Development of tools to measure behavioural and social drivers (BeSD) of vaccination

PROGRESS REPORT

June 2020

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ACKNOWLEDGEMENTS
WHO would particularly like to thank Noel Brewer, Julie Leask, Gilla Shapiro and Kerrie Wiley for their invaluable contributions to this document and the associated initiative.

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EXECUTIVE SUMMARY

For countries to receive the full benefit from vaccination, reaching and maintaining high coverage is vital. Addressing under-vaccination requires an understanding of the determinants of the problem, tailored evidence-based strategies to improve uptake, and monitoring and evaluation to determine the impact and sustainability of the interventions. To support programmes and partners' systematic assessment of factors affecting uptake, WHO is developing tools to measure and address reasons for under-vaccination, and to track consistent and comparable data over time. In November 2018, a global expert group called 'Measuring Behavioural and Social Drivers of Vaccination' (BeSD) was established by WHO, in collaboration with core partners, to oversee development of these tools. Specifically, these tools will include the BeSD Childhood Immunization In-Depth Interview guides (CI-IDIs), BeSD Childhood Immunization Survey (CIS), and User Guidance.

The development of tools to measure the BeSD of Childhood Immunization (BeSD CI) is currently ongoing. This report summarises key steps in the BeSD tool development process to date, including evidence reviews, expert input, partner consultations, and initial efforts to refine and test the draft package. As elaborated below, the BeSD group has thus far: 1) Initiated this work by developing terms of reference, recruiting experts, and conducting needs assessment interviews with regional and in-country stakeholders; 2) Conceptualized the framework for the BeSD CI tools by identifying known determinants of vaccination from existing systematic reviews, identifying relevant theories and frameworks that can help structure the tools, reviewing qualitative studies for conceptual themes, reviewing existing survey measures, and building a pool of potential items; 3) Developed the BeSD CI tools using input from the BeSD working group and regional UNICEF and WHO colleagues; and, 4) Refined the BeSD CI tools through cognitive interviewing techniques – completed in part at the time of writing this report. Future plans include further refining of the BeSD CI tools, field testing of the BeSD CI tools, and dissemination and implementation.

The contents herein reflect the status of work as of May 2020 and will be updated again by the end of 2020.

STEP 1. GETTING STARTED

Rationale for the creation of the BeSD expert group

WHO recognised the need for evidence-informed and globally standardized tools to support programmes and partners to assess and address reasons for under-vaccination. A series of discussions with key vaccination partners—including UNICEF; the US Centers for Disease Control; Gavi, the vaccine alliance; and the Bill and Melinda Gates Foundation—led to the idea of an expert working group in this area. Thus, WHO collaborated with core partners to establish the 'Measuring Behavioural and Social Drivers of Vaccination' (BeSD) working group of experts in November 2018. The group's aim is to support the systematic assessment of behavioural and social factors affecting vaccination uptake and oversee the development of potential tools and related implementation guidance.[1]

Members of the BeSD group include representatives of global agencies and experts from multiple geographical regions, covering a range of social and behavioural science disciplines with practical and programmatic experience in high-, middle-, and low-income settings (Appendix 1). The working group established terms of reference (Appendix 2) and a glossary of terms (Appendix 3) to guide the development of the BeSD CI tools. The BeSD working group also linked to the larger multi-partner Demand Hub to facilitate alignment and coordination with partner efforts in other technical areas, and BeSD has given regular updates to and had consultations with the Hub.

The expected primary outputs of the BeSD working group are as follows:

- BeSD Childhood Immunization Survey (CIS), for parents and caregivers of children under 5 years of age
- BeSD Childhood Immunization In-Depth Interview guides (CIDI), for parents and caregivers, health workers, community stakeholders, and authorities across the health and immunization system
- User guidance, to support the local testing and application of the tools for data gathering, analysis and use, including frameworks to guide programme planning
- Draft indicators aligned with the BeSD CI tools to contribute to the Immunization Agenda 2030 and Gavi 5.0 strategy, and updated WHO/UNICEF Joint Reporting Form questions
- Contributions to the establishment of a global BeSD repository for data, case studies and insights, together with coordinated technical assistance

Working group members have participated in regular teleconferences to support information sharing, contribute expert inputs, and create new insights from a range of relevant projects on immunization.

