



## Final Report

## End of Project Evaluation for NgenIRS Project

Unitaid

9<sup>th</sup> March 2020

---

## **Important notice**

### **Unitaid**

This publication was prepared independently, by the authors identified on the cover page, at Unitaid's request. The authors' views expressed in this publication do not necessarily reflect the views of Unitaid. Unitaid expressly disclaims all liability or responsibility to any person in respect of use of the publication or reliance on the content of the publication.

### **CEPA**

This report was prepared by CEPA for the exclusive use of the recipient(s) named herein.

The information contained in this document has been compiled by CEPA and may include material from other sources, which is believed to be reliable but has not been verified or audited. Public information, industry and statistical data are from sources we deem to be reliable; however, no reliance may be placed for any purposes whatsoever on the contents of this document or on its completeness. No representation or warranty, express or implied, is given and no responsibility or liability is or will be accepted by or on behalf of CEPA or by any of its directors, members, employees, agents or any other person as to the accuracy, completeness or correctness of the information contained in this document and any such liability is expressly disclaimed.

The findings enclosed in this report may contain predictions based on current data and historical trends. Any such predictions are subject to inherent risks and uncertainties.

The opinions expressed in this document are valid only for the purpose stated herein and as of the date stated. No obligation is assumed to revise this report to reflect changes, events or conditions, which occur subsequent to the date hereof.

CEPA does not accept or assume any responsibility in respect of the document to any readers of it (third parties), other than the recipient(s) named therein. To the fullest extent permitted by law, CEPA will accept no liability in respect of the report to any third parties. Should any third parties choose to rely on the report, then they do so at their own risk.

## Contents

<b>ACRONYMS</b> .....	<b>1</b>
<b>EXECUTIVE SUMMARY</b> .....	<b>1</b>
<b>1. INTRODUCTION</b> .....	<b>1</b>
1.1. Structure of the report .....	1
<b>2. PROJECT BACKGROUND AND EVALUATION OBJECTIVES</b> .....	<b>1</b>
2.1. Project background.....	1
2.2. Theory of Change of the NgenIRS project.....	2
2.3. Evaluation scope and objectives.....	4
<b>3. EVALUATION APPROACH AND METHODOLOGY</b> .....	<b>4</b>
3.1. Evaluation framework.....	4
3.2. Evaluation methods.....	5
<b>4. FINDINGS</b> .....	<b>7</b>
4.1. Relevance.....	7
4.2. Effectiveness and efficiency .....	10
4.3. Impact.....	23
4.4. Sustainability.....	41
<b>5. CONCLUSIONS, LESSONS LEARNT AND RECOMMENDATIONS</b> .....	<b>49</b>
<b>APPENDIX A LIST OF REFERENCES</b> .....	<b>52</b>
<b>APPENDIX B CONSULTEE LIST</b> .....	<b>55</b>
<b>APPENDIX C INTERVIEW GUIDES</b> .....	<b>59</b>
<b>APPENDIX D REMOTE COUNTRY CASE STUDY SELECTION</b> .....	<b>65</b>
<b>APPENDIX E PROJECT LOGFRAME AND ACHIEVEMENTS</b> .....	<b>67</b>
<b>APPENDIX F BUDGET ANALYSIS</b> .....	<b>68</b>
<b>APPENDIX G GHANA CASE STUDY</b> .....	<b>69</b>
<b>APPENDIX H UGANDA CASE STUDY</b> .....	<b>77</b>
<b>APPENDIX I KEY FINDINGS FROM THE REMOTE COUNTRY CASE STUDIES</b> .....	<b>88</b>
<b>APPENDIX J ASSESSMENT OF ROBUSTNESS OF FINDINGS</b> .....	<b>91</b>
<b>APPENDIX K PUBLIC HEALTH AND ECONOMIC IMPACT MODEL</b> .....	<b>92</b>

## Acronyms

Acronym	Full description
3GIRS	Third-Generation Indoor Residual Spray
AGAMal	AngloGold Ashanti Malaria Control Limited
ALMA	African Leaders Malaria Alliance
AI	Active Ingredient
ASTMH	American Society of Tropical Medicine and Hygiene
BMGF	Bill and Melinda Gates Foundation
CoG	Cost of Goods
DFID	UK Department for International Development
EAC	External Advisory Committee
GF	The Global Fund to Fight AIDS, Tuberculosis and Malaria
IRS	Indoor Residual Spray
IVCC	Innovative Vector Control Consortium
IVM	Integrated Vector Management
KPI	Key Performance Indicator
LIC	Low Income Country
LMIC	Low-Middle Income Country
LLIN	Long-lasting Insecticidal Nets
MACEPA	Malaria Control and Elimination Partnership in Africa
M&E	Monitoring and Evaluation
NgenIRS	Next Generation Indoor Residual Spray Project
NMCP	National Malaria Control Programme
OECD DAC	Organisation for Economic Co-operation and Development, Development Assistance Committee
PBO	Piperonyl Butoxide
PDP	Product Development Partnership
PMI	United States President's Malaria Initiative
PQ	World Health Organization Pre-Qualification
PR	Principal Recipient
RBM	Roll Back Malaria
RCT	Randomised Controlled Trial
ToC	Theory of Change
ToR	Terms of Reference
VCWG	Roll Back Malaria's Vector Control Working Group
VFM	Value for Money
WHO	World Health Organization
WMR	World Malaria Report

## Executive summary

Cambridge Economic Policy Associates (CEPA) has been appointed by Unitaid to conduct an end of project evaluation of the Market Intervention to Accelerate Uptake of New Vector Control Tool Project (“Next Generation Indoor Residual Spray (NgenIRS) Project”).

### Project background

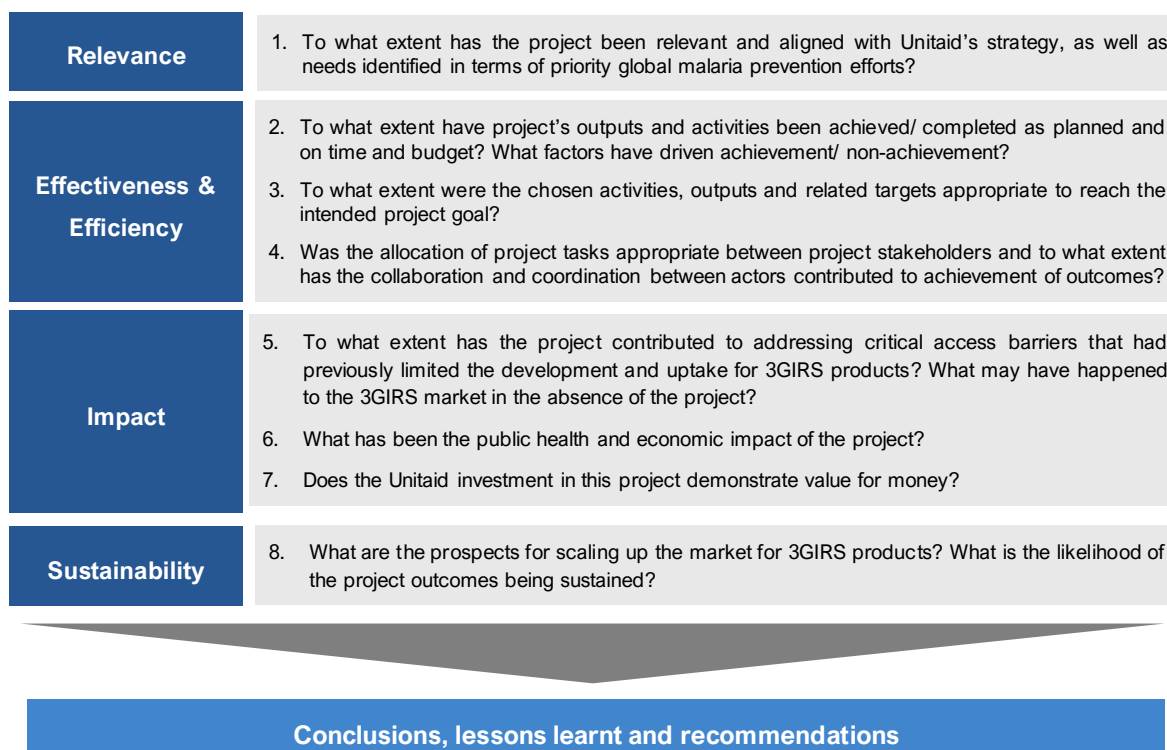
The Unitaid Executive Board committed up to US\$ 65.1 million to the Innovative Vector Control Consortium (IVCC) to facilitate the creation of a sustainable market for third-generation Indoor Residual Spraying (3GIRS) products that are needed to prevent the good progress made towards eliminating malaria from being jeopardised by the growing resistance to pyrethroid insecticides. Alongside issues relating to price and availability, this growth in resistance has been estimated to contribute to falling coverage of indoor spraying of walls globally by 40% between 2011 and 2015. Since 2016, IVCC has led the implementation of the NgenIRS project, a partnership with sub-grantees, Abt Associates and PATH. The project was also undertaken in partnership with the United States President’s Malaria Initiative (PMI) and the Global Fund as the main procurers of IRS in project countries. Spanning a four-year period from 2016 – 2019, the project has the objective of shaping the market for 3GIRS products by working with key market participants, specifically leading insecticide manufacturers, national malaria control programmes (NMCPs), and other global partners such as WHO and Roll Back Malaria (RBM) Partnership to End Malaria.

### Evaluation scope and objectives

The objective of the evaluation is to provide Unitaid with an assessment of the programmatic implementation of the project with a focus on the project’s overall contribution to public health impact and the part it played in establishing a sustainable, competitive and growing market for 3GIRS products, as captured by the outcome, outputs and activities performed.

An evaluation framework has been developed for the evaluation as shown in Figure E1.

Figure E1: Evaluation framework



The methodology was both quantitative and qualitative, incorporating primary and secondary data sources. This included: global stakeholder consultations conducted across a range of informants, two country case studies of

Ghana and Uganda based on country visits, four remote country case studies (Ethiopia, Mali, Tanzania and Zambia), a document review, and a quantitative data analysis and modelling of the contribution of the project to the public health and economic impact of 3GIRS.

## Conclusions, lessons learnt and recommendations

The main **conclusions** based on the evaluation are as follows:

- The project is considered to be closely aligned with Unitaids' strategy and was well aligned with global malaria prevention priority evidence and operational needs - in particular, relating to the important requirement for additional classes of insecticides to be introduced/ further adopted in order to aid insecticide resistance management.
- On a process and management level, the project has performed well to date and either met, or surpassed, most of the project targets. This was also notably achieved within budget and within the timeframes of the project plan. The allocation of project tasks between actors was seen as appropriate overall and has worked well with some lessons being learnt and the associated learning applied over the course of the project, such as IVCC's means to engage with countries (e.g. through regional coordinators) and ways of working with the Global Fund which became clearer during the project.
- In relation to progress made against specific outputs and the impact on overcoming the market access barriers, we note the following:
  - **Uptake of 3GIRS:** the large proportion of the budget being allocated to co-payments has had a significant impact on the success of the project – especially as it has aided an increase in uptake of 3GIRS.
  - **Improved consolidation of country forecasts for 3GIRS products:** consolidation of country forecasting has improved over the course of the project with most of the annual targets being met. The consolidation of these forecasts and presenting them to manufacturers has aided the price reduction of 3GIRS products. In contrast, country level demand forecasting efforts failed to meet the project target which poses some risks to sustainability of the consolidated country forecasts going forward.
  - **New quality assured products available from several manufacturers on the market:** The project met its target by having three different products pre-qualified (PQ) by WHO at the end of 2019. This has aided competition in the market and helped to reduce the price of 3GIRS products, especially in the latter two years of the project.
  - **3GIRS products are reduced in price:** There have been continuous price reductions throughout the project reaching the project logframe targets as well as the target price of US\$ 15 for two products from 2020 to 2021 (contingent on firm consolidated country demand forecasts). The use of the demand underwriting mechanism was appropriate for the project especially during the first three years when there was no competitive 3GIRS market and high fluctuation in demand. However, it may not have been appropriate to have the full US\$ 11.1m demand underwriting reserve fund (18% of the project budget) for the whole duration of the project due to the opportunity costs of the unutilised funding and thus would have benefited from review during the project.
  - **Documentation and dissemination of evidence showing cost-effectiveness of 3GIRS:** activities under this output have included evidence generation and dissemination (regarding cost-effectiveness and other studies) as well as broader communication activities around 3GIRS products. In general, the dissemination of evidence and broader communication activities conducted under the project were considered useful for country level stakeholders, although this was not uniform across countries and could have been further strengthened. In general, however, communication efforts have been less effective at engaging some global level stakeholders to date. Although the project exceeded its process target on disseminating evidence around the public health impacts and cost-effectiveness of 3GIRS products, there is still a need for further dissemination so as to further impact on demand and adoption. It is noted though that a number of key studies conducted under the project

have only recently been completed, boosting the evidence soon to be available, which will need to be effectively disseminated.

- Overall, solid progress has been made against the three market access barriers, with good progress made against the supply and delivery barrier and strong progress in particular made against the affordability and demand and adoption barriers. In particular:
  - Good progress has been made against the market access barrier of **supply and delivery** through an increase in the number of suppliers on the market. Whilst not appearing to encourage manufacturers to initially decide to develop products to enter the market, the project has encouraged manufacturers to continue proceeding to enter the market once they had started their product development, thus boosting the number of suppliers in the market. As there are now three products on the market, the market is seen to be more competitive and sustainable. However, as per effective insecticide resistance management plans and the associated need to ideally have at least three classes of products to aid insecticide resistance management through rotation of multiple chemicals, there is still need for at least one additional product. In addition, the project has aided supply and delivery in a number of other ways, such as ensuring reliable supply through further consolidation of country forecasts and enabling products with recently acquired WHO PQ status to become accessible to countries quickly.
  - The project has significantly helped to overcome the market access barrier of **affordability**, but the reduced price of US\$ 15, together with the high operational costs for IRS, remain barriers for further expansion of the 3GIRS market – especially given the cost in relation to other vector control interventions. Together these costs prevent uptake despite the project recently determining that 3GIRS is cost effective by WHO standards. The primary influences on the price at the start of the project was the demand underwriting (based on forecasting), the higher volumes due to the co-payment and more reliable forecasting to a lesser degree. The primary influence on the price later on in the project was supplier competition.
  - The project has made strong progress towards overcoming the market barrier of **demand and adoption**. The increase in uptake of 3GIRS has mainly been within areas that were previously covered by IRS and a slight increase in uptake of IRS more broadly from a previously shrinking market. There has been little expansion in uptake in 3GIRS into areas/ countries that did not previously use IRS, although there have been some examples more recently. This is likely to be due in part to a need for further dissemination of evidence to inform decision making, especially relating to cost-effectiveness (which is the focus of recently completed studies under the project), as well as the cost of the 3GIRS products and programmes in a relatively fixed funding envelope.
- There has been substantial public health impact through 3GIRS that would not have materialised without the NgenIRS project. Based on model estimates, the NgenIRS project contributed to averting an additional 16.7m [5.7m – 34.2m] malaria cases and to saving 49,967 [16,952 – 102,608] lives through 3GIRS across 2016-2024. There are also substantial economic impacts of the project which are driven by the monetisation of the public health impacts. Using the “full income” approach to value the additional life-years gained, it is estimated that the project contributed to additional economic benefits of around US\$ 9,853m [1,178m - 20,108m].
- In terms of the prospects for scale up in the short term, the current use of 3GIRS is highly dependent on external funding from the Global Fund and PMI with very little government support for 3GIRS commodity purchases. The support from the Global Fund and PMI is expected to remain at approximately the same levels for the next two years, to be reviewed thereafter. The 3GIRS product prices are also expected to stay stable in the short-to-medium term around US\$ 15. This together indicates that the 3GIRS market will maintain the gains made under the NgenIRS project and may expand slightly but is not expected to substantially expand over the short-to-medium term. The future of the 3GIRS market is more uncertain over the long-term and a contraction of the market may be possible in case of a substantial reduction in new nets prices and additional evidence on their effectiveness.

