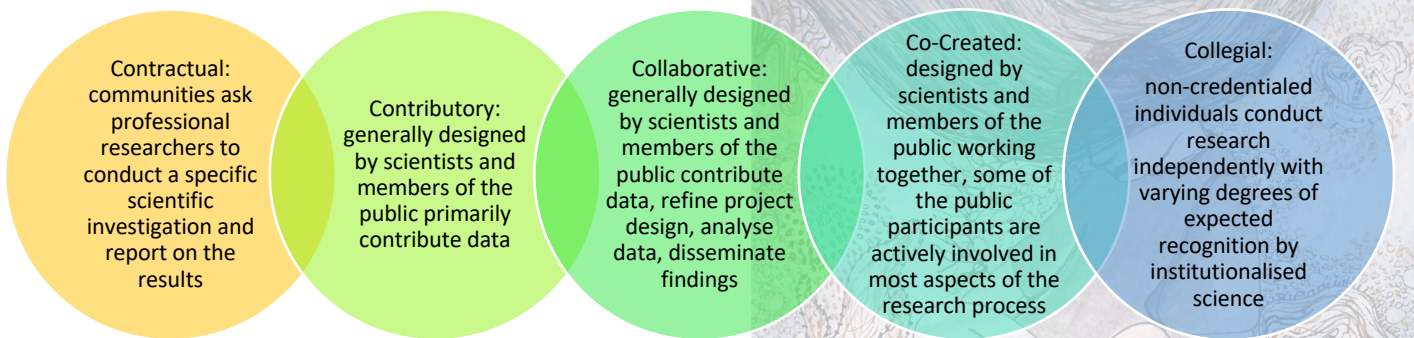


Figure 5. 5 Cs Typology of Citizen Science

He noted that there are several methods by which citizen science (particularly the extreme variant) could further CHIP's programme potential & allow collaborative science from problem definition & data collection to analysis.

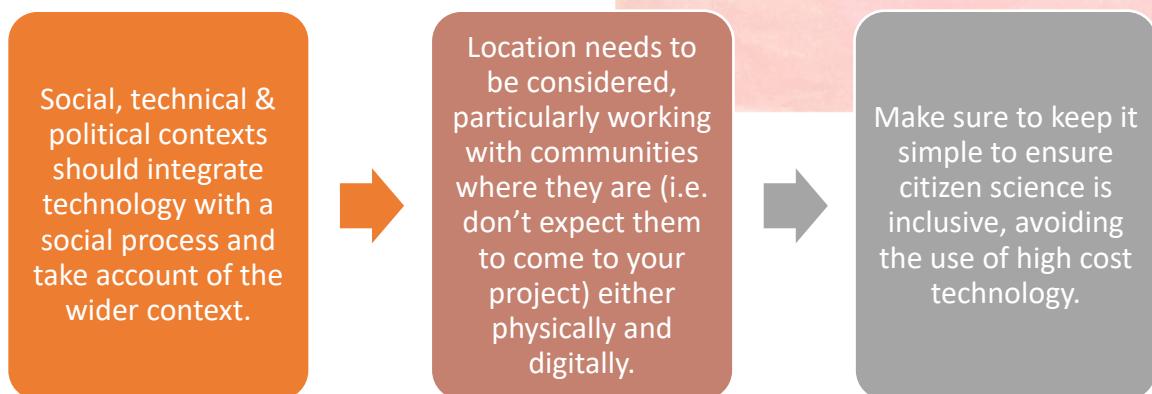


Figure 6. Principles and Guidelines of Citizen Science

One such example is Sapelli, developed by UCL ExCITES; an open-source project that facilitates data collection irrespective of literacy barriers through highly configurable icon-driven interfaces. It has numerous advantages including:

- (1) being freely downloadable from either the Google play store or the GitHub repository (& therefore editable for a user's own purposes) &
- (2) complete record transmission handled autonomously by the Sapelli platform, which periodically checks for connectivity and determines the most appropriate means by which to transmit the compressed data to another phone or a GeoKey web server.

He cautioned that with the use of any technology, extensive training should be given to communities to enable data collection together with providing adequate support to (a) create intelligent maps & (b) ensure robust Geokey data management to analyse and subsequently visualise findings using Sapelli's viewer.