Needs assessment interviews with regional and in-country stakeholders

We sought to identify the need for, capacity for, and potential use of the new BeSD CI tools. Our team conducted 20 semi-structured informant interviews with experts and stakeholders in a range of settings. The two phases of this work were a) informal consultation and six pilot interviews (April-May 2019), and b) formal semi-structured interviews (June-August 2019) (University of Sydney Ethical approval No.2019/284).

Country and regional WHO offices expressed a clear need for the proposed BeSD CI tools. We continue to rely on top-line findings from these interviews throughout development of the tools (Appendix 4), and formal analysis of the interviews is progressing. Insights from these interviews reinforced the need for the development of a package of tools to assess vaccination uptake.

STEP 2. CONCEPTUALIZATION OF THE BESD TOOLS

Literature reviews

We reviewed available theoretical models that have been applied to vaccination to locate potential domains of under-vaccination and facilitate the development of a conceptual model that would ground the structure of the BeSD quantitative survey (April-June 2019). The main theoretical models reviewed were COM-B,[2] 5 A's,[3] 5 C's,[4] Gates/UNICEF's Caregiver journeys,[5] the Social Ecological Model,[6] and Brewer et al.'s Increasing Vaccination Model.[7] We gave particular consideration to models that combined supply and demand reasons for under-vaccination, addressed sociocultural and structural issues, and described issues that are pertinent to low-, middle-, and high-income countries.

To locate constructs not identified in these theoretical models, we reviewed published qualitative and quantitative reviews of studies of barriers and facilitators to childhood vaccination. We grouped each barrier and facilitator under the six COM-B domains (Appendix 5). A review of existing relevant surveys on childhood vaccination and their psychometric properties (Appendix 6) also helped to identify constructs and potential items from previous scales to measure under-vaccination (Appendix 7). This process established a list of potential constructs to consider for the BeSD survey.

Conceptual model

In a face-to-face meeting at WHO in Geneva (May 2019), the working group developed a conceptual model of the behavioural and social drivers of vaccine uptake (Appendix 8) from the available theoretical models and empirically derived constructs. Our model has four domains: 1) Thinking and feeling, 2) Social processes, 3) Motivation (or hesitancy), and 4) Practical factors. These largely follow the domains of the Increasing Vaccination Model (IVM) [7] Motivation is part of the thinking and feeling domain of the IVM, but we separated it to clearly demonstrate where hesitancy fits.

We developed constructs for each domain. Then for each construct, we developed indicators that a country would calculate. We selected constructs and indicators that would provide countries with actionable information to inform their immunization programmes. We also prioritized constructs that would be meaningful in multiple contexts, consideration of issues that will become important in the future, affordability and practical aspects for country use, ease of translation, among other considerations. We subsequently refined and modified the list of constructs iteratively based on continued expert discussion and input, including adding several new constructs.

Project management

In early 2019, a planning framework was also developed and regularly updated throughout the year. The framework (Appendix 9) is structured around four main steps:

- Phase 1: Tool development (completed in 2019)
- Phase 2: Cognitive interviewing and user testing (started in Q4 2019)
- Phase 3: Psychometric validation and integration (in progress in 2020)

Each phase included a list of planned activities and expected outputs. The planning framework serves to guide the process for development of the tools and supporting materials for testing, integration and capacity building in country. The first phase represents the creation of a draft version of the BeSD Childhood Immunization tools including the BeSD CIS, BeSD CIDI, and User Guidance. Phase two represents the initial testing, translation and local adaptation of the tools includes related guides for recruitment, sampling, and translation, as well as training in research methods. The third phase of work will encompass the validation of the tools themselves and gathering feedback on the user guidance, with a focus on supporting integration with existing activities and processes in countries.

STEP 3. DEVELOPMENT OF BESD TOOLS

Development of the BeSD CIS

We sought to create a survey for parents of children under age 5 about the social and behavioural drivers of vaccination. As a first step, we created potential survey items (i.e., questions and response options) to address each of the proposed constructs (Appendix 8). We included items from the published and grey literatures (July-August 2019). We also reviewed the published literature for quantitative scales assessing vaccination attitudes, identified items from existing relevant survey instruments (Appendix 7), and reviewed the grey literature including (a) CDC surveys including EPI reviews, (b) Gates/Ipsos Vaccine Caregiver Journey Literature Review, (c) JRF/WHO reporting forms, (d) Missed Opportunities for Vaccination Strategy, and (e) UNICEF/ Harvard Opinion Research Program surveys. Next, we developed and agreed upon criteria to guide item development and selection (see Appendix 10). Criteria included length, simplicity, readability, translatability, existing use, psychometrics, validity, and ceiling effects. Two members of the core group examined all potential items, and recommended prioritization of items for each construct based on this criteria (August 2019).