- Project transition activities could have had more traction (in terms of sustainability of project progress) had they been introduced earlier and with further integration with existing activities being undertaken by partners such as PMI, Global Fund and RBM.

The project aimed to “create a sustainable, competitive and growing market for effective 3GRIS products at affordable prices”. There has been significant progress against the market access barriers of supply and delivery, affordability and demand and adoption, although there is still room for further progress relating to all three of these. While the market has grown during the project, it is not currently expected to grow a lot further in the near future. This is primarily due to the role of IRS in relation to broader malaria prevention efforts and existing funding envelopes rather than a reflection of the performance of the project. Overall, we consider that the project represents value for money for Unitaid.

## Recommendations

We present recommendations for Unitaid to consider based on lessons learnt under the project. We note that some of these aspects **have already been incorporated within the NgenIRS project** following process learning during the project, or have already been applied in subsequent Unitaid projects, but remain useful for Unitaid to consider going forward. These include:

- In terms of project coordination, if grantees are not in-country project implementers then it would be useful for Unitaid to ensure that the project team configuration and partner coordination activities take this into consideration. In particular:
  - Project team personnel should consider including regional coordinators or similar positions within the project teams.
  - Engagement with key organisations such as the Global Fund should be clearly established at the start of the project – particularly relating to a clear point of contact, ways of working and opportunities for integration of activities after project end.
- In instances where a key component of the project includes evidence generation, project activities should include close engagement with relevant WHO departments, especially at the outset, in order to ensure the evidence generated is as relevant as possible in targeting key gaps useful for addressing of furthering programmatic or policy decisions. In addition, communication activities should leverage existing subject area groups (e.g. within the wider malaria community) in order to facilitate dissemination of evidence. Dissemination should be as direct and specific as possible to encourage strong engagement from partners. To aid this, an evidence generation and dissemination plan should be developed from the outset and reviewed at points in line with insight generated on the findings being generated.
- Unitaid should consider use of a demand underwriting mechanism in projects with similar market scenarios. However, this should include review points during the project timeframe to assess its continued relevance.

Some **additional aspects to be considered in future Unitaid projects** include:

- Some projects could benefit from having clear phases and for progress to then be reviewed against specific indicators at a pre-defined interval at the end of the phase. Funds could potentially be reallocated at defined phase point(s) in line with focused review and decision making around the most relevant activities in line with the overall aims of the project.
- There is a strong need to focus on transition and sustainability components from the outset. This should entail strong analysis in order to feed into considerations regarding how project activities can be sustained and transitioned. For example, this could be through integration into existing structures already implemented by partners and country governments, rather than potentially creating parallel systems.
- Continue to consider using co-payments for other products with comparable market scenarios. However, as far as possible, Unitaid should ensure that there is sufficient commitment from manufactures who have received a lot of support through the co-payment mechanism, to make commitments regarding the supply and pricing of their product to reduce risk and aid sustainability of project gains.



# **1. Introduction**

Cambridge Economic Policy Associates (CEPA) has been appointed by Unitaid to conduct an end of project evaluation of the Market Intervention to Accelerate Uptake of New Vector Control Tool Project (“Next Generation Indoor Residual Spray (NgenIRS) Project”). This Final Report is the fourth deliverable for the assignment and presents the project background, evaluation framework, methodology and limitations, and findings. The introduction section outlines the structure of the rest of the report.

## **1.1. STRUCTURE OF THE REPORT**

The report is structured as follows:

- Section 2 includes some background and context to the project and the evaluation objectives;
- Section 3 presents the evaluation framework, approach and methods;
- Section 4 outlines the findings;
- Section 5 provides the conclusions, lessons learnt and recommendations.

The main report is supported by the following appendices:

- Appendix A presents the bibliography/ list of references;
- Appendix B includes the global and country level consultee list;
- Appendix C contains the stakeholder interview guides;
- Appendix D outlines the criteria used for the remote country case selection;
- Appendix E presents the progress made against the logframe indicators;
- Appendix F presents the budget analyses;
- Appendix G presents the findings from the Ghana case study;
- Appendix H presents the findings from the Uganda case study;
- Appendix I outlines the key findings from the remote country case studies;
- Appendix J provides an overview of the evidence robustness assessment;
- Appendix K presents the public health and economic impact modelling methodology and limitations.

## **2. Project background and evaluation objectives**

This section sets out a brief background to the project as well as the evaluation scope and objectives.

### **2.1. PROJECT BACKGROUND**

The Unitaid Executive Board committed up to US\$ 65.1 million to the Innovative Vector Control Consortium (IVCC) to facilitate the creation of a sustainable market for third-generation Indoor Residual Spraying (3GIRS) products that are needed to prevent the good progress made towards eliminating malaria from being jeopardised by the growing resistance to pyrethroid insecticides – which in part, alongside issues of price and limited availability, resulted in coverage of indoor spraying of walls falling by 40% globally between 2011 and 2015.

Since 2016, IVCC has led the implementation of the NgenIRS project, a partnership with sub-grantees, Abt Associates and PATH. The project was also undertaken in partnership with the United States President’s Malaria Initiative (PMI) and the Global Fund as the main procurers of IRS in project countries. Spanning a four-year period from 2016 – 2019,

the project had the objective of shaping the market for 3GIRS products by working with key market participants, specifically leading insecticide manufacturers, national malaria control programmes (NMCPs), and other global partners such as WHO and Roll Back Malaria (RBM) Partnership to End Malaria. Table 2.1 below specifies the project goal, outcomes and outputs. Further details regarding the targets as well as activities and indicators can be found in Appendix E.

*Table 2.1: Project goals, outcomes and outputs*

Result level	Description
Goal	Increased use of 3GIRS products in Insecticide Resistance Management Programmes
Outcome	A sustainable, competitive and growing market for effective 3GIRS products at affordable prices
Output 1	Accelerate uptake of 3GIRS products
Output 2	Improve global forecasts <sup>1</sup> for 3GIRS products
Output 3	Facilitate the introduction of competition with new quality assured products from several manufacturers (this output is funded separately by Bill and Melinda Gates Foundation (BMGF))
Output 4	Reduce prices of 3GIRS products
Output 5	Document and disseminate evidence showing the cost-effectiveness of 3GIRS products

## **2.2. THEORY OF CHANGE OF THE NGENIRS PROJECT**

When the NgenIRS grant was developed in 2015, Unitaid was not systematically utilising the theory of change (ToC) framework to provide overviews of the intended impact of grants. Therefore, as a ToC was not developed for the NgenIRS grant by IVCC, we have used Unitaid’s Result Framework from 2019 and the Project Plan<sup>2</sup> to retrospectively develop a ToC for the project that reflects the expectations and knowledge status of the project at the time of the grant application. The ToC has been discussed with Unitaid during the inception phase.

Figure 2.1 depicts the developed ToC which presents the public health need and key access barriers in the 3GIRS market, as well as provides the conceptual pathway through which the project aimed to address these access barriers and contribute to the identified health needs. It also outlines some of the main risks and assumptions that were highlighted prior to the start of the project.

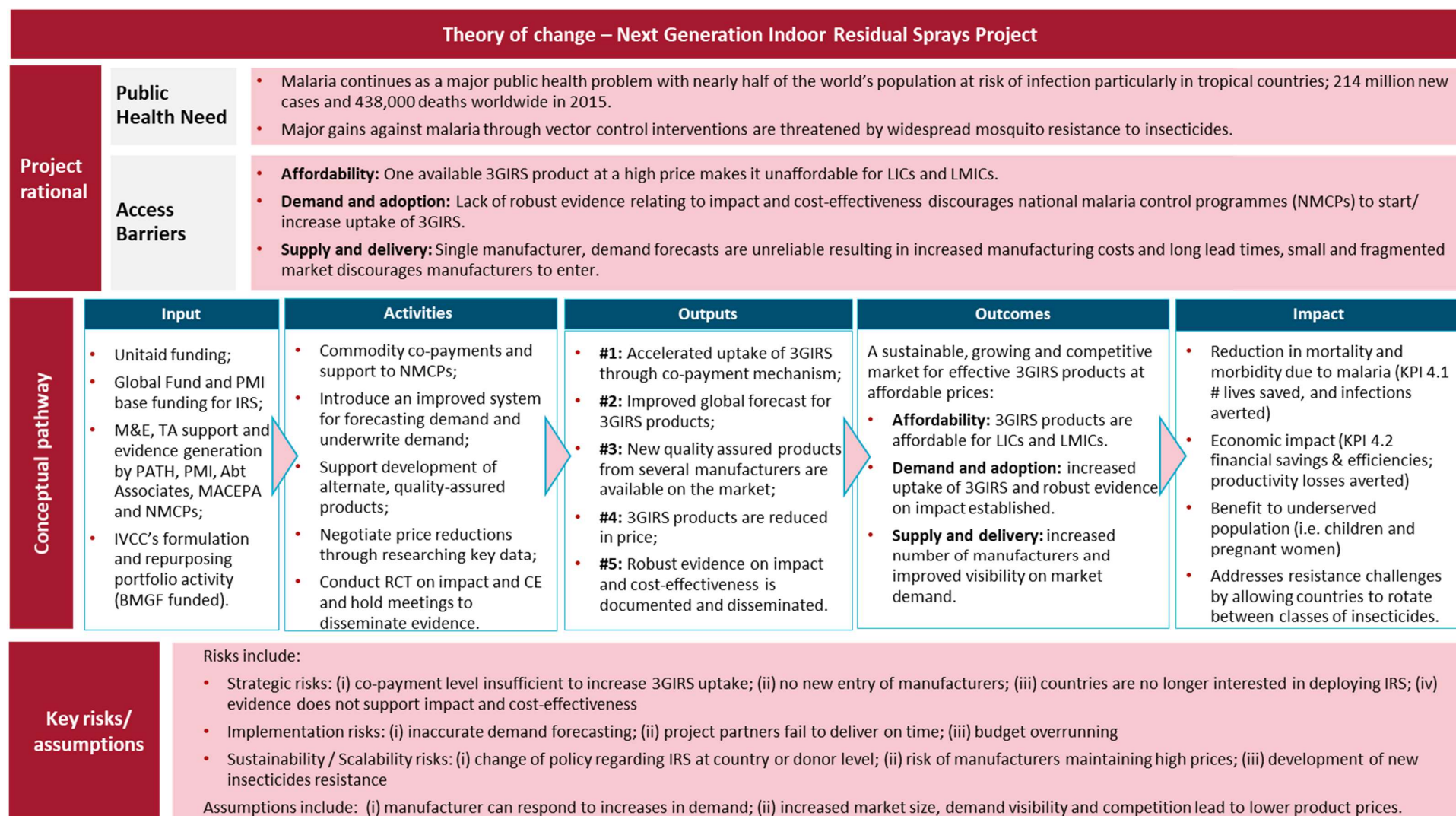
The developed ToC and Unitaid’s Results Framework have been used to inform the evaluation questions that are outlined below. The ToC will also aid to systematically analyse the contribution and combined effect of the project activities and resultant outputs in overcoming the identified market barriers. The ToC has also been used to review how risks and assumptions have evolved over the course of the project.

---

<sup>1</sup> Termed global forecast in the project documents but referred to as consolidated country forecasts in this report.

<sup>2</sup> IVCC, PMI, Abt Associates, PATH MACEPA (2015). Market intervention to accelerate uptake of new vector control tools. Project Plan

Figure 2.1: Theory of Change for the NgenIRS project



Source: CEPA analysis based on project documents; template based on Unitaids Results Framework 2019

## 2.3. EVALUATION SCOPE AND OBJECTIVES

As stated in the terms of reference (TOR), the objective of the evaluation is to provide Unitaid with an assessment of the programmatic implementation of the project with a focus on the project's overall contribution to public health impact and the part it played in establishing a sustainable, competitive and growing market for 3GIRS products, as captured by the outcomes and outputs achieved, and activities performed.

Drawing on the areas highlighted in the TOR as well as discussions with the Unitaid Secretariat, the following areas were priorities for the evaluation:

- **Progress made by the project against the overall goal, outcomes and outputs** as well as the range of activities contributing to each output and in particular considering the “so what” of results achieved;
- **Assess contribution/ attribution**, i.e. causal linkage between NgenIRS grant activities and the results reported under the project.
- **Assess scalability** by evaluating the extent to which the project achieved its stated aim, specifically that “by the end of the project, a stable and competitive market for multiple 3GIRS products will have been created and the co-payment designed to bring the 3GIRS price down to a level that is acceptable to NMCPs will no longer be required.... This project will put in place the foundations for a smooth transformation to the implementation of the IRM strategy through rotation of 3GIRS products.”<sup>3</sup> In particular this assessment will include:
  - the extent to which 3GIRS has been scaled up and the market share of 3GIRS is expected to grow or be sustained, as well as the extent to which key market interventions have been transitioned across project countries and beyond;
  - identify factors which may have contributed towards, or limited scalability and transition, including institutional dynamics both at country (e.g. countries where PMI/ Global Fund are key funders vs countries that use predominantly domestic funding) and global level (e.g. role of WHO and RBM).
- **Assess grant performance against Unitaid's Strategic Key Performance Indicators (KPIs)**, especially in relation to scalability (KPI 3.1; KPI 3.2), public health impact (KPI 4.1); market access barriers (KPI 2), efficiencies and savings generated (KPI 4.2) and return on investment (KPI 4.3).

These objectives are reflected in the evaluation framework and approach, discussed in Section 3.

## 3. Evaluation approach and methodology

This section sets out the evaluation framework and approach (Section 3.1) as well as the evaluation methods (Section 3.2).

### 3.1. EVALUATION FRAMEWORK

Figure 3.1 provides the evaluation framework. It is based on the OECD DAC evaluation criteria and draws on the objectives and priorities for this evaluation as discussed in Section 2.3. The framework comprises the following evaluation dimensions:

- **Relevance:** focusing on a review of the alignment with Unitaid's strategy as well as the priority global malaria prevention efforts;

---

<sup>3</sup> IVCC (2015), Market intervention to accelerate uptake of new vector control tools. Project Plan

- **Efficiency and effectiveness:** focusing on project implementation efficiency and effectiveness – both in terms of project management by the grantee (e.g. budget efficiency and timeliness) and the implementation of project activities, successes and challenges and achievements of outputs;
- **Impact:** focusing on the extent to which the project has addressed critical market barriers (focusing on affordability, supply and delivery and demand and adoption), public health and economic impacts as well as value for money;
- **Sustainability:** considering the potential for transition, scale up and sustainability of project outcomes.

Findings across the evaluation questions will support development of conclusions, lessons learnt and recommendations.

Figure 3.1: Evaluation framework



The proposed approach to assessing each of the evaluation dimensions and questions is discussed below.

### 3.2. EVALUATION METHODS

The evaluation methodology was both quantitative and qualitative, incorporating both primary and secondary data sources. Building on the evaluation approach in Section 3.1, this section summarises the methods that were employed. Table 3.1 below summarises the data collection approaches and component analyses deployed for the evaluation. A corroboration/ triangulation approach was adopted to review data collected across all of these methods to develop the overall findings and to inform the development of conclusions and recommendations.

Table 3.1: Evaluation methods

Method	Detail
Desk-based review of relevant documentation	Including a review of project documents such as the Project Plan, Logframe, Annual and Semi-Annual Reports and any other project-related material. We also reviewed relevant broader literature such as the Unitaids Strategy and evidence relating to 3GIRS, and broader documentation on the debate of the future role of IRS within the broader context of malaria prevention priorities.