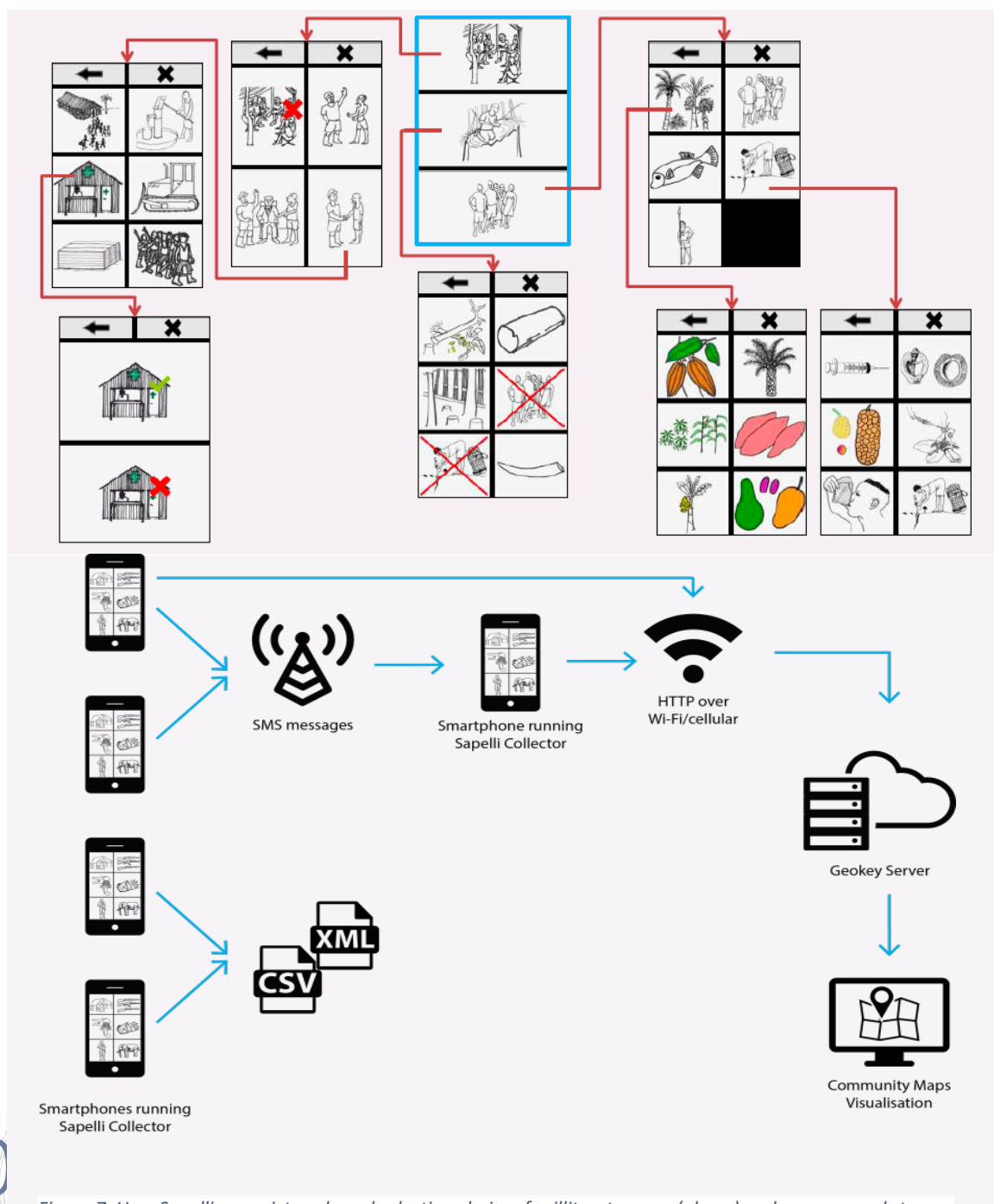


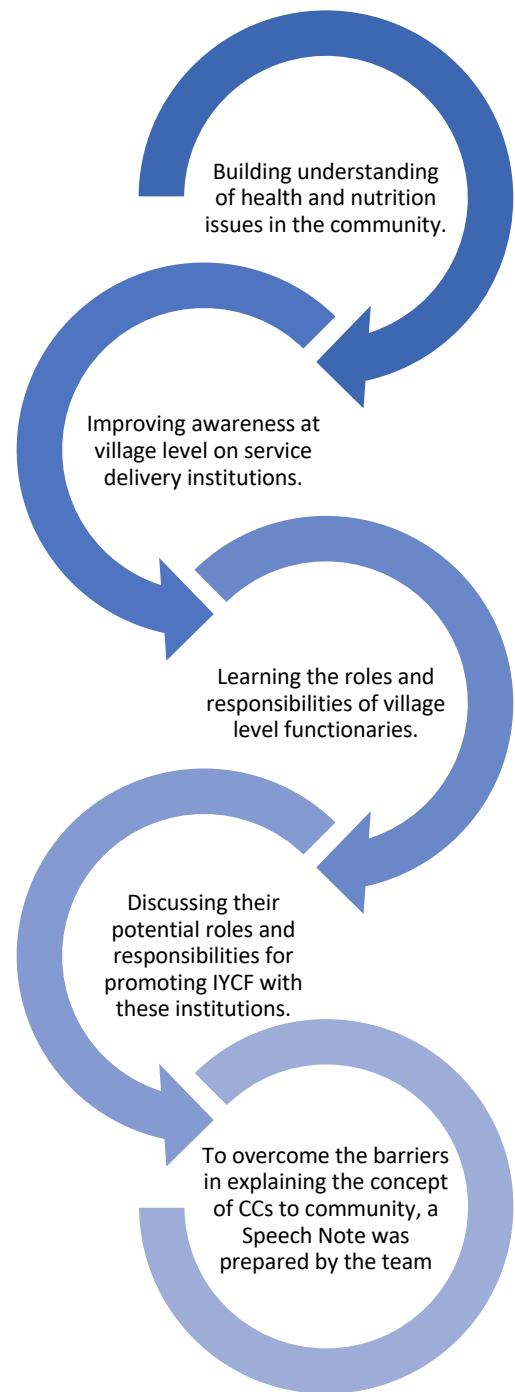
Figure 7. How Sapelli uses picture-based selection choices for illiterate users (above) and manage and store data (below)

DAY 2 SESSION 7: PANChSHEEL Study (Part 2)

Continuing from D1, Professor Lakhanpaul continued elaborating on the PANChSHEEL study's key features: (1) community participation across all study phases & (2) close alignment with POSHAN Abhiyaan, a Government of India mission that takes a multi-sectoral approach towards addressing the socio-ecological determinants of malnutrition. This was followed by Sanjay Sharma, Dr Khanna & Hemant Chaturverdi of SCI describing its methodology in detail:

- Village selection
- Social mapping
- Community champion selection & capacity building
- Intervention co-design
- Dissemination

Figure 8. Five phases of training for Community Champions



DAY 2 SESSION 8:

Slum Case Studies: Delhi, Bangladesh, Indonesia & Chile

Jacob Paulose formerly of CURE, continued D2 by introducing the OptiHouse project at Delhi which aims to optimise health and sustainability in a low-income settlement using urban design. He reflected on his experiences in the resettlement colony in Savda Ghevra and the challenges he faced in each stage using participatory action research (PAR);