Input from the working group informed the selection and refinement of indicators, survey questions, and response scales through an iterative process of consensus. Four to six experts participated in three sub-groups (20 experts in total), with two members participating across all groups to ensure consistency in the process. Each of the groups met on 3-4 occasions for 1.5 hours (August-October 2019). The groups developed about 75 candidate items (Appendix 11), which the full group then refined down to 40 items (Appendix 12).

To further reduce the number of survey items, we invited working group members and regional UNICEF and WHO colleagues to complete an online survey. UNICEF and WHO colleagues also forwarded the survey to colleagues and partners in priority countries. The survey asked for feedback on the specific wording of items and to rank the items in terms of their prioritization on a 5-point scale from 'Not at all' (coded as 1) to 'Extremely important' (coded as 5) for this item to be included in the CIS. The most highly rated items were retained (mean scores > 3.8) (Appendix 13), and four additional items with slightly lower scores (mean = 3.6 to 3.8) were also retained for further evaluation given WHO and partner priorities (see Appendix 13). Items retained were modified from insights provided by members in the survey. Where the core group was unable to resolve feedback, (this was the case for only two items), two versions of items were agreed on for further testing with the aim to select one over the other through an evidence informed approach (A/B testing).

We also selected demographic items, predominantly from the Multiple Indicator Cluster Surveys (MICS) and the WHO MOV Exit Survey, (World Health Organization, 2017) to support our pilot and testing. These demographic items will be available to CIS users but will not be part of the official survey. A final draft CIS was developed for cognitive interviewing (Appendix 14).

Development of BeSD tools for Childhood Immunization CIDI

We sought to create a set of qualitative interview guides for use with caregivers of vaccine-eligible children, front line health care workers, community health advocates, and immunization programme managers to provide greater depth of understanding of the issues they face regarding routine immunisation uptake (Appendix 15). Nine members of the working group with a combination of expertise in qualitative and mixed methods enquiry and practical and programmatic experience developed the interview guides to complement the CIS, structuring them around the same four domains of the Increasing Vaccination Model: (Thinking and feeling, Social processes, Motivation, and Practical factors). The interview guides are being designed for use either before the CIS as an exploratory approach to prioritize topics, or afterwards to enrich and contextualise survey findings.

Development of BeSD User Guidance

To support optimum use of the CIS and CIDI, a small sub-group was established to develop end-user implementation guidance targeted to immunization programmes and partners. The intended outputs consist of:

- **Implementation guidance** – to support local testing, integration and use of the tools and resulting data, accounting for existing data collection methods/platforms beyond household surveys and providing guidance for users to select appropriate methods for context. This will be a two-part resource, the first for programme implementers, and the second for social science researchers.
- **A digital data repository,** integrated with existing regional and global data platforms, accounting for ethical and other practical considerations related to data sharing.
- **Other supporting resources**, e.g. short case studies, to demonstrate usability and application of eventual data for the design and evaluation of targeted interventions.

The guidance is being developed using a design thinking approach to offer clear and concise step-wise recommendations on how to adapt and test the tools in the local context while retaining a level of global standardisation; integrate items into existing data collection mechanisms and processes; use agile processes for data analysis and reporting; and use the resulting data, triangulated with other sources to inform planning. The guidance is being developed and designed to promote usability and integration of the entire package into existing programme activities.

One priority group for the user guidance is national or sub-national policy-makers and programme implementers, primarily in a role that consists of decision-making and planning for research activities and then use of that data (triangulated with other sources) to inform intervention design and evaluation. The second priority group is researchers who have a role that is focused on local testing of the tools, data collection, analysis and reporting. High level draft guidance has been developed for each group, representing a "minimum viable product". The guidance will also include frameworks and decision trees that help to inform planning for data collection and later use of the resulting data.