Quantitative data analysis and impact modelling	<p>The quantitative data analysis included an examination of project data, such as the indicators and targets outlined in the project logframe and progress reports, as well as product and market data made available to us by Unitaid and the grantee. This included an analysis of the key dimensions at the output and outcome level (i.e. 3GIRS uptake, price of 3GIRS products, forecasting accuracy etc.) and also explored the scalability of 3GIRS going forward by assessing IVCC’s uptake forecast.</p> <p>The model is used to estimate the contribution of the project to the public health and economic impact of 3GIRS and also to provide an estimated cost-benefit ratio to help inform the value for money analysis.</p>
Key stakeholder and focus-group interviews	<p>Semi-structured key informant interviews comprised an important methodological tool for the evaluation and have been used to gather a range of perspectives and insights. Analysis of this data deployed a thematic approach. Respondents included: Unitaid Secretariat, the lead grantee (IVCC) and other key implementing partners; donors, specifically the Global Fund, PMI and BMGF; wider stakeholders that are indirectly involved with the NgenIRS grant, including the World Health Organization and RBM Partnership to End Malaria; manufacturers and the global experts or academics focused on 3GIRS or IRS more broadly. Appendix B includes a full list of consultees.</p> <p>Stakeholder interviews have been supported by semi-structured interview guides which are presented in Appendix C.</p>
Country visits	<p>Country visits have been undertaken to two of the project countries: Ghana and Uganda. In country, we consulted partners/ stakeholders such as key decision makers at the country level, officials (high and mid-level) at relevant Ministries (e.g., NMCP), Global Fund Principal Recipient (PR) and sub-recipients, civil society organisations, as well as other key informants in country. Further details can be found in Appendices G and H.</p>
Remote country assessments	<p>In addition to the country visits, four other project countries have been included as remote country level case assessments: Ethiopia, Mali, Tanzania and Zambia. Country selection has been undertaken to ensure representation across a number of criteria. Appendix D includes further details.</p> <p>For these remote country assessments, a desk-based review of grant information has been conducted as well as limited number of remote interviews.</p>

Table 3.2 below outlines the methods used to address each of the eight evaluation questions. **Green** indicates that the method provided key evidence for the question, **orange** indicates that some evidence was considered but was not a key driver and white means that that method was not used to generate evidence for the evaluation question.

*Table 3.2 Data sources for the eight evaluation questions*

	Quantitative data analysis	Impact modelling	Documentation review	Global level consultations	Country level consultations
<i>Q1: Relevance and alignment</i>					
<i>Q2: Achievement of project activities and outputs</i>					
<i>Q3: Appropriateness of project activities and outputs</i>					
<i>Q4: Collaboration and coordination</i>					
<i>Q5: Contribution to addressing access barriers</i>					
<i>Q6: Public health and economic impact</i>					

Q7: Value for money					
Q8: Sustainability and Scalability					

At the end of each evaluation question, we have provided summary findings as well as provided an indication of the strength of evidence for the findings based on a robustness framework. Robustness of findings is based on both the underlying quality of the evidence, as well as triangulation, or quantity, of the evidence source. A four-point scale is used to bring these aspects together. This assessment of robustness of findings is described further in Appendix J.

### 3.2.1. Limitations

There are a number of key limitations of the above-noted evaluation methods that have been encountered and considered during the evaluation. These include:

- As the project has not been completed, it has not been possible to fully assess progress made over the course of the full implementation period. However, it is expected that this relates only to a few aspects (e.g. some dissemination and transition activities) and therefore does not have considerable bearing on the overall evaluation findings.
- Quality issues around the quantitative data available, especially with regard to some input assumptions for the public health, economic impact and return on investment modelling. A robustness rating has been developed for all key inputs which is outlined in Appendix K.2 and we developed sensitivities around the key inputs to determine the true range of the NgenIRS project’s impact.
- Some possible interviewee bias, given a number of the consultees are implementers and/ or recipients of funding. This was mitigated through emphasis of confidential questioning, explanations of the purpose and implications of the evaluation, and probing interview technique. Possible biases in qualitative data were also considered during the analysis stage.
- Limited insight from the remote country assessments, given the much more limited scope of key respondent enquiry as compared with the country visits. In addition, it was challenging to secure the most appropriate interviews due to in staff turnover or otherwise. The findings from remote country case studies were therefore assigned less ‘weighting’ as compared with the detailed county case studies.

## 4. Findings

In this section we present key findings across the evaluation questions, in line with the evaluation framework.

### 4.1. RELEVANCE

#### 4.1.1. Evaluation Question 1

1: To what extent has the project been relevant and aligned with Unitaid’s strategy, as well as needs identified in terms of priority global malaria prevention efforts?

In this section, we consider the alignment of the project with both Unitaid’s strategy as well as priority malaria prevention efforts.

#### Alignment with Unitaid’s strategy

*The project is closely aligned with Unitaid’s strategy*

The starting point for the evaluation was to assess the relevance or alignment of the project objectives with Unitaid’s strategy and approach in terms of supporting access and scale-up for malaria prevention efforts through innovative and catalytic approaches. Although the project was approved under Unitaid’s previous strategy and operating model,

it was mostly implemented under the current (2017-21) strategy and as such, it has been assessed against this version, in particular from the lens of Unitaid's three strategic objectives of innovation, access and scalability.<sup>4</sup> In terms of the project's aims to create a "sustainable, competitive and growing market for effective 3GIRS products at affordable prices", this is very closely aligned to the core aspect of Unitaid's operating model of the investments being catalytic and to trigger and accelerate changes for health outcomes. In terms of alignment with the three strategic objectives, we note the following:

- **Innovation** – the project is aligned in its aim to assist new products to come onto the 3GIRS market and its support to prioritising and extending the reach of 3GIRS products to people who needed it most – i.e. in higher burden malaria countries;
- **Access** – the project is closely aligned with this strategic aim as it sought to overcome a number of critical access barriers, especially affordability, supply and delivery, and demand and adoption. Our assessment, alongside that of global and country level stakeholders, is that the approach that the project undertook to address these access barriers from a number of angles is commendable;
- **Scalability** – the project was aligned with this objective at the start with the overall aim to support scale-up of 3GIRS products. However, whilst the transition of project activities was outlined at the start of the project, stakeholders consider that this could have been given more detailed consideration at the start of the project. However, given the project was introduced under the previous strategy, and transition is now more of a focus in the current strategy, we consider that the relative lack of emphasis on transition activities within NgenIRS is not as an issue of misalignment with the current strategy, but rather under-elaborated due to the timing when it was introduced.

Global level stakeholders, especially those closely acquainted with Unitaid's strategy and mandate consider generally that the project was "*very closely aligned with Unitaid's strategy*" and also highlighted the "*unique approach which the project had to address barriers in the market*". Our assessment of documents and qualitative data from interviews enables us to reach the same conclusion on strong alignment.

## **Alignment with global malaria prevention efforts**

### ***The project is relevant and aligned with global malaria prevention priorities***

The project was assessed in terms of its relevance in the context of global malaria prevention efforts, specifically the scope and purpose of the project in terms of improving effective and sustainable prevention efforts, including alignment with the Global Plan for Insecticide Resistance Management in Malaria Vectors.<sup>5</sup> This plan notes that there has been an increasing resistance to malaria including for pyrethroids and carbamates which threatens gains made in malaria control and that one mechanism to address this was for "two, or preferably more, insecticides with different modes of action to be rotated from one year to the next". This highlights a high need for additional classes of insecticides to be introduced or further adopted. As the Project Plan stated, if the trends in insecticide resistance seen at the start of the project continued unabated, it was estimated that more than 55% of the benefits of vector control could be lost, resulting in an estimated 120,000 additional deaths from malaria resurgence each year.

Relevance should also be considered within the broader context of IRS and LLINs approaches as per both WHO guidance and the available evidence on combining vector control strategies. As per WHO guidance, IRS is seen as a key component of a malaria vector control strategy within national malaria control strategic plans in countries in both the control and pre-elimination phase. The WHO 2019 guidelines specify that vector-control strategies should be devised through an integrated vector management (IVM) approach, with malaria control and elimination programmes prioritising the delivery of either LLINs or IRS at high coverage and to a high standard rather than introducing the

---

<sup>4</sup> Unitaid (2016), Unitaid 2017-21 Strategy

<sup>5</sup> WHO (2012), Global plan for insecticide resistance management in malaria vectors



second intervention as a means of compensating for deficiencies in the implementation of the first.<sup>6</sup> The distribution and use of LLINs has for a long time been predominantly considered as the primary malaria prevention method, at least in settings where high coverage with LLINs is habitually targeted and protection from LLINs is seen to be effective over periods of time. This is primarily due to cost and for operational reasons given the durability of LLINs, while varying and declining over time, exceeds the timeframe required for repeated rounds of IRS, which feeds into considerations of the cost effectiveness of both interventions.<sup>7</sup> There has been relatively limited evidence regarding whether using LLINs and IRS in combination provides additional benefit over using either of these methods alone, particularly as countries move through various control phases towards elimination. While the 2019 WHO guidelines conditionally recommend against combining these interventions as outlined above, once high coverage with one core intervention has been achieved, the recommendations suggest that programmes may consider deploying the other core intervention as an approach to prevent, manage and mitigate insecticide resistance.<sup>8</sup> Given the limited available funding, the market for IRS will remain dependent on the market and demand for LLINs products (as well as other malaria interventions) shaped by evolving public health impact and cost-effectiveness of new emerging products and based on a prioritisation analysis. Therefore, as the project aimed to generate evidence on effectiveness and cost-effectiveness, we consider this to be relevant within the global malaria prevention efforts.

In addition, overall the use of IRS globally has also been declining in recent years - the percentage of the population at risk protected by IRS declined globally from a peak of 5% in 2010 to 2% in 2018, with decreases seen in all WHO regions except the WHO Eastern Mediterranean Region.<sup>9,10</sup> Reasons for this likely include the switch from pyrethroids to more expensive alternatives in response to increasing pyrethroid resistance, as well as changes in operational strategies (e.g. decreasing at-risk populations in countries aiming for elimination of malaria). PMI, one of the biggest donors for IRS had also substantially reduced the number of structures sprayed in the years leading up to the project start, mostly related to the increased cost of non-pyrethroid insecticides.<sup>11</sup> This further emphasised the need for up to date evidence on the impact on insecticide resistance with novel IRS active ingredients, such as with 3GIRS, so as to continue to shape the demand for IRS products. In addition, it emphasises the high need for the project to aim to reduce the price of 3GIRS products. This opinion was also reflected by many global and country level stakeholders. This highlights the high need for a range of vector control tools which remain responsive to emerging and current resistance data and to reduce the price of a new generation IRS product in order to increase the number of tools available in the malaria vector control space. We therefore we consider the project to be aligned and important within the global malaria prevention efforts.

## Summary findings

Key issue/ theme	Findings	Robustness rating and explanation	
Alignment with Unitaid's strategy	<ul style="list-style-type: none"> <li>The project is closely aligned with Unitaid's strategy</li> </ul>	Strong	Supported by majority of consultations, with relevant consultee base for specific issues at hand and documentation review

<sup>6</sup> WHO (2019), Guidelines for Malaria Vector Control. Guidelines for malaria vector control. Geneva: World Health Organization.

<sup>7</sup> The literature available on the comparative cost effectiveness of both interventions in general and across specific settings is extensive.

<sup>8</sup> Ibid.

<sup>9</sup> WHO (2019). World Malaria Report.

<sup>10</sup> WHO (2018) World Malaria Report however highlights that in the WHO African Region, IRS coverage dropped from 80 million people at risk in 2010, to a low point of 51 million in 2016 before rising to 64 million in 2017.

<sup>11</sup> Oxborough R. et al. Trends in US President's Malaria Initiative-funded indoor residual spray coverage and insecticide choice in sub-Saharan Africa (2008–2015): urgent need for affordable, long-lasting insecticides. (2016); 15 (146).

Key issue/ theme	Findings	Robustness rating and explanation	
Alignment with global malaria prevention efforts	<ul style="list-style-type: none"> <li>The project is relevant and aligned with global malaria prevention priorities</li> </ul>	Good	Supported by majority of consultations and document review

## 4.2. EFFECTIVENESS AND EFFICIENCY

The second dimension of the evaluation relates to efficiency and effectiveness. We consider these evaluation criteria from the implementation of the project activities (e.g. whether planned activities were completed, what driving factors and constraints were faced etc.) and how appropriate the chosen activities, outputs and related targets were in terms of reaching the intended project outcomes. Therefore, we discuss findings under Question 2 and 3 together. In this section we also consider the overall project management (e.g. whether planned budgets and timelines were adhered to, the effectiveness of the project implementation and coordination structure etc.).

### 4.2.1. Evaluation Question 2 and 3

2. To what extent have project's outputs and activities been achieved/ completed as planned and on time and budget? What factors have driven achievement/ non-achievement?

3. To what extent were the chosen activities, outputs and related targets appropriate to reach the intended project goal?

These two evaluation questions assess whether the NgenIRS project achieved its planned activities and output targets as specified in the logframe of the project, and whether this has been done on time and within budget. It also explored what factors contributed to achievement especially with regard to the project implementation. Within this evaluation question, we consider the extent to which some activities, outputs and related targets were appropriate to reach the intended project goal. The activities, outputs and related targets that were flagged by Unitaid and other stakeholders for specific analyses have been included. The impact of the activities on addressing the market barriers is discussed in Question 5.

### Overall achievement of project's outputs and activities against the project logframe

*Overall, the project has performed well to date and either met, or surpassed, most of the project output targets*

The NgenIRS project has performed well when assessed against the logframe targets for the whole time period of the project. This is illustrated in Table E.1 in Appendix E that sets out the goal, outcome and output targets of the project and the performance to-date against these targets. Five out of seven of the project output targets have been met (with one of the two effectively being achieved at 99% progress) and this strong performance has contributed to the project reaching one of its goal targets too.<sup>12</sup> The project grantees have performed well to reach the targets.

However, this does raise the question as to whether, in hindsight certain targets could have been more ambitious. Overall, we consider that the targets were appropriate at the start of the project, given that the ability to meet the targets was uncertain, especially with the market uncertainties. Progress against the output targets are discussed

<sup>12</sup> Progress against the second indicator is not possible to report on as the data is not yet available.

more fully in the section below together with a more detailed overview of the performance and budget of the project. Performance relating to the project goal and outcomes are discussed in the impact sections.

***The NgenIRS project completed its activities whilst staying in its initial budget of US\$ 65.1million***

Overall, the NgenIRS grantees have done well to complete the project activities and achieve most of the project targets within its total, as well as, annual financial targets. The latest budget has been updated in 2019 and was slightly reduced to US\$63.1m mostly by reducing the co-payment in the last year of the project.<sup>13</sup> A detailed analysis of the budget by different tasks and by project partners and other stakeholders can be found in Appendix F.

## **Output 1: Uptake of 3GIRS**

***The largest proportion of the budget was allocated to co-payments and was critical for the project success***

Around US\$ 38.6million, the majority of the total budget (61.2%), was allocated to increase the uptake of 3GIRS. This funding was predominately used for the co-payment to manufacturers which ensured that country programmes had access to 3GIRS at the agreed price of US\$ 15. As a result, manufacturers were also the group of stakeholders that received the biggest proportion of the total budget at US\$ 38 million - representing 60%. The majority of this has been paid to Syngenta which was in the market from the start of the project, and also had the highest negotiated price which in turn required a higher co-payment. Sumitomo received funding through the co-payment after SumiShield 50WG entered the market at the end of 2017. Bayer did not receive any co-payment as they entered the market below the target price of US\$ 15.

Overall, this large proportion of the budget being allocated to the co-payment was critical for the project success, especially as it aided uptake (discussed below). However, the overall value for money in terms of this activity will hinge on sustainability aspects around the price of 3GIRS given that the aim was to make it more affordable, as well as depend on the extent to which it influenced longer-term uptake of 3GIRS.