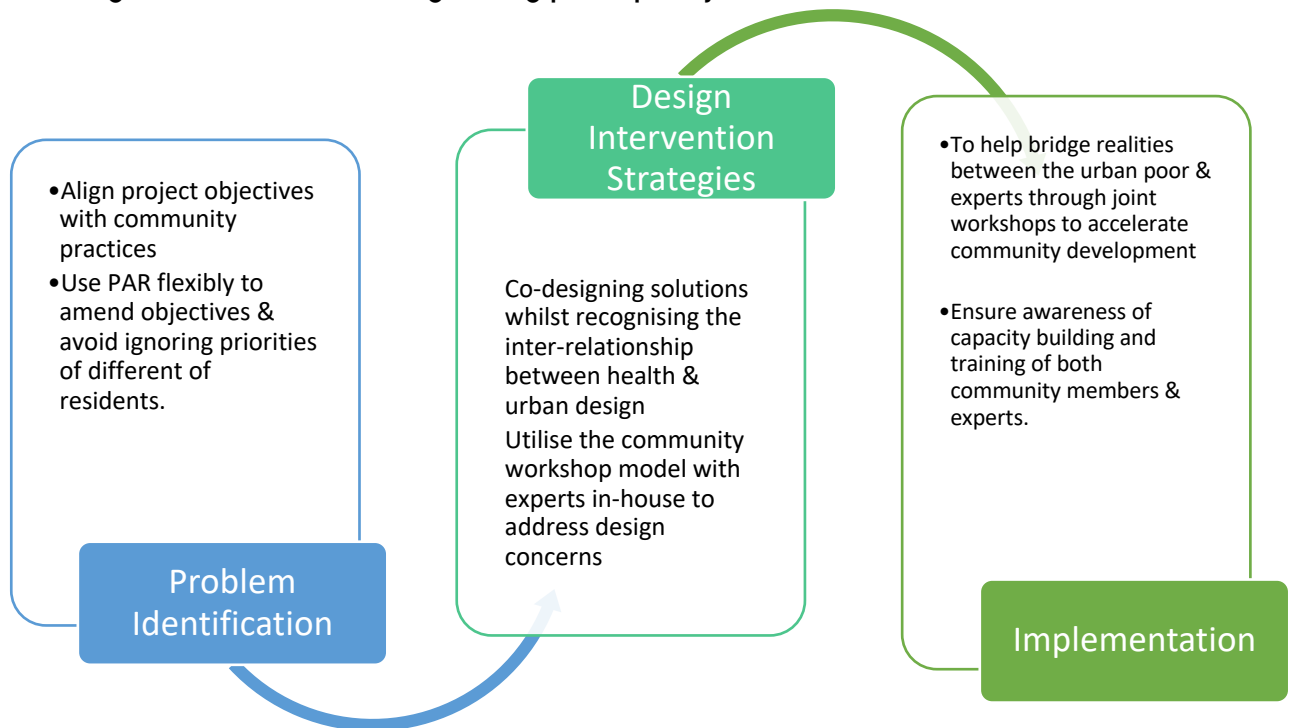


Figure 9. Methodology of Participatory Action Research into 3 Steps

This was followed by a presentation from Dr Hector Altamirano of UCL on slums in Chile. Reflecting on his experiences at the UK Centre for Moisture in Buildings & an interdisciplinary network on preventing vector-borne diseases (VBDs) in sub-Saharan Africa, he also outlined how the built environment is closely related to disease spread and an essential consideration for public health initiatives.

Obaidu Rahman of St Luke's International University provided a narrative on Bangladesh's urban slums including the continuing high infection related mortality rates. To reduce this, scaled up health system initiatives are needed to maximise healthcare accessibility in U5 children.



DAY 3

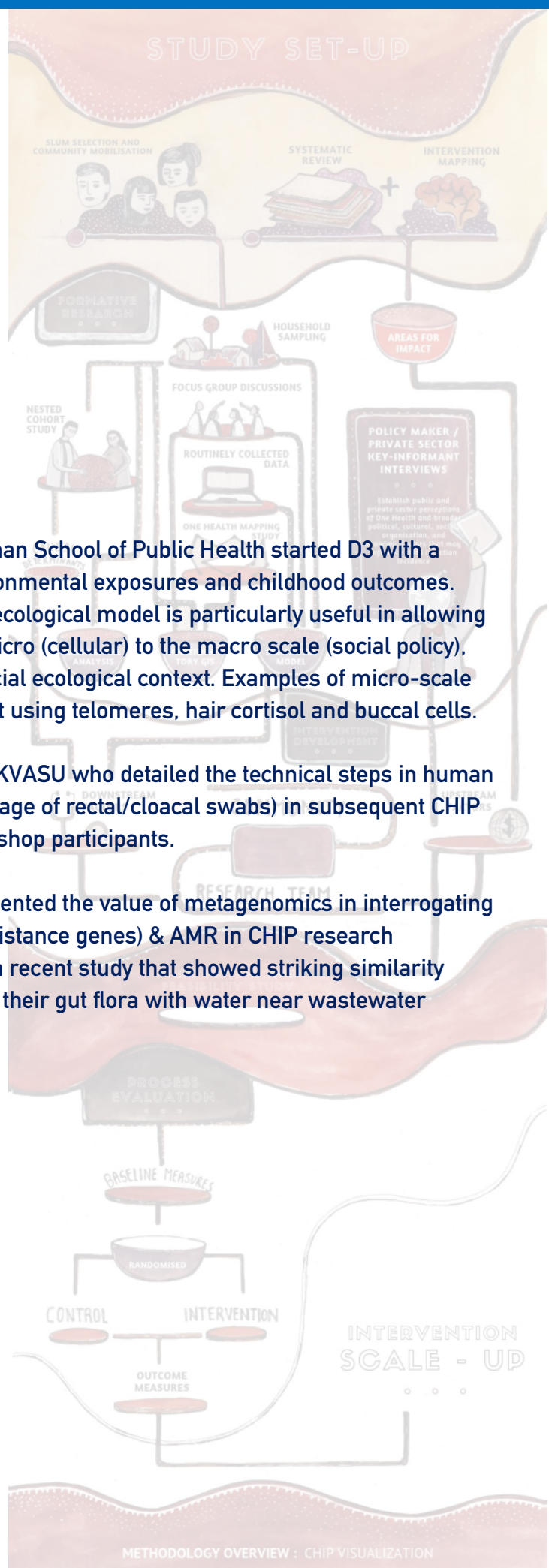
SESSION 9:

Technical Research Methods

Professor Factor-Litvak of Columbia Mailman School of Public Health started D3 with a presentation on psychosocial stress, environmental exposures and childhood outcomes. Specifically, she described how the social ecological model is particularly useful in allowing researchers to study stressors from the micro (cellular) to the macro scale (social policy), positioning their work within the larger social ecological context. Examples of micro-scale investigations include stress measurement using telomeres, hair cortisol and buccal cells.

This was followed by Dr Prejit Nambiar of KVASU who detailed the technical steps in human & animal sampling (e.g. collection and storage of rectal/cloacal swabs) in subsequent CHIP programme phases for the benefit of workshop participants.

Dr Hein Min Tun of HKU subsequently presented the value of metagenomics in interrogating antimicrobial resistomes (i.e. antibiotic resistance genes) & AMR in CHIP research methodology. This included findings from a recent study that showed striking similarity between the resistome of inhabitants from their gut flora with water near wastewater treatment plants across Europe.



Day 3 SESSION 10: Review of CHIP Protocol

This was followed by a session by Spencer Rutherford & Dr Manikam eliciting feedback on the CHIP Protocol to date; incorporating the knowledge gained from presentations & slum visits over the course of the workshop. Below is a snapshot of key discussion points raised:

Social bond between children and animals

- Focus on indicator organisms such as *E. coli*, *Salmonella* & *Streptococcus* on the mucosa & skin of companion animals.

Definition of "pets"

- There are animals that are in the community but linked to the household (i.e. don't live in the house)
- The pilot study noted that 2 out of 15 households said they had a pet however some animals may be marked as a 'vehicle' & not as a 'pet'.

"We know exposure to faecal material is a cause of gastro-intestinal (GI) infections; what forms of contact people have with animals that then leads to other infections?"

- Aim to get more than just faecal (i.e. nasal, skin) samples in animals to allow more in-depth analysis of transmission pathways.

"Which water sources in slums that are important to assess AMR?"

- Drinking, bathing, waste & ground water should be explored alongside soil

"Can microbiome cause malnutrition?"

- Evidence that it is part of an interlinked cycle. This will be explored in CHIP as a potential intervention target

Sampling Training & Community Sensitisation

- Need for comprehensive training as consent to collect biological samples is heavily cultured
- Community sensitisation is paramount for study success (settlement maps may be useful in establishing community power dynamics)
- To increase participant uptake, non-invasive human sampling using culture independent methods may be necessary (e.g. old stool)

Sampling Sources & Variation

There is need for intensive human (i.e. nasal/faecal/hair), animal & water sampling to accurately identify relationships between pathogens and their wider environment

Longitudinal sampling needed to account for seasonal variation in addition to sampling both public & private water sources

"How will comparisons across multiple countries be undertaken?"

- Challenges may be due to different built environments, infection rates & AMR patterns
- Will be explored in upcoming feasibility work

Day 3 SESSION 11:

Slum Case Studies: Delhi, Bangladesh, Indonesia and Chile (Part 2) & Vector Borne Diseases

The afternoon of D3 continued with Dr Pradeep Kumar Srivastava formerly of Ministry of Health & Family Welfare describing how several vector-borne diseases (VBDs) are putting millions of children at risk of infection in India. He described several national diseases control programme including the National Health Programme & National Vector Borne Disease Control Programme (NVBDCP) alongside showcasing a framework for malaria elimination across India.

D3 was closed with a presentation by Dr Dewi Aisyah of INDOHUN. In 2014, Indonesia had approximately 38,431 hectares of slums. In Jakarta alone, 25% of its population live in slums with high infection & stunting rates observed amongst U5 children. She further added how arts could be incorporated in CHIP related slum upgrading interventions. One such example is the Rainbow Village, the Indonesian Government's national slum upgrading project (below).



Figure 10. Rainbow Village: Indonesian Government's national slum upgrading project in Kampung Pelangi

DAY 4

The final day consisted of further CHIP protocol refinement & planning the subsequent phase of feasibility work in India, Indonesia & Chile in Q3-Q4 2019 prior to reconvening in the 2nd CHIP Consortia workshop in Q1-Q2 2020 to discuss findings & plan next steps (i.e. grant & implementation opportunities). Followed by consortia approval, the 2nd workshop was provisionally agreed to be held in early 2020 following feasibility work in both countries.