STEP 4. REFINING THE BESD TOOLS

In late 2019 and the first half of 2020, we sought to test the BeSD CI tools to identify and address major issues prior to use in the field. Testing was done through cognitive interviewing techniques in the US and Australia first to identify any major issues and to stabilize the English version of the CIS. We plan to test all the BeSD CI tools in at least 5 countries based on specific criteria below:

- One or more countries for each WHO region
- Countries where greatest number of un/under-vaccinated children reside
- Representing four major UN Languages (Spanish, French, English, Arabic) or where translation from English to a local language is likely to occur (to simulate this process in testing)

In November 2019, WHO HQ approached WHO Regional Offices with details of the proposed activities and potential suggestions to guide the selection of countries, based on the pre-set criteria. Given this background information, each Regional Office selected a country and facilitated introductions with the appropriate in-country WHO colleagues/partners. At the time of writing, due to the COVID-19 pandemic, the planning process for testing of the tools in these countries has been placed on hold.

Australia and the United States

To refine and finalize an English version of the CIS, we completed cognitive interviews with the draft CIS in Chapel Hill, North Carolina, USA (*n*=14, November 17-20, 2019) and in Sydney, Australia (*n*=9,

December 12-18, 2019). Convenience sampling was used in the USA and in Australia the sample was pre-recruited by a market research agency. The inclusion criteria in the USA included being a parent with a child under 18, and specifically aimed to recruit fathers (n=4), diversity in level of education was also considered during recruitment. Inclusion criteria in Australia included being a parent with a child under 5, and specifically recruiting a sub-sample of fathers. Diversity in education and race were also prioritized.

Based on feedback from parents, and in conjuncture with expert input, minor modifications were made to a few items, and the draft CIS was revised (Appendix 16). These modifications aimed to address any misinterpretation of the items, verify response options, simplify or clarify language used, and improve the flow of questions. All modifications were subjected to further testing through cognitive interviewing techniques to confirm the utility of these changes.

Feedback on the translatability of CIS concepts

The WHO and UNICEF Regional and Country Offices were re-engaged for feedback on the refined CIS items (January - February 2020). Feedback was collected using a short online survey. Colleagues were invited to review each CIS item to assess whether the item would translate adequately to the main language(s) in their country. Colleagues were also asked to indicate whether they would prioritise inclusion of items (response options: 'yes' or 'no') if conducting a survey to inform immunization programmes in their country or region. The rate of inclusion allowed the BeSD group to prioritise items and remove alternate versions of items that had been A/B tested. This feedback was collated and addressed alongside insights and modifications resulting from cognitive interviews in Sierra Leone (Appendix 17).

Sierra Leone

We tested the BeSD CI tools in Sierra Leone (February, 2020). English is the official language, but Krio (a derivative of English) is more commonly spoken. To support testing of the BeSD CI-IDIs and CIS, experts from the group developed guidance and training materials. These materials were developed to enable country staff to carry out the cognitive interviews for testing of the CIS, and to conduct qualitative interviews that will inform improvements of the CI-IDIs. This fieldwork was also an opportunity to explore future integration of BeSD CI tools in existing processes such as Expanded Programme on Immunization (EPI) coverage surveys.

Given the similarity of Krio to English, the tools were not formally translated in a written format in accordance with the usual practice of 'live' translation for this kind of activity in country. Instead, a group exercise was conducted to ensure a harmonised understanding of each item and support the intended meaning was understood ahead of live translations. Parents were pre-recruited for interviews and inclusion criteria included being a parent with a child under 5. Interviews were conducted across two days, sampling from urban and rural areas (*n=6*) and a further interview (*n*=1) was conducted using the in-depth interview guide.

Insights led to minor modifications of the survey items. Adjustments to the survey were implemented together with those resulting from comments from the WHO and UNICEF Regional and Country Offices on translatability of items (Appendix 18). However, in addition to slight modifications to the survey, insight was developed regarding requirements for an optimal translation process and adaptations to response options. Descriptions to support the translation of items were also modified to reflect changes and what was learnt from testing.

Additional countries

As noted above, discussions have taken place with various WHO and UNICEF Regional and Country Offices to plan for field testing. Countries involved include: Indonesia, Pakistan, Nigeria, Guatemala, and Estonia. Given the prioritization of COVID-19 response, these conversations will be revisited at the

appropriate time. Concurrently, alternate options are being explored that would allow for the main objectives of phase two to be achieved, that is, testing for global comparability and quality improvement of the BeSD CI-IDIs and CIS, through telephone or online interviewing. In determining a new way forward, global, regional and national colleagues and partners will be consulted, and we will prioritize research in the countries already engaged, as far as is feasible.