***There has been an increase in uptake of 3GIRS – primarily within areas previously covered by IRS***

As demonstrated in more detail in Appendix E, the project had a target of 15 countries adopting 3GIRS in partnership with the project and this target was exceeded with 20 countries being included (Indicator O1.1). This higher than expected amount has been positive for the demand and adoption of 3GIRS, as discussed further in Question 5.

***The country selection was appropriate at the start of the project. A more ambitious rollout could have been possible in hindsight, but it is not expected that this would have had a significant effect on the market (with the exception of bringing in Nigeria, Democratic Republic of Congo and/ or Sudan)***

The NgenIRS project is understood to be one of Unitaids' projects with one of the highest numbers of project countries. Concerns around implementation as well as the overall funding envelope of the NgenIRS project played key roles in restricting the number of additional participating countries at the start of the project. The project countries were selected based on a range of criteria including malaria prevalence, emerging insecticide resistance, willingness of countries to participate and the strength and secured funding of existing IRS campaigns. The number of project countries has been increased during the project (with Malawi and Burkina Faso being added in 2018). In addition, a number of non-project countries (Sierra Leone, Sudan, Djibouti, Yemen, E8 countries) were engaged during the project with some procuring 3GIRS at the discounted prices that the project facilitated through its price negotiations with manufacturers.

Some global level stakeholders suggested that the country selection could have been more ambitious and could have included additional high burden countries – especially Nigeria and the Democratic Republic of Congo as these are both high burden and high population countries - as such they are seen as important for the market. We consider that the number of countries included was appropriate at the start of the project, especially given budget constraints as well as considerations regarding the feasibility of implementation. However, if there were additional funds made

---

<sup>13</sup> Expenses are lower, especially due to the US\$ 11.1 million set aside for the demand underwriting reserve fund which has not been used. As of October 2019, once the demand underwriting reserve fund has been removed from the budget, 97% of the budget had been disbursed (Source: IVCC 2019, NgenIRS Semi-Annual Review Financial Update 18th October 2019 Liverpool).

available part way through the project (e.g. some of the unused funds allocated to the demand underwriting function as discussed further below), this could potentially have been allocated to co-payments. These co-payment amounts could have potentially been used to either (i) expand the number of project countries or (ii) expand coverage of IRS within existing project countries. If additional countries, or areas within countries had been included, this would have had a positive public health affect. Overall, we do not consider that a larger number of countries would have significantly changed the market for 3GIRS with the exception of including Nigeria and/or Democratic Republic of Congo in the project.

***Overall the goal target for the number of people protected in Africa through 3GIRS (logframe indicator G1) appears to have been appropriate given the available information at the time though the uptake increases towards the end of the project could have been more ambitious***

It is hard to assess retrospectively what would have been the most appropriate target for the NgenIRS project in terms of population covered. That the target was likely to relatively easily be met (i.e. above 140% was achieved) was by no means evident at the time of target setting given there remained a large number of unknowns such as the approval of the PQ-status for new products and the in-country demand in project and non-project countries. It is also hard to assess the appropriateness of the target as it greatly depends on the market research conducted by IVCC in 2014.<sup>14</sup> The structure of the targets assumes that most gains were expected to be made in 2016 and 2017 with introduction of 3GIRS in many of the project countries. However, the later targets for 2018 and 2019 (at growth rates of the market share at 20% and 10% of respectively) could have potentially been more ambitious with new product introductions, unlikely drop-outs of project countries and an increase in demand outside of project countries.

## **Output 2: Improved consolidated country demand forecasting for 3GIRS products**

***Consolidated country demand forecasting has improved over the course of the project with most of the annual targets being met, in contrast the improvements in individual country demand forecasting failed to meet the project target***

The NgenIRS project developed an Excel-based forecasting tool to help countries with the quantification of their 3GIRS demand and started to conduct regional forecasting workshops in 2017. The workshops were used to provide training and guide country implementers and NMCP staff to better quantify and forecast the demand for 3GIRS.

As shown in Table 4.1 below, over the years of the project, progress was made in terms of the accuracy of country specific forecasts. A number of country level stakeholders reported that forecasting capacity had been built through the workshops. However, the project did not manage to reach its target on the proportion of countries where orders stayed within 10% of their annual forecast. Instead, the proportion of countries' orders within 10% of the annual forecast was 53%, though no data has yet been provided for the 2019 period. There are a range of reasons why in-country demand forecasting remains a challenge, which include (i) lack of predictability of committed funding; (ii) lack of quality data to base forecasting on (iii) factors which affect operations in the time lag between forecast and order such as security incidences/ concerns, changes in strategies or target areas or delays in carrying out campaigns. For example, a key reason behind the variation of the demand forecasting in mainland Tanzania was a change in target districts (partly driven as response to a reduction in PMI funding) after the forecasting workshops took place. As a result, actual dose usage in Tanzania was 54% below their forecast in 2018.

In contrast, the project achieved its global grant start-to-end target by reducing the fluctuations in the consolidated country demand forecasts to below 5% from a baseline of 50% in 2014. It also reduced the fluctuations consistently over the years, resulting in meeting its annual 2017 and 2019 targets respectively (Table 4.1 below). As the consolidated country forecasting is based on a cumulation of individual country level forecasting, the fact that this aggregated target was achieved is due in part to the role that IVCC has played in ensuring that the global orders were met. For example, IVCC supported the redeployment of over 300,000 units of unused Actellic 300CS from Madagascar to Comoros, Eswatini, Namibia, Rwanda and Zambia. The overestimation of the doses needed occurred due to a change in Madagascar's strategy from blanket to focal spraying which was decided on after the annual procurement took place.

---

<sup>14</sup> The evaluators have not seen this market research.

Table 4.1: Progress in country and consolidated country demand forecasting for 3GIRS

Indicator	2017 Period			2018 Period			2019 Period		
	Target	Result	Achieved	Target	Result	Achieved	Target	Result	Achieved
O2.1 Proportion difference in volume of consolidated forecast for project countries with actual orders procured	25%	24.5%	100%	10%	13%	77%	5%	4.8%	100%
O2.2 Proportion of countries orders that are with 10% of annual forecast	70%	33%	47%	80%	57%	71%	90%	TBD	TBD

***The forecast tool and workshops have been a useful activity, especially as a platform for knowledge sharing across countries. However, the long-term sustainability of the forecast workshops is somewhat uncertain at present, especially given the focus on one vector control intervention***

The forecasting workshops were well received by in-country stakeholders that participated (e.g. for Ghana the NMCP, Abt Associates and AGAMal and for Uganda, the NMCP, Abt Associates and Pilgrim Africa). The workshops are considered to have provided a useful platform that allowed the exchange of ideas between countries and facilitated cross-learnings and uniformity in forecasting. In addition, they reportedly aided coordination within countries across stakeholders working in IRS (e.g. Uganda). In-country stakeholders also reported that the workshops significantly furthered their understanding around the 3GIRS markets, the interplay between demand forecasts and prices, available products and their characteristics, as well as insecticide resistance management. For example, it was reported that countries were also encouraged to gather and bring their own data on resistance profile in countries to discuss them during the workshop with regard to the appropriate 3GIRS product choices. However, we note as evaluators that there can be a common bias amongst participants when reporting on the value of workshops because the opportunity in itself to come together and learn is often appreciated. Therefore, it is important to assess how the knowledge gained is then applied. Based on the impact on in-country demand quantification, the workshops appear to have been less successful, although a number of challenges may not be due to capacity. A notable key value add of the workshops has been the opportunity in facilitating the pooling of country level data for the consolidated country demand forecasts and then providing these to manufacturers which is an aspect which was not consistently done before (although PMI and Global Fund have undertaken distinct quantification efforts).

Furthermore, whilst the majority of global level stakeholders were also supportive of the forecasting workshops and new tool, some stakeholders voiced concerns regarding their high costs and the single focus on one vector control intervention – thus posing risks for long-term sustainability. In particular, the workshops could have been more sustainable by integrating them with the quantification processes for other vector control interventions. In contrast, other stakeholders thought that having such a narrow focus on 3GIRS allowed the workshops to be much more effective especially at a stage when not many countries had a strong knowledge on the topic. Going forward, we consider that it would be appropriate to integrate the quantification of 3GRIS with other malaria vector control interventions. There are plans for this to be undertaken, including through support from DFID for two years as well as and for the forecasting to be integrated further with other vector control tools, which is expected to aid transition of this activity. However, at present the sustainability of the forecast workshops is still somewhat uncertain. These sustainability aspects are further discussed under evaluation Question 8.

### **Output 3: New quality assured products available from several manufacturers on the market**

***The project met its target by having three different products pre-qualified (PQ) by WHO at the end of 2019, but missed out on a fourth product due to the continued delay of the WHO PQ status of Sylando (from BASF)***

IVCC facilitated the development of alternate products with other active ingredients from quality assured suppliers. While these activities were funded through IVCC's Formulation and Repurposing portfolio and not through the

NgenIRS grant, it was understood that these two funding streams were closely intertwined and that the increased market size and stability from the NgenIRS project would leverage IVCC’s existing work on product development.

Over the course of the NgenIRS project, IVCC met its target by facilitating the introduction of SumiShield 50WG produced by Sumitomo (WHO PQ status in October 2017) and Fludora Fusion produced by Bayer (WHO PQ status in December 2018). Both products are neonicotinoid IRS formulation and provide a different mode of action to the existing product Actellic 300CS which use an organophosphate IRS formulation. A fourth product that would offer a third mode of action, BASF’s Sylando, is currently undergoing examination for WHO PQ status after it resubmitted its application in October 2018 (the first application was made in 2010). However, the different mode of action of the product means that it does not perform well under the standard cone testing usually used for determining efficacy of products by WHO. This has reportedly contributed to the ongoing open application and the length of the WHO PQ process has meant that the expected introduction of Sylando has been repeatedly pushed back.

#### **Output 4: 3GIRS products are reduced in price**

There were a number of ways in which the project aimed to reduce the price of 3GIRS products including through (i) improved forecasting combined with the demand underwriting mechanism<sup>15</sup> and (ii) increasing the competition amongst manufacturers. In addition, the target price of US\$ 15 was based on an options analysis and then was confirmed by a cost of goods (CoG) study for Actellic 300CS and an elasticity study which was commissioned during the project. Under this Output, we therefore firstly consider the achievement of the project in terms of price reduction as well as how useful the different activities were to achieve this. Secondly, we describe how appropriate the use of the demand underwriting mechanism as well as the target price of US\$ 15.

***There have been continuous price reductions throughout the project reaching the project logframe targets as well as the target median price of US\$ 15 for 3GIRS products from 2020 to 2021***

The NgenIRS project has been successful in consistently reducing the prices for 3GIRS products meeting the logframe targets in each year. The annual median price across available 3GIRS products is outlined in Table 4.2 below. The price reductions after the first year from 2016/17 were seen to be strongly driven by the demand underwriting mechanism.<sup>16</sup> Price reductions in later years were seen to be more closely related to the increased competition through the entry of SumiShield 50WG and Fludora Fusion. The competition and price reductions of the latter two products was driven by the fact that they are of the same insecticide class (and, thus, are direct substitutes in terms of resistance management). In addition, these two products reportedly have lower production costs than Actellic 300CS. However, the production costs for SumiShield 50WG are reportedly higher than those for Fludora Fusion, with the entry of Fludora Fusion therefore facilitating the price reduction of SumiShield 50WG from a price that was originally set higher to account for these production costs.

*Table 4.2: Median price of 3GIRS products over time<sup>17</sup>*

Included Products (Manufacturers)	2015 (prior to NgenIRS project)	2016	2017	2018	2019	2020 – 2021 (negotiated price caps)
<ul style="list-style-type: none"> <li>• Actellic 300CS (Syngenta)</li> <li>• SumiShield 50WG (Sumitomo)</li> <li>• Fludora Fusion (Bayer)</li> </ul>	US\$ 23.50	US\$ 23.50	US\$ 19.30	US\$ 19.10	US\$ 16.50	US\$ 15.00

<sup>15</sup> In order to be able to ensure the manufacturers with a volume guarantee, the NgenIRS project created an underwriting reserve fund which would be given to manufacturers even if the forecasted volumes were not realised following country quantification exercises.

<sup>16</sup> A finding also confirmed in Cardno (2018) External Verification Agent Report – IVCC NgenIRS Grant.

<sup>17</sup> Due to confidentiality agreements between IVCC and manufacturers, only median price is reported here.

The project also negotiated price caps for the years 2020 and 2021 that are close to the price of US\$ 15 that countries paid after they received the project co-payment. Given that the global demand volume is in line with the forecasts for 2020 and 2021, this means that for at least the next two years, country programmes are expected to pay a median price of US\$15.

***The selection of a project price target of US\$ 15 was appropriate at the start of the project – both in terms of affordability for countries and manufacturer sustainability***

The project plan initially set out two options for the target price - at US\$ 15.00 and US\$ 17.50. These were based on an informal examination by IVCC on the risk of manufacturer and countries withdrawing at certain price point. The target price of US\$ 15.00 was selected but was subject to review and adjustment of the commissioned price elasticity study (conducted by CHAI)<sup>18</sup> and a CoG analysis of Actellic 300CS (funded by BMGF). Stakeholders suggested that both were helpful in keeping the price target at US\$15. Reportedly the CoG study of Actellic 300CS was key – both for the target price setting as well as the price negotiations with Syngenta.

In addition, the elasticity study suggested that US\$ 15.00 was an important price point that would lead countries to expand their IRS programme, especially in Uganda and Ethiopia. The setting of the target at this price seems appropriate based on the available information at the time although uptake has not been as much as expected in these two countries (discussed further under Question 5 below). Overall, we consider the CoG study to have been a more important activity in terms of setting the price target rather than the elasticity study.

In general, it was very appropriate for the project to use the same target price for the price reductions and the co-payment. This allowed for stability in the product prices that countries face during and after the project which aided for the transition process (discussed more fully under Question 8).

***Cost of Goods studies for the new products Fludora Fusion and SumiShield 50WG could have potentially helped in setting a more aggressive target price for new entrants***

As noted above, the CoG study for Actellic 300CS was an integral part of the early price negotiation. Stakeholders commented that two further CoG studies on new product entries would have been very helpful had they been conducted, especially as both new entrants used a different insecticide requiring other ingredients and, reportedly have a less complex and costly production process (e.g. no need to micro-encapsulate the active ingredients as was the case with Actellic 300CS). Having a more detailed understanding of at least one of the new neonicotinoids-based products could potentially have enabled IVCC to be more aggressive during the price negotiations and, this may have aided in achieving an even lower target price (at least for new products) if it became apparent from the analysis that the new products could enter the market substantially below US\$ 15. The fact that Fludora Fusion offers a price below US\$15 (and reportedly knew that it would be possible to enter the market below US\$15 before the start of the project) provides evidence that this may have been possible, at least for this product.

***The use of the demand underwriting mechanism was appropriate for the project especially during the first few years when there was no competitive 3GIRS market and high fluctuation in demand***

In order to be able to ensure the manufacturers with a volume guarantee, the NgenIRS project created an underwriting reserve fund with a capacity of US\$ 11.1 million that represented 18% of the total budget. The reserve fund was not needed throughout the project which meant that the US\$ 11.1 million has not been utilised.

This was the first time that the demand underwriting mechanism was used in a Unitaidd project. The vast majority of stakeholders (both manufacturers and non-manufacturers) considered the volume guarantee that was provided to manufactures under the demand underwriting mechanism as appropriate for the project and a key element in the reduction of prices, especially during the initial years of the project. Specifically, stakeholders suggested that the volume guarantee strengthened the NgenIRS position in the price negotiations with manufacturers. It shifted risks

---

<sup>18</sup> CHAI (2017) Price Elasticity of Demand for 3GIRS

away from participating manufacturers (Syngenta since 2016, Sumitomo since 2018) enabling them to offer a lower price by allowing the optimisation of the procurement of ingredients (i.e. ordering in bulk without risk of needing to store unused ingredients) and allowing to secure production slots against internal competition. This is also in line with the findings from the external verification agent report.<sup>19</sup> In addition, the demand underwriting mechanism helped to facilitate a market for 3GIRS manufacturers by stabilising demand (i.e. in addition to the positive aspects on price reduction).