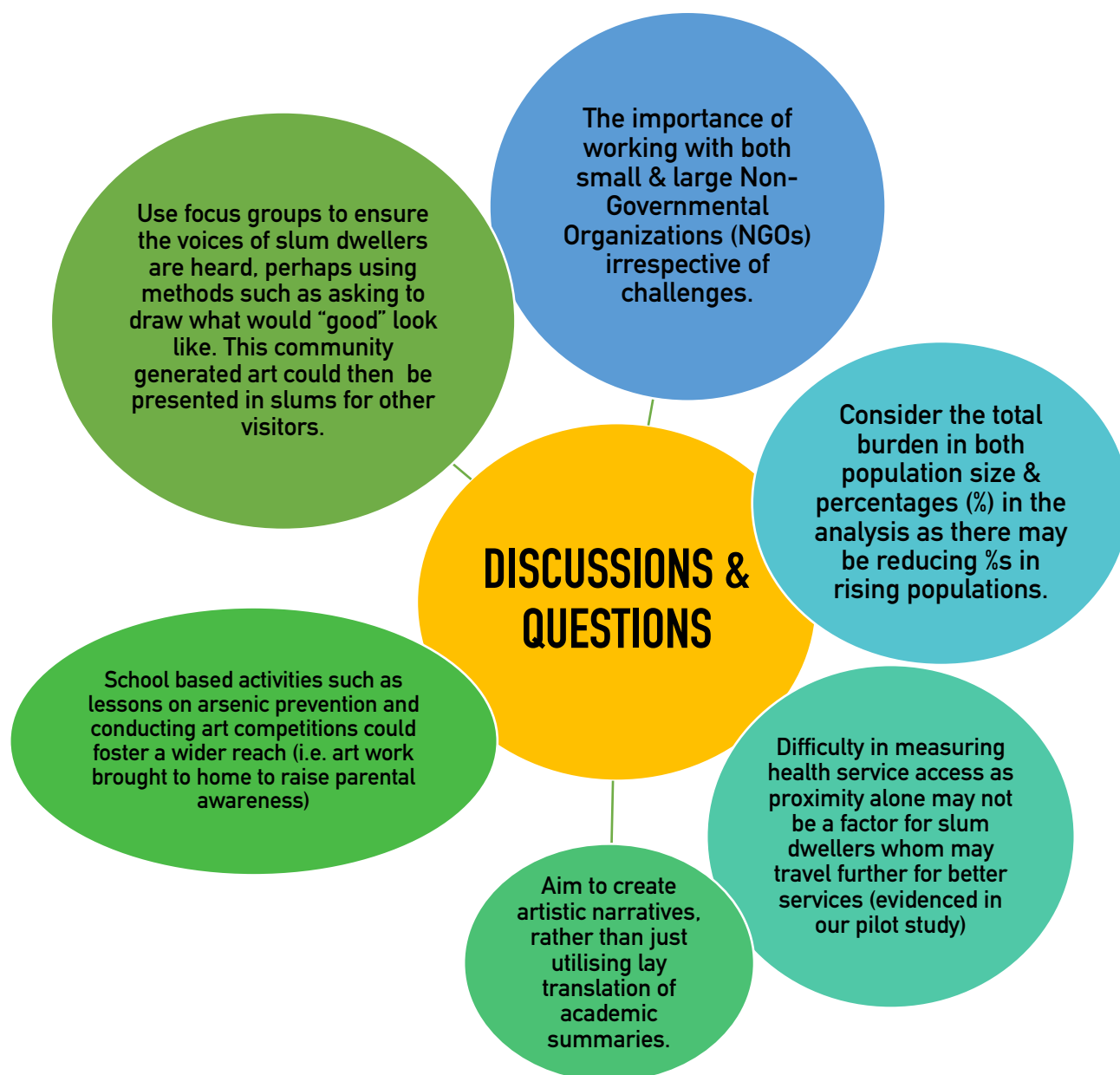


Figure 11. A snapshot of discussion points and questions from the last day of the workshop.

To close, a Vote of Thanks was given to all the funders, presenters, attendees and administrative staff who made the workshop possible. Dr Manikam also thanked all participants for helping to shape the CHIP research programme to date & their input going forwards.

For further details and opportunities to collaborate please visit <https://www.acesoghc.com/chip-project> or email ysabelle.boo@acesoghc.com