STEP 5. FIELD TESTING THE BESD CIS

We plan to finalize the CIS to yield a long form of approximately 15 items and a short form of about 5 items. In partnership with local immunization programmes in approximately five countries, we will conduct surveys with approximately 300 individuals per country to conduct psychometric validation of the CIS. The data will allow us to complete psychometric validation of the tool to further refine the tool and eliminate items. We will also examine which items are most reliable and predictive of vaccination behaviour between and within countries.

STEP 6. DISSEMINATION AND IMPLEMENTATION OF BESD TOOLS

A plan for disseminating the BeSD CI tools will be developed to promote an understanding of the tools, how to implement and incorporate these tools, and processes for data gathering, analysis and use. This plan will also consider the necessary technical support required to assist programmes and partners, as well as contribute to capacity building where needed. We plan to disseminate the tools through the WHO website, the WHO and UNICEF Regional and Country Offices, and through the many partner organizations represented on the expert group and global Demand Hub. Additional communications, such as peer-reviewed publications and presentations to public health practitioners, will help to raise general awareness of the tools and their benefit to programmes.

Consideration will also be given to establishing a learning agenda to support the tools and inform any future updates. This may include a centralised database, case studies, and other documentation on country experiences in relation to data gathering and use for programme planning and evaluation. This phase of work will be further elaborated in the second half of 2020.

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APPENDICES

LIST OF APPENDICES

Please note that as this work is in progress, some of the appendices cited are pending publication and therefore not included in this report. The BeSD group is looking forward to making these available in future.

Item no.	Item title	Availability
Appendix 1	Members of the BeSD Working Group	Included in this report
Appendix 2	BeSD terms of reference	Available on request
Appendix 3	Glossary of terms	Included in this report
Appendix 4	Top line findings from needs assessment with key stakeholders	Included in this report (*detailed findings pending publication)
Appendix 5	Barriers and facilitators using the COM-B model	Pending publication
Appendix 6	Review of existing relevant surveys on childhood vaccination	Pending publication
Appendix 7	Constructs and potential items identified from previous scales	Pending publication
Appendix 8	The increasing vaccination model	Included in this report
Appendix 9	BeSD planning framework	Included in this report
Appendix 10	Criteria for item selection	Included in this report
Appendix 11	Initial list of 75 candidate items	Pending publication
Appendix 12	Refined list of 40 candidate items	Pending publication
Appendix 13	Item reduction survey results	Included in this report (*detailed findings pending publication)
Appendix 14	Draft CIS used for cognitive interviewing	Pending publication
Appendix 15	Draft qualitative interview guides	Pending publication
Appendix 16	Revised CIS post-cognitive interviews US and Australia	Pending publication
Appendix 17	Revised CIS post-cognitive interviewing Sierra Leone and comments from WHO and UNICEF colleagues	Pending publication

Appendix 1: Members of the BeSD working group and secretariat

Membership as of June 2020

Members

Julie Leask (Chair)	University of Sydney, Australia
Neetu Abad	Centers for Disease Control and Prevention, US
Cornelia Betsch	University of Erfurt, Germany
Noel Brewer	University of North Carolina, US
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Lisa Menning	World Health Organization Headquarters
Francine Ganter-Restrepo	World Health Organization Headquarters

Appendix 2. BeSD terms of reference

This information is available on request.

Please see page 11 for the full list of appendices and their availability.

Appendix 3. Glossary of terms

Below are terms that people use to discuss vaccine uptake and related factors. We provide a brief definition to each to help orient readers.

1. CONCEPTS

Confidence
"The belief that vaccines work, are safe, and are part of a trustworthy medical system."[1]

Demand
Desire for vaccination - the motivations of individuals and communities to seek, support, and/or advocate for vaccines and immunization services.[2] "Demand for vaccines and vaccination is a complex concept that is not external to supply systems but rather encompasses the interaction between human behaviours and system structure and dynamics."[2]