It was also seen as positive that the reserve fund for the demand underwriting mechanism was not needed during the project. This meant that no financial obligations occurred to IVCC and Unitaid as there was always sufficient demand from countries to fulfil the volume guarantees given to manufacturers. Stakeholders credited this to the work of IVCC as they were able to fulfil a coordination role in shifting forecast orders from one country to another, as well as with regard to improvements of the consolidated country demand forecasts, in addition to demand creation in countries.

Global stakeholder consultations and the document review suggest that the following characteristics of the 3GIRS market made the demand underwriting mechanism an appropriate market intervention for the NgenIRS project:

- **No, or very limited, competition in the market.** This meant that there was no incentive for the sole manufacturer Syngenta to lower the product prices due to no market competition in the first years of the project. The volume guarantee was seen as an important tool that allowed IVCC to offer a tangible benefit to Syngenta (and later Sumitomo) during the product price negotiations.
- **Costliness/ willingness for manufacturers to take on risks due to demand uncertainty.** Stakeholders suggested that the more complex production process around Actellic 300CS as well as the Syngenta supply chain meant that there was a lower willingness by Syngenta to take on risks relating to storing unused ingredients and underused production lines. This made the volume guarantee a stronger incentive compared to other manufacturers that can take on these risks at no substantial extra cost.
- **Improved consolidation of country forecasts as part of the project allowed to limit the financial risk to IVCC / Unitaid.** IVCC used the improved consolidated country forecasts to set the annual volume guarantees to manufacturers. Thus, by improving the accuracy of the consolidated country forecasts over time the NgenIRS project also limited the financial risks that could occur by severely overestimating the existing level of demand.

***The full allocation of funds for the demand underwriting reserve fund for the whole duration of the project may not have been appropriate due to the opportunity costs of the unutilised funding and thus would have benefited from review throughout the project as market dynamics changed***

A minority of global stakeholders considered that the demand underwriting mechanism was important for the whole duration of the project. This is because it was regarded that there was a continued role for manufacturer-specific volume guarantees in a competitive market due to the fact that manufacturers not only face uncertainty around the overall market size but also uncertainty around the market share of their specific product. Therefore, it continued to provide certainty to manufacturers. In contrast, whilst all stakeholders consider it to have been very useful in the first three years of the project, a large number of stakeholders considered it to be less important towards the end of the project. The increased competition in the 3GIRS market as well as the inclusion of other manufacturers with a, reportedly, less complex and costly production process meant that there was less need for the demand underwriting mechanism towards the end of the project. In addition, there was already some improvement in the consolidated country forecasts providing further assurance to manufacturers. In general, our assessment is that volume guarantees

---

<sup>19</sup> Cardno (2018). External Verification Agent Report – IVCC NgenIRS Grant



are less appropriate in these circumstances as they would directly intervene into the competition process between companies and ultimately restrict choices for countries.<sup>20</sup>

In particular, at 18% of the project budget, the reserve fund for the demand underwriting was a considerable amount of the funding which was then prohibited to be used to fund other activities. In particular, some stakeholders questioned whether the full funding for the demand underwriting mechanism was still needed in the last year of the project or could instead whether some of it could have been used for other project activities such as co-payment to increased 3GIRS coverage. However, if the funds were to be made available, this would need to be considered to be value for money for Unitaid. When IVCC submitted a request for an extension to Unitaid, this was not granted.

Our assessment is therefore that while the demand underwriting was very useful, it should have been subject to review throughout the project, especially in light of uncertain market dynamics changes. The available evidence also suggest that the demand underwriting mechanism added less value in the last year of the project.

## **Output 5: Document and disseminate evidence showing cost-effectiveness of 3GIRS**

Activities within this output include (i) evidence generation (including data collection, analysis and interpretation) and (ii) dissemination of findings for cost-effectiveness and other studies. It also includes broader communication activities such as about 3GIRS product information, insecticide resistance management etc. The funding under this output included funds for a dedicated communication officer at IVCC.<sup>21</sup>

Within the project, evidence regarding 3GIRS has been generated through observational analyses (Ghana, Mali, Uganda and Zambia) as well as through a randomised control trial (RCT) in Mozambique considering the impact of IRS in addition to Long Lasting Insecticidal Net (LLIN) distribution. To date, one of the studies has been published (Mali) and otherwise intermediate findings from the studies (as well as broader communication around 3GIRS) have been shared with global and country stakeholders through opportunities including forecasting workshops, vector control advisory committee meetings in country and direct communication with stakeholders in countries. In addition, information was shared at meetings such as RBM Vector Control Working Group (VCWG), Pan African Mosquito Control Association (PAMCA), American Society of Tropical Medicine and Hygiene (ASTMH) conference, Multilateral Initiative on Malaria and partner meetings. Communication of findings was also shared through five evidence fact sheets, project pamphlets, websites and newsletters.

We highlight upfront that it is too early to fully assess progress in relation to this output as a number of activities have not been completed yet (e.g. an end of project dissemination event which is proposed for March 2020) as well as evidence only recently being completed and disseminated (e.g. cost-effective study for Mozambique and posters presented at the ASTMH meeting).<sup>22</sup>

### ***IVCC has exceeded its process target on disseminating evidence around the public health impact and cost-effectiveness of 3GIRS products***

IVCC has conducted more presentations at national and international level than initially targeted (17 instead of 6) and has also surpassed the number of targeted presentations to key country level stakeholders (32 instead of 26). However, a number of the academic and peer-reviewed studies are only expected to be published in journals after the end of the NgenIRS project,<sup>23</sup> although, some posters relating to these studies were recently presented at the

---

<sup>20</sup> There are further nuances in the current 3GIRS market as there is the need for products with different insecticide classes to implement IRM. Nevertheless, even in circumstances where manufacturer threaten with market exist, we do not consider that volume guarantees would be a sustainable approach in the long-term.

<sup>21</sup> According the Project Plan, the technical communication officer was planned to be the focal point for the Unitaid/IVCC communications and also tasked with developing the communication material for the demand creation side of the project and communications with countries to bring them into the project.

<sup>22</sup> IVCC (2019), Semi Annual Review Meeting, End of Project Event, March 2020

<sup>23</sup> There relate to impact and cost-effectiveness for 3GIRS in Mozambique as well as observational studies in Ghana, Uganda, and Zambia.

ASHTM conference. While the overall number of presentations have been surpassed, we note that this is a process indicator with limited reflection of broader impact in terms of knowledge or shaping of policy, implementation approaches etc. which would be hard to effectively capture through the methods deployed in this evaluation. The impact in terms of demand and adoption at country level as well as the impact on forecasting is discussed under Question 5.

***In general, the communication activities conducted under the project have been useful for country level stakeholders (although this was not uniform and could have been further strengthened) but have been less effective at engaging some global level stakeholders to date***

Stakeholders held mixed views regarding the communication activities conducted by IVCC – with a majority considering them to be appropriate activities to further the understanding of 3GIRS products in-country. One of the main communication components within the project was to present emerging evidence on the impact of 3GIRS and to provide country stakeholders with understanding around the different choices of 3GIRS products and their respective impacts on resistance management. Most stakeholders considered the communication activities to have been useful at a country level to strengthen understanding around the 3GIRS market, the available products including their price, efficacy and implementation concerns, resistance management and, to some degree, the public health impact and cost-effectiveness of products. In addition, these aspects were seen as important to “*change the conversation around 3GIRS in-country*” and improve the demand for 3GIRS products during a time when IRS use was on the decline.

However, whilst the communication activities were generally considered useful, and were undertaken across all countries, the efficacy of the dissemination appears not to be uniform across countries as some stakeholders considered that communication components could have been further strengthened. For example, while the ‘overall the conversation around 3GIRS’ has changed within the project countries, it is considered that more work around effectively sharing evidence on the health and economic impact could have been done. Stakeholders who worked on the specific studies themselves were familiar with the evidence and knowledge was stronger amongst stakeholders who engaged more frequently with a regional coordinator (e.g. Ghana). However, some in-country stakeholders could not recall specific public health impact evidence being shared through the NgenIRS project. In addition, communication could have been strengthened around the transition of the project (discussed further in Question 8).

At the global level, a number of stakeholders highlighted the missed opportunity not to effectively engage further with some key organisations and actors in malaria vector control, within the communications activities. Beyond the issue of dissemination of evidence, many stakeholders and the evaluators consider that the project did not engage sufficiently with relevant global level stakeholders. In particular many global level stakeholders were not aware of evidence generated through the project. We do recognise that some of the studies have only recently been completed but this may have been a missed opportunity during the course of the project. Further aspects regarding engagement of global level stakeholders are discussed under evaluation Question 4 below.

As a more minor point, a minority of global stakeholders questioned the appropriateness of the communication and advocacy component in principle as they considered that the advocacy work of IVCC, a product development partnership, could potentially ‘slip into a marketing activity’ for IVCC supported products. Stakeholders were specifically concerned that advocacy to increase volumes for a specific vector control intervention, or even products, did not fit well into the current debates that advocate for a more holistic approach across all available and emerging malaria vector control interventions (i.e. dual AI / PBO nets, vaccines, larva source management, odour baited traps etc.). Thus, the sustainability of a more intervention-specific communication was questioned. Going forward, most stakeholders agreed that 3GIRS would only play one part in the available vector control toolbox and that this is how it should be positioned in the future. As evaluators, we consider that it was appropriate that 3GIRS products were advocated for, especially as the IRS uptake had been decreasing prior to the start of the project, but also consider that this should importantly be positioned as one vector control tool amongst others.

## **Project implementation**

***Overall, IVCC and the sub-grantees have managed the project well, especially in relation to staying in budget and within the timeframes of the project plan, as well as through applying learnings during the project***

Based on outputs achieved against targets, the absorption of funds, and the fact that IVCC managed to achieve these within the specified timeframe, our assessment is that the project was managed well from a process and output perspective. In addition, where there were deficiencies in the original project plan (e.g. challenges with coordination at the country level which is discussed further in Question 4 below), we note that IVCC applied learnings during the project to improve on these aspects. Stakeholder feedback also supports the assessment that IVCC and sub-grantees have generally managed the project well, with country level stakeholders in particular, commending their responsiveness and overall project management.

Further details regarding coordination or project activities across stakeholders are discussed in Question 4.

***In some instances, Unitaid’s processes were not seen to be flexible but where necessary, solutions were found***

In some instances, Unitaid’s processes were not seen to be flexible. Examples relate to reporting requirements as well as changes to activities in the project plan, or project extensions.<sup>24</sup> Where it was necessary to make changes, solutions were found, but the relatively cumbersome processes were seen to be somewhat costly. For example, the process of reallocating funding across activities was seen as cumbersome and the reporting process was found to be less practical especially during the first years of the project. Another example where Unitaid has been seen as relatively inflexible relates to whether a project extension could have been granted, especially given that there were funds available from the demand underwriting mechanism. However, as evaluators we note that aspects such as the project extension would have needed strong justification that outcomes would have changed considerably and reportedly this was not evident. We also highlight that Unitaid has reportedly revised their processes over the timeline of the project so that learnings can be applied in more timely ways.

**Summary findings**

Key issue/ theme	Findings	Robustness rating and explanation	
Overall achievement of project’s outputs and activities against the project logframe	<ul style="list-style-type: none"> <li>Overall, the project has performed well to date and either met, or surpassed, most of the project output targets</li> </ul>	Strong	Supported by the documentation review, stakeholder consultations and country cases studies
	<ul style="list-style-type: none"> <li>The NgenIRS project completed its activities whilst staying in its initial budget of US\$ 65.1million</li> </ul>	Strong	Supported by documentation review
Output 1: Uptake of 3GIRS	<ul style="list-style-type: none"> <li>The largest proportion of the budget was allocated to co-payments and was critical for the project success.</li> </ul>	Good	Supported by the documentation review, stakeholder consultations and country cases studies
	<ul style="list-style-type: none"> <li>There has been an increase in uptake of 3GIRS – primarily within areas previously covered by IRS</li> </ul>	Good	Supported by the documentation review, stakeholder consultations and country cases studies
	<ul style="list-style-type: none"> <li>The country selection was appropriate at the start of the project. A more ambitious rollout could have been possible in hindsight, but it is not expected that this would have had a significant effect on the market (with the exception of bringing in Nigeria, Democratic Republic of Congo and/ or Sudan)</li> </ul>	Limited	Supported by some stakeholder consultations but with contradictory opinions and country cases studies
	<ul style="list-style-type: none"> <li>Overall the goal target for the number of people protected in Africa through 3GIRS (logframe indicator G1) appears to have been</li> </ul>	Poor	Supported by some stakeholder consultations

<sup>24</sup> For example, the need to conform to stringent word restrictions in the reporting template was seen as less efficient due to the fact that then often additional information was requested from Unitaid after submission.

Key issue/ theme	Findings	Robustness rating and explanation	
	appropriate given the available information at the time though the uptake increases towards the end of the project could have been more ambitious		
Output 2: Improved consolidated country forecasts for 3GIRS products	<ul style="list-style-type: none"> <li>Consolidated country demand forecasting has improved over the course of the project with most of the annual targets being met, in contrast the improvements in country demand forecasting failed to meet the project target</li> </ul>	Good	Supported by the documentation review, stakeholder consultations and country cases studies
	<ul style="list-style-type: none"> <li>The forecast tool and workshops have been a useful activity, especially as a platform for knowledge sharing across countries. However, the long-term sustainability of the forecast workshops is somewhat uncertain at present, especially given the focus on one vector control intervention</li> </ul>	Good	Supported by in-country stakeholders, country case studies and some documentation.
Output 3: new quality assured products available from several manufacturers on the market	<ul style="list-style-type: none"> <li>The project met its target by having three different products pre-qualified (PQ) by WHO at the end of 2019, but missed out on a fourth product due to the continued delay of the WHO PQ status of Sylando (from BASF)</li> </ul>	Strong	Supported by the documentation review and stakeholder consultations
Output 4: 3GIRS products are reduced in price	<ul style="list-style-type: none"> <li>There have been continuous price reductions throughout the project reaching the project logframe targets as well as the target median price of US\$ 15 from 2020 to 2021</li> </ul>	Strong	Supported by the documentation review, stakeholder consultations and country cases studies
	<ul style="list-style-type: none"> <li>The selection of a project price target of US\$ 15 was appropriate at the start of the project – both in terms of affordability for countries and manufacturer sustainability</li> </ul>	Good	Supported by the documentation review, stakeholder consultations and country cases studies
	<ul style="list-style-type: none"> <li>Cost of Good studies for the new products Fludora Fusion and SumiShield 50WG could have potentially helped in setting a more aggressive target price for new entrants</li> </ul>	Good	Supported by majority of consultations, with relevant consultee base for specific issues at hand
	<ul style="list-style-type: none"> <li>The use of the demand underwriting mechanism was appropriate for the project especially during the first few years when there was no competitive 3GIRS market and high fluctuation in demand</li> </ul>	Good	Supported by majority of consultations, with relevant consultee base for specific issues at hand and documentation review
	<ul style="list-style-type: none"> <li>The full allocation of funds for the demand underwriting reserve fund for the whole duration of the project may not have been appropriate due to the opportunity costs of the unutilised funding and thus would have benefited from review throughout the project as market dynamics changed</li> </ul>	Limited	Supported by some consultations, but with some contradictory opinions
Output 5: Document and disseminate	<ul style="list-style-type: none"> <li>IVCC has exceeded its process target on disseminating evidence around the public health impact and cost-effectiveness of 3GIRS products</li> </ul>	Strong	Based on document review

Key issue/ theme	Findings	Robustness rating and explanation	
evidence showing cost-effectiveness of 3GIRS	<ul style="list-style-type: none"> <li>In general, the communication activities conducted under the project have been useful for country level stakeholders (although this was not uniform and could have been further strengthened) but have been less effective at engaging some global level stakeholders to date</li> </ul>	Limited	Supported by majority of stakeholder consultations and country case studies but with some conflicting opinions
Project implementation	<ul style="list-style-type: none"> <li>Overall, IVCC and the sub-grantees have managed the project well, especially in relation to staying in budget and within the timeframes of the project plan, as well as through applying learnings during the project.</li> </ul>	Good	Supported by stakeholder consultations and documentation review
	<ul style="list-style-type: none"> <li>In some instances, Unitaids' processes were not seen to be flexible but where necessary, solutions were found</li> </ul>	Poor	Supported by only a few consultations

#### 4.2.2. Evaluation Question 4

#### 4. Was the allocation of project tasks appropriate between project stakeholders and to what extent has the collaboration/coordination between actors contributed to achievement of outcomes?

This question considers the implementation of the project and the extent to which the allocation of project tasks was appropriate between project stakeholders and to what extent the effective (or otherwise) collaboration/ coordination between actors has contributed to the achievement of outcomes.

***The allocation of project tasks between actors was appropriate overall and has worked well with some shortcomings being addressed over the course of the project***

Overall, stakeholders considered that the allocation of roles and activities across the different partners under the NgenIRS project has worked well and has been well aligned with the specific competitive advantages of each organisation. For example, IVCC as a product development partnership with strong technical expertise and understanding of the 3GIRS market was in a strong position to lead the project. Similarly, having PMI VectorLink / Abt Associates as implementers and PATH as evidence generation lead was considered to have worked well. The roles of the grantee and sub-grantees were also considered to be clearly outlined. However, there were a few specific concerns and lessons learnt which were flagged with regard to the allocation of activities:

- Concerns regarding a conflict of interest of IVCC conducting price negotiations.** Initially it was planned that the price negotiations with the manufacturers would be conducted by an independent consultant rather than by IVCC. However, this was changed during the course of the project based on the fact that the CoGs study, improved forecasts and existing market knowledge enabled IVCC to successfully conduct the negotiation. Some stakeholders considered that the close working relationship of IVCC with manufacturers could lead to a potential conflict of interest. The External Verification Agent Report focused on the question of perceived conflict of interest and while it found that generally reasonable and appropriate controls were in place, it was identified that the confidential price negotiations by NgenIRS constituted a limited concern that could lead to the perception of a conflict of interest.<sup>25</sup> Concerns around the perception of a conflict of interest have decreased since the entry of other manufacturers (also due to the use of request for quotations that provide more transparency around pricing decisions). There also have been no suggestions that a conflict of interest led to a more favourable outcome for the manufacturers in the price negotiations. Nevertheless, the

<sup>25</sup> Cardno (2018) External Verification Agent Report – IVCC NgenIRS Grant, p. 4-5

use of an external consultant for the price negotiations, especially during the start of the project when there was only one supplier in the 3GIRS market, could have reduced the perception of the conflict of interest (although there is no evidence that this would have yielded a better outcome for the price negotiations).

- ***Demand forecasting should have been a more collective effort as the inclusion of partners such as RBM and the Global Fund could have addressed transition concerns early on.*** Country stakeholders thought it was appropriate for IVCC to conduct the forecasting workshops, as this activity was considered very beneficial, but considered that any partner or actor with strong technical expertise could have done so. However, it was seen as a missed opportunity that there was not a stronger push to include other stakeholders to ensure a smooth transition of the conducted activities. Specially, an engagement with RBM on forecasting early on would have been helpful for transition purposes. Equally, closer engagement with the procurement team at the Global Fund would have been helpful for the transition process (these aspects are discussed further under Question 8).

***Collaboration and coordination between partners have worked well overall and improved over the course of the project where there have been shortcomings***

In general, the coordination and collaboration between partners has reportedly worked well overall and, in cases where there were shortcomings at the start of the project, these improved over the course of the project. In particular:

- ***IVCC engagement with countries improved considerably over the course of the project including through the use of regional coordinators that were seen as valuable additions by in-country stakeholders.*** IVCC's strengths as a Product Development Partnership (PDP) were considered to lie in its 3GIRS market understanding, its working relationship with manufacturers and technical expertise. It was viewed as an institution with less of a strong understanding of in-country decision-making, especially in countries which received their main funding from the Global Fund. However, stakeholders emphasised that IVCC improved considerably in their engagement with countries, especially through the use of regional coordinators when they were introduced in late 2016 (more information in Appendix G).
- ***The working relationship with the Global Fund was not clear at the beginning of the project and IVCC had limited expertise in working with the decentralised system and grant-making process of the Global Fund.*** This was in part addressed by focusing the first year of the project on PMI countries where the relationship was more formalised – i.e. PMI has a more central approach and also contracted Abt Associates as an implementing partner in all their supported countries. Reportedly, it took some time for IVCC to understand the Global Fund structure and the importance around country-specific decision making in the form of the Country Coordinating Mechanism as well as the key roles that the Global Fund's Fund Portfolio Managers (FPMs) played in each country. This realisation in terms of the need for visibility in-country and direct work with country teams came only later in the project. However, it was considered positive that IVCC adjusted to this and fostered a better understanding and relationships as the project progressed – with some arguing this made IVCC a stronger partner in the long-run which now has expertise in understanding both upstream (i.e. manufacturers) and downstream (i.e. NMCPs in countries) partners.

***Engagement with some global partners in malaria vector control could have been stronger***

Stakeholders commented that IVCC and the NgenIRS project (and to some extent Unitaid) could have emphasised the collaboration with actors who were not directly involved with the NgenIRS project. Similarly, global level stakeholders also highlighted that other actors such as African Leaders Malaria Alliance (ALMA) or RBM could have been more actively engaged to leverage on their existing network to further increase demand and adoption for 3GIRS and to improve coordination with other vector control interventions respectively. Stakeholders highlighted that the communications and advocacy interventions should have been further extended to other relevant global malaria stakeholders, including further engagement with WHO and the Global Fund. In particular, it was highlighted that the evidence generation and dissemination team could have collaborated more closely with WHO departments such as the Global Malaria Programme (GMP) (department given the importance of the evidence being used to potentially shape policy recommendations. Reportedly WHO GMP was more involved in the project at the start and did review the trial designs. However, with staff turnover and changing internal processes at WHO regarding institutional collaboration, the engagement has been less in the latter years of the project. IVCC did undertake a number of

initiatives to involve a number of global stakeholders, including WHO. However, engagement with WHO GMP was not as effective as it could have been, in particular a more direct method of engagement is likely have been more beneficial, which may have been a missed opportunity.

***The use of an external advisory committee (EAC) has been useful***

The project governance structure included an EAC. The purpose of the EAC was to be the “*external eye of the project*” and provide advice based on the EAC members’ expertise. The EAC met twice yearly and kept track as to whether recommendations from the previous meeting had been addressed, which they reportedly were. There were reportedly a number of benefits from the EAC given the expertise the EAC members offered as subject matter and programmatic experts. In particular this included: (i) technical guidance (on aspects such as sub-national IRM as well as research guidance), (ii) market guidance and (iii) policy issues at the global level as well as within African countries, especially as the EAC members could bring in perspectives from the malaria field more broadly, which for IVCC as a PDP rather than in-country implementer was seen as valuable.

**Summary findings**

Key issue/ theme	Findings	Robustness rating and explanation	
Allocation of project tasks between project stakeholders and collaboration/ coordination between actors	<ul style="list-style-type: none"> <li>The allocation of project tasks between actors was appropriate overall and has worked well with some shortcomings being addressed over the course of the project</li> </ul>	Good	Supported by the documentation review, stakeholder consultations of a smaller number of stakeholders and country case studies
	<ul style="list-style-type: none"> <li>Collaboration and coordination between partners have worked well overall and improved over the course of the project where there have been shortcomings</li> </ul>	Good	Supported by the documentation review, stakeholder consultations of a smaller number of stakeholders and country case studies
	<ul style="list-style-type: none"> <li>Engagement with some global partners in malaria vector control could have been stronger</li> </ul>	Limited	Supported by a majority of stakeholder consultations with knowledge of the specific issues at hand but some conflicting views
	<ul style="list-style-type: none"> <li>The use of an external advisory committee (EAC) has been useful</li> </ul>	Poor	Supported by only a few consultations

**4.3. IMPACT**

As an end-term evaluation, impact is a key focus, with this section firstly outlining the market impact of the project, followed by the direct and indirect public health and economic impact and finally the value for money of the project.

**4.3.1. Evaluation Question 5**

**5. To what extent has the project contributed to addressing critical access barriers that had previously limited the development and uptake for 3GIRS products? What may have happened in the absence of the project to the 3GIRS market?**

This evaluation question assessed the extent to which the project has achieved its stated aim of creating a stable and competitive market for 3GIRS products, whilst determining the role that the NgenIRS project played in facilitating the development of the market. As such it is a key question of the evaluation. We consider this question in light of the three critical market access barriers identified in the ToC: (i) supply and delivery; (ii) affordability and (iii) demand and adoption, recognising that these are interdependent to some extent. Table 4.3 below provides a summary of the progress made against the three main market barriers and these are further explained below. Further details regarding aspects relating to the sustainability of overcoming the access barriers are discussed under Question 8.

Table 4.3: Summary of progress made against market barriers

Market barrier	Progress	Key NgenIRS contribution	Remaining barrier
Supply and Delivery	Good	<ul style="list-style-type: none"> <li>Facilitated continued interest from manufacturers to enter the market.</li> <li>Aided reliable supply through reliable forecasts and quick access to products recently acquiring WHO PQ status.</li> </ul>	Third class of insecticide needed in order to aid insecticide resistance management.
Affordability	Strong	<ul style="list-style-type: none"> <li>The primary influences on the price at the start of the project was the demand underwriting, the higher volumes due to the co-payment and more reliable forecasting to a lesser degree.</li> <li>The primary influences on the price later on in the project was supplier competition and the project played a key role in setting the reference point for the price competition at US\$ 15.</li> </ul>	The reduced price of US\$ 15 price still remains a barrier for further expansion of the 3GIRS market, especially given the cost in relation to other vector control interventions. In addition, the operational costs also remain a barrier to uptake.
Demand and adoption	Strong	<ul style="list-style-type: none"> <li>There has been an increase in uptake of 3GIRS and a slight increase in uptake of IRS more broadly from a previously shrinking market.</li> <li>This has primarily been from within areas that were previously covered by IRS rather than an expansion of IRS into areas/ countries that did not previously use IRS.</li> <li>The project has significantly helped countries in their decision making across 3GIRS products.</li> </ul>	There is a need for further dissemination of evidence, especially relating to cost-effectiveness (which is the focus of recently completed studies under the project) in comparison to other vector control interventions.

## Supply and delivery

*The market access barrier of supply and delivery has had good progress made in overcoming it through the increase in number of suppliers on the market. Whilst not encouraging manufacturers to initially decide to enter the market, the project has encouraged manufacturers to continue to proceed to enter the market and thus aided the number of suppliers in the market. As there are now three products on the market, the market is seen to be more competitive and sustainable. However, as per effective insecticide resistance management plans and the associated need to have ideally at least three classes of products to aid insecticide resistance management through the rotation of multiple chemicals, there is still need for at least one additional product.*

*In addition, the project has aided supply and delivery in a number of other ways such as ensuring reliable supply through consolidated country forecasts and that products with recently acquired WHO PQ status were accessible to countries quickly.*

***The project did not significantly impact the decision of the three additional manufacturers to initially develop a 3GIRS product, but it did facilitate continued interest for manufacturers to proceed with their decisions to enter/ remain in the market***

Sumitomo, Bayer and BASF had already started developing their products before the start of the project – a process which IVCC had been supporting prior to the project for a number of manufacturers. The project therefore did not aid them in deciding initially to invest in product development to enter the market. The manufacturers had already recognised the need for the 3GIRS market given the evidence emerging with regards to increasing resistance to pyrethroid and then Bendiocarb products.

It is difficult to disentangle the effect of the project on the decision of these manufacturers to then continue with their decision to enter the market (together with the support from BMGF regarding activities under Output 3) based on whether they considered that the conditions were favourable regarding sufficient demand and manageable risk. However, the project has encouraged manufacturers to continue proceeding with their decision at multiple stage gates to enter the market. Reportedly the criteria that manufacturers consider when determining whether to enter the 3GIRS market is based on the following:



- Overall funding available for a product globally (e.g. the market was seen as more appealing when PMI started supporting countries for IRS in 2009);
- Perceived demand for 3GIRS – linked to a shift in focus towards resistance management and the need for a variety of products;
- The number of products and suppliers on the market. If this is crowded and well served by a number of suppliers, that would be a deterrent to entry;
- Increased confidence from manufacturer management which then may have helped to prioritise/ invest in more 3GIRS product lines etc.

Importantly the NgenIRS project is considered to have played a significant role in maintaining the visibility and emphasis on 3GIRS, thus facilitating demand and adoption (discussed further below). This is considered to have assisted in making the 3GIRS market an attractive market for manufacturers to enter. Had the market been considered at risk to shrink and therefore hold limited market appeal, these manufacturers may not have decided to continue to seek WHO PQ approval or to potentially have used production lines for other products. Therefore, the project has aided entry of new products in this regard.

***The market has become more competitive over the course of the project but there is still need for at least one additional product given insecticide resistance management requirements***

As per Output 3 of the project, two additional manufacturers have entered the market which all stakeholders recognise as being very positive in terms of supporting a competitive and sustainable market. On a more minor note, stakeholders consistently highlighted that the market supply strength is not only about the number of manufacturers but also about the number of products and the number of classes of insecticides available. Given that there are currently only two classes of 3GIRS, stakeholders consider that there is need for at least one additional class, especially given WHO's recommendations on rotating insecticides in order to tackle insecticide resistance. Therefore, it is positive that BASF is currently undergoing the application for WHO PQ for Sylando, which would be another class of 3GIRS insecticide should it come to market, but at this stage of the project it has not yet achieved WHO PQ status (as discussed above).

It is considered that the sustainability of the 3GIRS market should be viewed a bit differently from markets which do not have different classes of the same product. In particular, the 3GIRS market needs to ensure that demand and adoption for multiple classes of insecticide can be supported, in order to aid resistance management. Therefore, it is considered important that there is room for different products – potentially at different price points – rather than an approach which would encourage competition across all products in a market in order to reduce the price.

We therefore agree with a number of stakeholders that there is still room for additional products and as such that “the market is not fully there yet”.

***Consolidated country level forecasting has improved over the course of the project and has aided supply security***

As noted in Indicator O2.11, consolidated country level demand forecasts for 3GIRS used to be around 50% accurate<sup>26</sup> but as of 2019 they are accurate within 5% of the orders. In addition, the fact that the funds set aside for the demand underwriting mechanism have not needed to be used, further emphasises that the consolidated country forecasts have been fairly accurate (or that in some limited instances IVCC have managed surplus forecasts well by redeploying doses in other countries). However, with more suppliers in the market, there is uncertainty regarding the proportionate split across 3GIRS products going forward which may create some volatility between supplies from manufacturers (discussed further in Question 8).

While consolidated country demand forecasts have been accurate, there is more discrepancy within these forecasts at the country level. As noted in indicator O2.2, the proportion of countries' orders that are within 10% of the order are 53.5%. Based on our country case studies, stakeholders reported that a key value add of the project was (i)

---

<sup>26</sup> Based on baseline from 2014 in the logframe

bringing country level stakeholders within countries to coordinate in-country forecasts (e.g. NCMP, Vectorlink, other implementing organisations like AGAMal etc) as well as (ii) helping country stakeholders across countries to better understand the importance of accurate quantification and advanced forecasting in order to support manufacturers to reduce prices as well as facilitate timely delivery of products to countries. However, given that country level forecasts are still not that reliable, this poses a risk to sustainability of the consolidated country level forecasting, in addition to uncertainty regarding the sustainability of the forecasting activities (discussed further in Question 8).