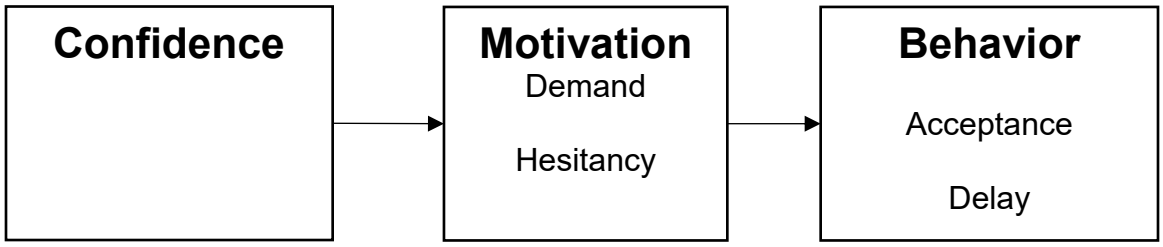
Hesitancy
"A motivational state of being conflicted about, or opposed to, getting vaccinated." [1] Vaccine hesitancy can result in "a delay in acceptance or refusal of vaccines despite availability of vaccination services."[3]

Acceptance
Agreeing to receive a vaccine.

Un-vaccinated
An individual has received none of the recommended vaccines for age.

Under-vaccinated
An individual has received some, but not all recommended vaccines by schedule milestone.

Figure 1. *How concepts related to confidence, motivation and behaviour relate to each other.*



2. METHODS

Quantitative research.
Research that involves the collection and analysis of data primarily for the purposes of enumeration (quantitative data can be manipulated numerically). Quantitative research seeks explanation or causation and pertain to larger populations, answering questions such as What? When? Where?

Qualitative research.
Research that involves the collection and analysis of data in non-numerical form such as texts, images or field notes from observations. Qualitative research seeks to build meaning or understanding, answering questions such as How? Why?

Construct
A general concept, e.g., "Vaccine Safety" covered in a survey. A construct is usually measured by a number of items (see below). It is sometimes referred to as a domain.

Item
A survey question or statement, usually accompanied by response options. This is a form of quantitative data collection.

Measure
"an item or set of items that provides an indication of the quantity or nature of the phenomenon under study."[4]

Survey
A set of items used to obtain information from a respondent about a topic of interest.[3] It may be administered face-to-face, by telephone or other method. This term is often used interchangeable with "questionnaire".

Interview guide
Used in qualitative studies, a set of questions or topic areas to be covered in an in-depth interview or focus group. The questions are almost always open. For example, "Could you tell me about your experiences with vaccination?"

Validation
The process of establishing that a survey item or measure serves the intended purpose. This process can include establishing whether it measures the intended construct using qualitative means (advice from experts, cognitive testing with lay people) and quantitative means (convergent, discriminant, predictive validity).

Guidelines
A set of recommendations for methods to implement a tool/s, including sampling, method of administration, and analysis.

1. Brewer NT, Chapman GB, Rothman AJ, Leask J, Kempe A. Increasing Vaccination: Putting Psychological Science Into Action. Psychological Science in the Public Interest. 2017;18(3):149-207.
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Appendix 4. Top line findings from needs assessment with key stakeholders

TOP LINE SUMMARY:

- Most countries / regions (but not all) already doing a variety of or mixture of KAP surveys, as well as EPI and DHS.
- Some reported that tools need to be able to integrate with existing surveys / systems, others said it needs to be stand alone because the current systems aren't really good.
- Many report issues with current data quality – different sources often don't match up and would like to be able to triangulate it.
- Denominator (i.e. number of children) is a common issue – not consistent
- Variety of people used to deploy quant surveys and do analysis, many within the various MOHs but also use other collaborators like CDC or WHO.
- Qual data collection done by consultants if done at all, but have had limited success owing to heavy training requirements and language / community access issues and acceptance of the data by MOHs as legitimate.
- General feeling is that there is existing capacity for quantitative data but not so much for qual
- Most reported that only proportions and percentages are needed, others reported that more complex analysis (e.g. regression) would be helpful.
- Some talk of having the results feed into existing dashboards for MOH – would ensure ongoing use.
- Mixed feedback on whether it needs to be stand-alone or be implemented into existing systems – many systems not yet very good
- C005 had very good, specific feedback on what we need to do to get the tools accepted and used – need to start engaging with MOH / government people now in the different countries.
- Guidance doc needs to cover how to present / "sell" results to MOHs

OTHER THOUGHTS FROM PARTICIPANTS (ASIDE FROM ANSWERS TO SPECIFIC QUESTIONS):