***The project has aided reliable supply to countries based on reliable forecasts***

A minority of stakeholders highlighted that an unexpected benefit of the project, through management from IVCC, has been the reliable supply of products from manufacturers. This has included reliable delivery timeframes – which has most likely been aided by the longer lead times as well as clearer volumes based on the forecasting which manufacturers have received.

Stakeholders noted that if reliable forecasts are continued, then manufacturers would have increased confidence of the overall orders required. Therefore, a potential health benefit could be the ability for manufactures to respond to urgent requests in light of malaria outbreaks. However, if reliable forecasts are not available, this may jeopardise this ability to quickly respond to outbreaks. While some manufacturers do hold a certain minimum quantity of 3GIRS product on hand, this has a cost requirement to store and repack the product.<sup>27</sup> In addition, some other manufacturers would need an additional 2-3 months of lead time which may pose a risk to timely supply of the product.

***Once new products received WHO PQ, countries were able to access these quicker because of the project***

Reportedly there can often be a considerable delay between products receiving WHO PQ and then take up at the country level. However, stakeholders noted that because of IVCC's engagement with countries, the information sharing about products available to inform choices and in some instances providing assistance to progress in-country registration (e.g. Ghana), countries were able to receive the products very soon after they were pre-qualified. Therefore, this was a benefit from the project in terms of aiding faster access to 3GIRS products.

## **Affordability**

*The project has significantly helped to overcome the market access barrier of affordability, but the reduced price of US\$ 15 remains a barrier for further expansion of the 3GIRS market especially given the cost in relation to other vector control interventions. In addition, the high operational costs also remain a barrier to uptake. The primary influences on the price at the start of the project was the demand underwriting, the higher volumes due to the co-payment and more reliable forecasting to a lesser degree. The primary influences on the price later on in the project was supplier competition.*

***The product price of US\$ 15 is much more affordable than the previous price of US\$ 23.50***

The reduction of 3GIRS product prices to US\$ 15 is seen as a significant achievement of the project. As described in Question 2/3, the target of US\$ 15 helped to set a lower price for 3GIRS. Stakeholders consider that the various approaches used in conjunction to aid the reduction of the price of the 3GIRS products were successful (demand underwriting mechanism, increase in demand through co-payments and increasing competition across manufacturers). The extent to which the price has decreased would not have been realised without the project.

***US\$ 15 is still considered relatively expensive in relation to other vector control interventions and remains a barrier to further scale up***

Although a reduction in price to US\$ 15 is a significant achievement, it is expected that the overall budget envelope for 3GIRS is not likely to expand, especially at the current 3GIRS product prices which results in other products being considered to be more cost-effective. US\$ 15 is still extremely expensive for most country governments and therefore it is expected that they will need to continue to rely on support from donors. Given the high proportion of IRS programme costs attributable to the cost of the product, the high cost remains a barrier to scale up, even though it was reduced to around US\$ 15. For example, based on elasticity study, it was thought that Ethiopia and Uganda

---

<sup>27</sup> Cardno Emerging Markets USA, Ltd. (2018), External Verification Agent Report - IVCC NgenIRS Grant

might increase uptake. However, in Uganda although the price point of US\$15 has facilitated uptake over use of Bendiocarb with PMI funding Actellic 300CS, US\$ 15 is still seen as prohibitively expensive to further expand uptake. In Ethiopia, 3GIRS uptake has not increased except with PMI undertaking some 3GIRS spraying, although there are aspects other than price such as the need for further locally specific evidence and the existence, and willingness to support, a locally manufactured product (Propoxur) which has been a factor in that.

Some stakeholders commented that US\$ 8 – US\$ 10 would be much more affordable for countries but other stakeholders noted that this is unlikely to eventuate in the short term given the chemical ingredient costs, as well as the manufacturer processes. The production processes required to make Actellic 300CS are different from processes to make SumiShield 50WG and Fludora Fusion (with Actellic 300CS being a more expensive process) and as such it is unlikely that the price of Actellic 300CS can be reduced to that of SumiShield 50WG and Fludora Fusion. In addition, it was highlighted that the cost of the products should also be considered in terms of the product specific residual durability rather than a 'blanket' cost across the products when considering product prices.

Another aspect which is important within price considerations is the operational costs of deploying IRS. Although there is quite significant country variation in costs, according to PMI programme data from 2016, 2017 and 2018, roughly a third of the costs are for the insecticide while two thirds are for operational costs.<sup>28</sup> Therefore in terms of sustaining the existing spraying coverage, these overall costs can be a significant barrier in addition to the insecticide cost. In addition, the fixed costs required if districts are changed can reportedly also be very high, therefore presenting a barrier to further uptake. Together these operational costs and product costs currently prevent a larger uptake despite the project recently determining that 3GIRS is cost effective by WHO standards.<sup>29</sup>

Finally, we highlight that whilst price is an important consideration for product selection, through their commitments to IRM, countries must rotate products. Therefore, countries may choose more expensive products even if they are at higher price.

***The primary influences on the price at the start of the project was the demand underwriting, the higher volumes due to the co-payment and to a lesser degree, more reliable forecasting***

The influences on the price reductions changed over the course of the project. At the start of the project, when Actellic 300CS was the only product, the main influences which helped to reduce the price were the demand underwriting mechanism and the higher volumes due to the co-payment. To a lesser extent, more reliable consolidated country forecasting also contributed.

At the start of the project, product procurement volumes were uncertain. A number of stakeholders recognised the challenges that this posed to the only manufacturer, Syngenta. Therefore, through the demand underwriting mechanism, IVCC agreed to underwrite the volumes ordered through the demand forecasting taking on the financial risk in case there would be lower actual volume procured than forecasted. In addition, the higher volumes that countries ordered due to the co-payment mechanism meant that there were opportunities for economies of scale for Syngenta, and later Sumitomo (but not for Bayer who benefited from the volume guarantee but did not benefit from the co-payment as their product launch price was below the US\$ 15 threshold). This also instilled confidence in the likelihood of higher procurement volumes going forward. Together, these were reportedly extremely helpful for Syngenta as it was possible to obtain commitment from their production team to change their processes to facilitate a reduction in price. Another important step towards a price reduction was from Syngenta in removing some of the costs from their supply process.

Therefore, although the funds for the demand underwriting was not actually used (given forecasts were accurate across countries even if not always accurate within country forecasts), this is considered to have played an important role.

---

<sup>28</sup> PMI IRS Country Programs Comparative Cost Analysis – 2016, 2017, 2018

<sup>29</sup> Yukich et al (forthcoming, not yet published), Cost and cost-effectiveness of third-generation indoor residual spraying in sub-Saharan Africa: Results of data collection and analysis in the Next Generation IRS project. (Abstract for the ASTMH 2019)

***The primary influences on the price later on in the project was supplier competition and the project played a key role in setting the reference point for the price competition at US\$15***

As noted in Question 2/3, Sumitomo achieved WHO PQ status for SumiShield 50WG at the end of 2017. Therefore for 2018, there were two 3GIRS products available on the market. In 2019, Fludora Fusion was also available on the market, thus furthering competition. Whilst the product costs are reportedly lower for SumiShield 50WG and Fludora Fusion, it is considered that the fact that the project has set a target price of US\$ 15, significantly aided Sumitomo and Bayer to come in around this price point as an upper limit instead of potentially coming in at a higher price point. As one stakeholder noted, “*The project forced consciousness around the US\$ 15 level, and this has become a reference point for pricing going forward. Hard to think that someone who’s coming into the market would have confidence going above US\$ 15*”.

However, as noted in Question 2/3, some stakeholders queried whether CoG studies for these two products could have potentially provided more evidence for negotiation to further reduce this price point. In addition, it would not have made commercial sense to come in at a price significantly lower than US \$15 and as such CoG studies could potentially have aided a further price reduction.

***The current price of US\$ 15 is expected to be maintained for the next two years but prices are uncertain after that timeframe***

The ability of the project to negotiate a two-year price cap of around US\$ 15 for 3GIRS products (though contingent on firm forecasting) is a significant achievement and is considered likely to be key to sustaining the market for the near future. However, given that the budget envelope for 3GIRS is currently expected not to significantly increase (discussed further below), a key concern for stakeholders is the price for 3GIRS products going forward. Therefore, the stability of this price (or potentially this price decreasing) going forward will be key for sustainability of the 3GIRS market, together with the programme operational costs and whether these can be reduced (discussed further in Question 8).

## **Demand and adoption**

*The project has made strong progress towards overcoming the market barrier of demand and adoption. The increase in uptake of 3GIRS has mainly been within areas that were previously covered by IRS and a slight increase in uptake of IRS more broadly from a previously shrinking market. There has been little expansion in uptake in 3GIRS into areas/ countries that did not previously use IRS, although there have been some examples more recently. This is likely to be due in large part to a need for further dissemination of evidence to inform decision making, especially relating to cost-effectiveness (which is the focus of recently completed studies under the project), as well as the cost of the 3GIRS products and programmes in a relatively fixed funding envelope.*

***There has been an increase in the uptake of 3GIRS across countries in Africa***

The project was successful in achieving its overall goal of increasing the number of persons protected with 3GIRS throughout Africa. By the end of Q3 2019, 119.5 million people had benefitted from 3GIRS through the NgenIRS project (either directly as a project country or indirectly through the discounted price). This is 42% more than the start-to-end grant target of 84.4 million. The NgenIRS project only had a few project countries in 2016 which is reflected in the slow uptake at the start of the project (Indicator P1 in Table 4.4). This changed quickly with the inclusion of many high and medium IRS uptake countries including Kenya, Madagascar, Mozambique, Tanzania, Uganda, and Zimbabwe in 2017.

Table 4.4: Progress in the uptake of 3GIRS across countries in Africa

Indicator	Baseline (2014)	2016 <sup>30</sup>	2017 <sup>31</sup>	2018	2019
G.1. Persons protected with 3GIRS	8.35 million	5.9 million	38.4 million	31.7 million	42 million (projected)
P.1. Aggregated Volume of 3GIRS	723,247	678,569	4,140,592	3,649,661	4,001,146

In addition, the number of countries procuring 3GIRS has increased from eight countries to 31 (Indicator P2).<sup>32</sup> This is a positive increase for the uptake of 3GIRS which most stakeholders consider to have been on the decline at the start of the project. As one key stakeholder commented “*the project was instrumental in being able to instigate change to uptake of 3GIRS – especially in areas of high resistance where it was considered too expensive. Even in countries which were not formally engaged, it enabled them to be engaged*”. The project is not, however, expected to achieve its target of the expansion of the proportion of the volume of IRS that is 3GIRS in project countries in Africa (Indicator P3). A major factor of this has been the slow uptake of 3GIRS in Ethiopia, a country with a very large market share, as Ethiopian stakeholders have preferred to continue to use the locally manufactured IRS product, Propoxur.

***The use of the co-payment has facilitated uptake of 3GIRS within areas already being covered by IRS and in some instances has enabled additional areas to be covered because of the subsidy***

Within countries, the use of the co-payment has facilitated uptake of 3GIRS in some additional areas which otherwise would not have been possible for countries to fund 3GIRS within existing envelopes. For example, in Ghana the project facilitated the expansion of 3GIRS to an additional four districts. Within other countries, the overall coverage of IRS is not considered to have significantly expanded but rather the coverage of 3GIRS within existing areas already undertaking IRS has increased. For example, in Uganda, the project did not facilitate an expansion of IRS but rather facilitated a switch from Bendiocarb to 3GIRS within districts previously covered. Many stakeholders consider the ‘maintenance of coverage’ of either 3GIRS or in areas which were previously covered with other insecticides to still be a valuable achievement, especially given resistance concerns.

***While IRS is very popular in some countries, coverage has been maintained rather than increased given the limited budget envelope. There has been little expansion into countries that did not previously use IRS, although there have been some examples more recently***

‘Traditionally IRS’ countries have a lot of support for IRS (e.g. Uganda) given that IRS does not rely much on social and behaviour change or wear and tear (in contrast to nets). However, despite the keenness to scale up IRS as evidenced in national malaria implementation plans, they are restricted from doing so by the limited budget which needs to be spread across competing vector control interventions. This is because the government budget is limited and so funding is predominately dependent on donors for which the budget envelope has reportedly not increased significantly over the course of the project.

In terms of take up in countries not previously using IRS, this has not been extensive. However, this was not surprising to most stakeholders as it is considered that there are generally ‘traditionally IRS countries,’ which have used IRS and are expected to keep using IRS for at least the short term, and ‘non-IRS countries’ which historically have not utilised IRS to the same extent. However, there have been some recent gains made in countries which previously stopped using IRS which are in the process of relaunching (e.g. Angola, Kenya, Malawi, Senegal) and some examples

<sup>30</sup> The data for 2016 only includes NgenIRS project countries.

<sup>31</sup> The data for 2017 has been revised and these numbers are based on the additional documentation from IVCC rather the annual reports.

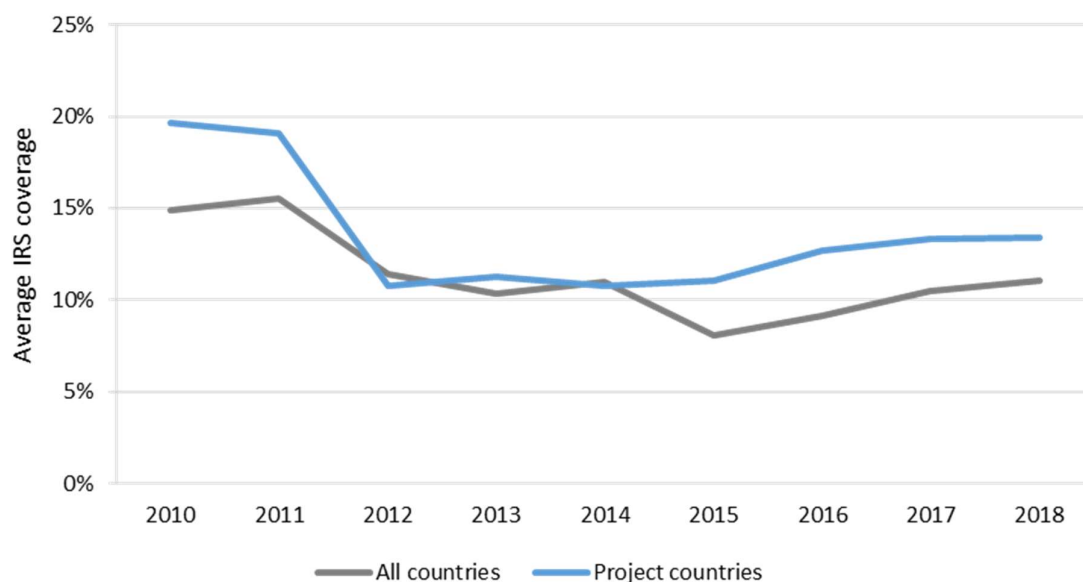
<sup>32</sup> Project logframe and progress to date

of countries which have begun or are considering starting to use IRS (e.g. Comoros, Cote d'Ivoire, Djibouti, Sierra Leone, Yemen).