- Paper-based but also electronic, like small YouTube videos to help – like a tutorial
- Have a FAQ
- Perhaps build guidance based on role. E.g. if you're an EPI manager these are the bits you need, if you're UNICEF these are the bits you'll need. Or in situation. E.g. if there's a yellow fever emergency, what kinds of tools can you use for rapid assessment, perhaps have a "light" version for emergencies / rapid assessment to understand what's happened.
- Main challenge is how to maintain the demand with the current funding level?
- Some data stays on the shelf – doesn't get used. Need to be able to operationalise their data.
- Important – government buy-in needed (EPI) or it won't be accepted and used.
- Need quality checks in place because this is where they lose information
- Could the guidance document have a section that refers the user to other experts in their region who has experience in operationalising the data (i.e. what to do with the data). Perhaps a review of all the interventions that were used in given situations?
- RE: D2 Social Processes: Western cultures tend to see decision-making as individual, whereas in other regions it's more family and community-level. That community aspect is very strong and is often missed if the questions aren't framed the right way, want to make sure this isn't missed.

Appendix 5: Barriers and facilitators using the COM-B model

This information is pending publication.

Please see page 11 for the full list of appendices and their availability.

Appendix 6. Review of existing relevant surveys on childhood vaccination

This information is pending publication.

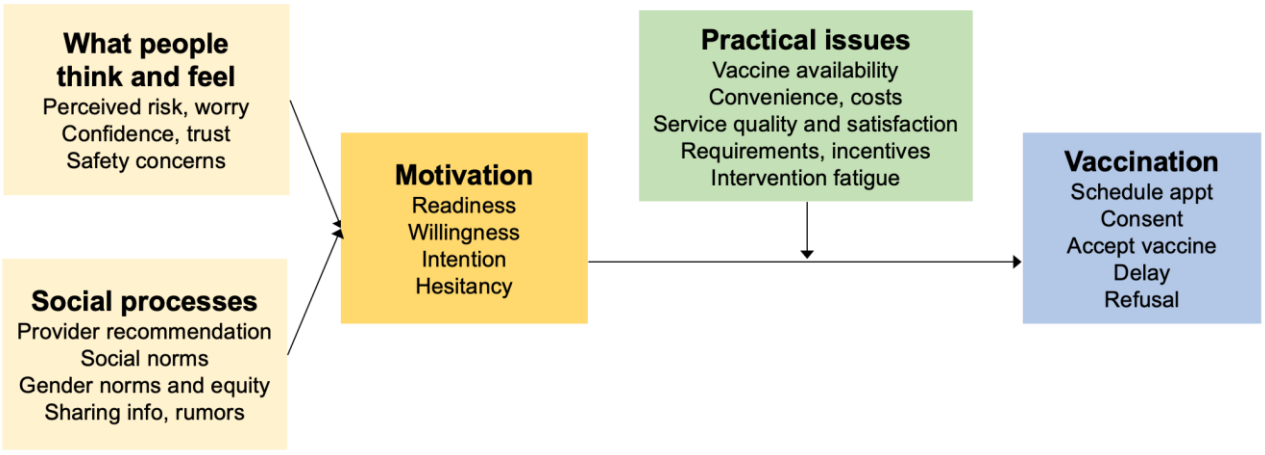
Please see page 11 for the full list of appendices and their availability.

Appendix 7. Constructs and potential items identified from previous scales

This information is pending publication.

Please see page 11 for the full list of appendices and their availability.

Appendix 8. The increasing vaccination model



Source: The BeSD expert working group. Based on: Brewer NT, Chapman GB, Rothman AJ, Leask J, and Kempe A (2017). Increasing vaccination: Putting psychological science into action. *Psychological Science for the Public Interest.* 18(3): 149-207

Appendix 9. BeSD planning framework

	Phase	Documents needed	Output
P1	Tool development	☑ Conceptual model ☑ Constructs from the literature ☑ Qualitative interview guide questions ☑ Survey items from the literature ☑ Prioritized short list of survey items ☑ Socio-demographics ☑ Survey intro and transition language ☑ Plan for translation ☑ User guidance scaffold	**Draft BeSD survey** 30-40 questions w/response scales intro and transition text in ~6 languages **Draft BeSD interview guides** **User guidance scaffold**
P2	Cognitive interviewing and user testing	**IRB** ☑ Countries and languages selected ☑ Study protocol ☑ Participant recruitment materials in English ☑ Consent forms in English ☑ IRB applications: (U Sydney, WHO HQ & RO, country ethics) **Cognitive testing for CIS** ☑ Cognitive interview guide (with instructions) ☑ Data capture framework ☑ Survey for participants in English ☑ Guides to support translation, staffing, recruitment & sampling ☑ Materials translated: consent, interview guide, survey, training ☑ Analysis guide & insights template **User testing** ☑ Qualitative interview guides for testing ☑ User Guidance Scaffold ☑ Interviewer debrief consultation guide ☐ Heuristic evaluation framework **Training** ☑ Schedule for 5-day in-country visit ☑ Agenda for training ☑ Cognitive interviewing and user testing protocol ☑ Training slides (PowerPoint) ☑ Other interviewer training materials in English	**Draft BeSD survey** 15-20 questions w/response scales intro and transition text in 5 languages **Draft BeSD interview guides** **Training and testing materials** (to support implementation and capacity building) 5-7 priority indicators for JRF **Research paper**
P3	Psychometric validation and integration	☐ Validation study protocol ☐ IRB application and related materials (see Phase 2) ☐ Survey with translations ☐ Qualitative Interview Guides ☐ Rough Draft User Guidance ☐ Data analysis plan ☐ Tool integration plan	**Final BeSD survey** long form (~15 items) short form (~5 items) **Final BeSD interview guides** **Draft User Guidance** **Research paper** Launch **BeSD network** for exchanging learning and implementation support

Appendix 10. Criteria for item selection

Consideration	Notes
Short length	Shorter items are easier to understand and less prone to variations in meaning
Tried and tested	If it has been used/validated in more than one LMIC and has undergone cognitive testing by a lead agency
Evaluative	More focused on evaluation of service, not reason for vaccination
Predictive validity	Known to be associated with coverage
Capacity to link to key indicators	WHO: see Immunization Agenda 2030 GAVI: see Gavi 5.0
Applicable to multiple contexts	Not specific to a certain delivery setting – must be adaptable to multiple countries, cultures
Avoid hypothetical questions	More prone to social desirability and misunderstanding (abstract)
Avoid relying on subgroups to deliver	Questions based on actual service experience or reasons for under-vaccination need to be filtered
Simplicity of response options	Few response options are easier to understand
Ease of translation	Can be easily translated to different languages
Low reading age	Short and simple sentences, words with the least number of syllables possible, etc. Question should not be cognitively demanding to read and understand.
Usability of insights/programmatic perspective	Definitely need this input. Need to avoid getting too roped into making it a program evaluation questionnaire. Go through it live with Deepa and Vinod?
Future perspective	To consider ongoing issues as well as anticipate future issues
Reduce ceiling effect and questions with psychometric flaws	Questions should be sensitive to the full range of opinions (from weak to strong endorsement)
Survey consistency	E.g. coding of all 'don't know/refused to answer' will be modified to be consistent in this survey

Appendix 13. Item reduction survey results

A sample of items, their mean expert priority rating and the proposed action is included in this report. A complete list will be available pending future publications. Please note the items included below are in the original form, prior to any refinement following cognitive interviews.

Sort	Construct	Mean rating	Proposed action	Original item
ITEMS RETAINED				
2	Knowledge	**4.5**	Retain.	Do you know where to go to get vaccines for your child?
3	Household Decision Making	**4.4**	Retain.	In your family, who has the final say about vaccinating your child?
15	Confidence - Benefits	**4.0**	Retain.	How important are vaccines for your child's health?
19	Vaccination Availability (*)	**3.8**	Retain: Lower score but important implications for missed opportunities to vaccinate.	Have you ever been turned away by the vaccination clinic?
ITEMS REMOVED				
26	Time Required for Vaccination	**3.6**	Remove: Low score, redundant	Does waiting at the vaccination clinic take too long?
39	Perceived Risk	**3.1**	Remove: Low score, duplicative	How likely is it that unvaccinated children can get diseases that vaccines can prevent?

Note. The response scale ranged from 'Not al all' (coded 1) to 'Extremely important' (coded 5).

Appendix 14. Draft CIS used for cognitive interviewing

This information is pending publication.

Please see page 11 for the full list of appendices and their availability.

Appendix 15. Draft qualitative interview guides

This information is pending publication.

Please see page 11 for the full list of appendices and their availability.

Appendix 16. Revised CIS post-cognitive interviews US and Australia

This information is pending publication.

Please see page 11 for the full list of appendices and their availability.

Appendix 17. Revised CIS post-cognitive interviewing Sierra Leone and comments from WHO and UNICEF Regional and Country Office colleagues

This information is pending publication.

Please see page 11 for the full list of appendices and their availability.