***The NgenIRS project contributed to the reversal of the declining trend in overall IRS usage (i.e. IRS of any type including non-3GIRS) in countries in sub-Saharan Africa***

Figure 4.1 outlines the IRS usage in relevant countries in sub-Saharan Africa (i.e. including project countries and those countries using or potentially using IRS)<sup>33</sup> between 2010 and 2018. As the figure shows, the average IRS coverage of the population at risk dropped from a peak in 2010, declining rapidly until 2012 when many countries started to experience resistance issues with pyrethroid IRS. Since then, the IRS usage has declined further for all countries though in the countries later selected to be part of the NGenIRS project, IRS usage started to plateau between 2012-15. Since 2016 there has been an increase in the average IRS coverage in project countries which translated into an increase across all countries in the sample. The timing suggests that the NgenIRS project did indeed contribute towards an increase in the IRS usage in sub-Saharan Africa.<sup>34</sup>

*Figure 4.1: Average IRS coverage of the population at risk in relevant countries in sub-Saharan Africa*



*CEPA analysis, using World Malaria Report (2019) data on the IRS coverage of the population at risk.<sup>35</sup>*

***The main drivers for countries to choose to introduce or scale up 3GIRS is based on resistance management concerns and cost/ cost-effectiveness considerations***

Stakeholders at both the global and country levels consider the most important aspects which countries consider with regards to switching to 3GIRS from other insecticides to firstly be the level of insecticide resistance (or considerations regarding insecticide resistance plans so therefore a need to switch in advance of developing resistance) and secondly the cost and cost-effectiveness of alternative products. The acceptability of products at the community level was a less important reason (e.g. based on smell, residual stain on walls etc). In addition, whilst

<sup>33</sup> Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Democratic Republic of the Congo, Djibouti, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gambia, Ghana, Kenya, Madagascar, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Somalia, South Africa, South Sudan, Sudan, Uganda, United Republic of Tanzania, Zambia, Zimbabwe

<sup>34</sup> A very similar trend can be observed when the IRS coverage is weighted by the population at risk. However, the weighted trend line fluctuates more from year-to-year due to changes in IRS use in Ethiopia (the largest overall market for IRS)

<sup>35</sup> Where necessary, we updated inaccurate data from the WMR with more up-to-date information from the NgenIRS project.

broader programme considerations such as wastage of bottles versus sachets are a component in decision making, these are of much lesser importance.

In terms of decisions as to whether to scale up IRS more generally, other considerations were made including: the entomological situation, availability of cost-effectiveness of other vector control interventions (e.g. nets) at a country specific level, acceptability of IRS in comparison to other vector control measures, the ability to sustain the intervention for a long period of time or to have a clear exit strategy to avoid resurgence post IRS withdrawal; issues of cross-border transmission and the risks this might pose, political will and expected government commitment for the long term, as well as expertise in country to lead implementation.

Given the main factors which influence decision making, this highlights the need for evidence on cost and cost-effectiveness which the project aimed to address. This is discussed further below in this section.

***The project has significantly helped countries in their decision making across choice of 3GIRS products***

Stakeholders at the country, regional and global level noted that the project helped countries with their decision making around different product choices. Reportedly engagement with IVCC individuals (especially the regional coordinators who frequently went to countries and engaged with NMCPs to let them know when the products would be available and the benefits of rotating through them) as well as the workshops were very useful for country stakeholders to learn more about the different products, including to engage with manufacturers. Stakeholders considered the product information to be very valuable to them as it is an area for which they consider to usually be limited information. We therefore note this to be a key value add of the project.

***There is a need for further dissemination of evidence to inform take up of 3GIRS, although the recently presented cost-effectiveness studies may go some way to addressing this***

As the project has not yet ended, and the evidence from some of the studies has only just been shared (e.g. the cost-effectiveness study in Mozambique), we note upfront that it may be too early to conclude on the degree of evidence available, or how well the evidence has been disseminated.

However, in relation to the dissemination of evidence, in general country and especially, global level stakeholders were not well aware of the evidence generated through the project. Stakeholders highlighted that it would have been useful for evidence to be shared more widely within project countries. For example, some stakeholders noted that in some instances, dissemination relied to a large extent on a smaller number of stakeholders who were involved in the evidence generation or who attended the workshops to then share evidence with additional stakeholders - which it seems was not consistently done. In addition, it would have been useful if evidence was shared further with non-project countries as limited evidence is perceived as a barrier to take up of 3GIRS for non-project countries. We therefore note that within the activities undertaken to date, potentially more could have been done to share the evidence more widely such as amongst in-country vector control technical working groups.

In terms of meeting the need for evidence for 3GIRS to inform decision making and ultimately demand and adoption, stakeholders highlighted that there is now a lot more evidence than before from Abt Associates as well as from the NgenIRS project. However, while the WHO recommendation for use of IRS as a public health intervention is strong, the evidence is categorised as low certainty,<sup>36</sup> therefore highlighting the need for additional evidence. As noted above, cost-effectiveness is a primary aspect to inform decision making and in general stakeholders consider there to currently be a lack of evidence in this area, limiting uptake. As one stakeholder noted “*the main market constraint is simply the lack of evidence*”. Whilst the evaluators do not agree that this is the main market constraint, this is a key area of need especially in the context of choices around which vector control intervention should be chosen in country specific settings. The fact that the project therefore aimed to address this barrier to take up through the cost-effectiveness study in Mozambique therefore is expected to be a strong contribution to this barrier. However, as it has only recently been made available, it has not been used so far to address this barrier.

In addition, in Ethiopia – the country with the largest IRS market – the government are interested in scaling up IRS using Fludora Fusion and SumiShield 50WG given perception of long durability (6-8 months) but consider further

---

<sup>36</sup> World Health Organization (2019), Guidelines for malaria vector control. This does not include the recently completed RCT undertaken in the project.

evidence to be needed first. They will therefore be undertaking further studies to trial SumiShield 50WG and Fludora Fusion after 2019 and this emphasises the need at country level for evidence to inform uptake.

Overall, as evaluators we conclude that the limited dissemination evidence remains a barrier to scale up, however the recently published cost-effectiveness study may go some way to addressing this.

***Further engagement of the project at the global level might have been useful to share evidence to increase adoption and demand***

As noted above in question 2/3 and 4, stakeholders consider that more could have been done to engage and share evidence with global stakeholders. In particular, it was noted that further engagement with organisations such as ALMA, RBM and the Global Fund may have helped to further increase demand and adoption of 3GIRS.

**Counterfactual (what might have happened in in the absence of the project)**

***The 3GIRS and overall IRS market is expected to have shrunk further, although some countries would have continued to procure 3GIRS products***

Whilst it can be hard to state what would have happened in the absence of an intervention, we describe a few of the most significant gains that most stakeholders consider the project to have achieved. In particular stakeholders consider that the project stopped the 3GIRS and overall IRS market from shrinking further. This can be seen in Figure 4.1 above that showed the decline of the IRS market from its peak in 2010. Some countries may have continued to procure 3GIRS but given there was only one expensive product, it is considered a key contribution of the project to reduce the cost and ensure the overall IRS market did not continue on a shrinking trajectory. A number of stakeholders consider that countries would have been likely to have continued to use or have switched to Actellic 300CS even in the absence of the project given an emerging resistance to carbamates, but a key benefit of the project was to allow countries to either maintain spraying in existing areas (but with 3GIRS instead of carbamates or pyrethroids) or to increase the areas covered by 3GIRS within the same budget envelope.

Based on gathered evidence from stakeholder consultations, countries that would likely have continued to use or introduce 3GIRS albeit at a lower scale included Ghana, Zambia and, to a much lesser extent, Tanzania. Other countries would have more likely continued to rely predominately on non-pyrethroid IRS (e.g. Uganda and Ethiopia) whilst others may have stopped using IRS altogether (e.g. Kenya).

As noted above, another key benefit was the reduction of price of the 3GIRS products which is considered would have not been reduced as much as they have been, even with product competition now that there are three products on the market.

**Summary findings**

Key issue/ theme	Findings	Robustness rating and explanation	
Supply and delivery	<ul style="list-style-type: none"> <li>The project did not significantly impact the decision of the three additional manufacturers to initially develop a 3GIRS product, but it did facilitate continued interest for manufacturers to proceed with their decisions to enter/ remain in the market</li> </ul>	Good	Supported by stakeholder consultations with knowledge of specific issues at hand
	<ul style="list-style-type: none"> <li>The market has become more competitive over the course of the project but there is still need for at least one additional product given insecticide resistance management requirements</li> </ul>	Good	Supported by stakeholder consultations with knowledge of specific issues at hand as well as select documentation
	<ul style="list-style-type: none"> <li>Consolidated country level forecasting has improved over the course of the project and has aided supply security</li> </ul>	Good	Supported by documentation review and majority of consultations
	<ul style="list-style-type: none"> <li>The project has aided reliable supply to countries based on reliable forecasts</li> </ul>	Good	Supported by documentation review and majority of consultations



Key issue/ theme	Findings	Robustness rating and explanation	
	<ul style="list-style-type: none"> <li>Once new products received WHO PQ, countries were able to access these quicker because of the project</li> </ul>	Limited	Supported by limited number of consultations
Affordability	<ul style="list-style-type: none"> <li>The product price of US\$ 15 is much more affordable than the previous price of US\$ 23.50</li> </ul>	Strong	Supported by documentation review and majority of consultations
	<ul style="list-style-type: none"> <li>US\$ 15 is still considered relatively expensive in relation to other vector control interventions and remains a barrier to further scale up</li> </ul>	Strong	Supported by documentation review and majority of consultations
	<ul style="list-style-type: none"> <li>The primary influences on the price at the start of the project was the demand underwriting, the higher volumes due to the co-payment and to a lesser degree, more reliable forecasting</li> </ul>	Good	Supported by majority of consultations with stakeholders with knowledge of specific issues at hand
	<ul style="list-style-type: none"> <li>The primary influences on the price later on in the project was supplier competition and the project played a key role in setting the reference point for the price competition at US\$15.</li> </ul>	Good	Supported by majority of consultations with stakeholders with knowledge of specific issues at hand
	<ul style="list-style-type: none"> <li>The current price of US\$ 15 is expected to be maintained for the next two years but prices are uncertain after that timeframe.</li> </ul>	Good	Supported by majority of consultations with stakeholders with knowledge of specific issues at hand
Demand and adoption	<ul style="list-style-type: none"> <li>There has been an increase in the uptake of 3GIRS across countries in Africa</li> </ul>	Strong	Supported by majority of consultations, documentation review and country case studies
	<ul style="list-style-type: none"> <li>The use of the co-payment has facilitated uptake of 3GIRS within areas already being covered by IRS and in some instances has enabled additional areas to be covered because of the subsidy</li> </ul>	Good	Supported by majority of consultations (although with some discrepant views), documentation review and country case studies
	<ul style="list-style-type: none"> <li>While IRS is very popular in some countries, coverage has been maintained rather than increased given the limited budget envelope. There has been little expansion into countries that did not previously use IRS, although there have been some examples more recently</li> </ul>	Limited	Supported by some consultations
	<ul style="list-style-type: none"> <li>The NgenIRS project contributed to the reversal of the declining trend in overall IRS usage (i.e. IRS of any type including non-3GIRS) in countries in sub-Saharan Africa</li> </ul>	Good	Supported by majority of consultations, documentation review and country case studies
	<ul style="list-style-type: none"> <li>The main drivers for countries to choose to introduce or scale up 3GIRS is based on resistance management concerns and cost/ cost-effectiveness considerations</li> </ul>	Good	Supported by majority of consultations and country case studies
	<ul style="list-style-type: none"> <li>The project has helped countries in their decision making across choice of 3GIRS products</li> </ul>	Good	Supported by majority of consultations and country case studies
	<ul style="list-style-type: none"> <li>There is a need for further dissemination of evidence to inform take up of 3GIRS, although the recently presented cost-effectiveness studies may go some way to addressing this</li> </ul>	Limited	Supported by some consultations

Key issue/ theme	Findings	Robustness rating and explanation	
	<ul style="list-style-type: none"> <li>Further engagement of the project at the global level might have been useful to share evidence to increase adoption and demand</li> </ul>	Limited	Supported by some consultations
Counterfactual	<ul style="list-style-type: none"> <li>The 3GIRS and overall IRS market is expected to have shrunk further, although some countries would have continued to procure 3GIRS products</li> </ul>	Good	Supported by majority of stakeholder consultations.

### 4.3.2. Evaluation Question 6

#### 6. What has been the public health and economic impact of the project?

This question assesses the public health and economic impact of the NgenIRS project. The public health impact of the project has been assessed against Unitaids’ strategic KPI 4.1 ‘Increasing public health impact’ using malaria cases averted and lives saved. The economic impact was assessed against Unitaids’ KPI 4.2 ‘Financial and health system efficiencies’ using treatment cost savings and productivity losses. Lastly, this section also outlines the impact of the project on insecticide resistance management.

#### Modelling objective and design

CEPA constructed an Excel-based impact assessment model to assess the public health and economic benefits of the NgenIRS project. A full description of the model design, input assumptions and limitations can be found in Appendix K.

The objective of the modelling was to estimate the direct (during the project) and indirect (future) impact of the NgenIRS project. As such, the direct impact was modelled from 2016-19 and the future impact was estimated for the five years after project end from 2020-24.<sup>37</sup> The additionality of the NgenIRS project was captured by comparing the outcome of two scenarios: one capturing the public health outcomes with the project (*the factual scenario*) and the other the outcomes in the absence of the project (*the counterfactual scenario*). Specifically, the scenarios were defined as the following:

- Factual scenario:** captures the public health and economic impact of 3GIRS campaigns that benefited from the NgenIRS project. For the project period (2016-19) this only included countries that were either NgenIRS project countries (i.e. received a co-payment) or countries that received 3GIRS products at the discounted price negotiated by IVCC. For the indirect (future) impact, all 3GIRS use in sub-Saharan Africa was considered as all countries can now benefit from the price reduction as well as the increased competition in the market. In total, 35 countries were considered in the analysis.<sup>38</sup>
- Counterfactual scenario:** captures the public health and economic impact of IRS campaigns (both 3GIRS and non-pyrethroid IRS) in the same countries and years as in the factual scenario, in the absence of the

<sup>37</sup> Following Unitaids’ impact assessment methodology set out in Unitaids’ Results Framework 2019

<sup>38</sup> Angola, Benin, Botswana, Burkina Faso, Burundi, Comoros, Cameroon, Democratic Republic of the Congo, Djibouti, Equatorial Guinea, Eritrea, Eswatini, Ethiopia, Gambia, Ghana, Kenya, Madagascar, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Somalia, South Africa, South Sudan, Sudan, Uganda, United Republic of Tanzania, Yemen, Zambia, Zimbabwe

NgenIRS project. Specifically, it was modelled whether people who have been covered with 3GIRS in the factual scenario would (i) still be covered with 3GIRS; (ii) be covered with non-pyrethroid IRS (i.e. carbamate-based IRS) or (iii) not be covered by any IRS product.<sup>39</sup>

To capture the underlying uncertainty in many of the input assumptions (especially for the indirect, forward-looking assessment) scenarios for a conservative case, central case and best case were created. The central case scenario aims to capture the most likely impact estimate of the NgenIRS project, while the conservative and best case scenarios have been constructed to capture the endpoints of the range in which the true impact of the project can be expected to be found.<sup>40</sup> The detailed input assumptions for the conservative, central and best case scenario can be found in Appendix K.3.

A key limitation of this assessment is that it only captures the development in the IRS market and what would happen to the use of 3GIRS and non-pyrethroid IRS, with and without, the NgenIRS project. Importantly, it is not assessed as to what the public health impact would be if resources were instead shifted to other vector control interventions.

### **Public health impact (KPI 4.1)**

The malaria cases averted under each scenario have been estimated by multiplying the reduction in the annual malaria incidence rate per person covered by IRS type with the total number of people covered by each IRS type. This can be expressed through the following equation:

*Malaria cases averted* = *Malaria incidence rate per person*<sub>yc</sub> \* *Reduction of incidence rate by IRS campaign*<sub>i</sub> \* *Number of people covered*<sub>yci</sub>; (*y*=year, *c*=country, *i*=IRS type)

The annual malaria incidence rate per person was calculated for each country based on the information in the World Malaria Report (WMR) 2019.<sup>41</sup> The reduction in the incidence rate was based on the generated evidence from the IVCC project in Uganda, Ghana, Mali and Mozambique.<sup>42</sup> Lastly, the averted malaria cases were converted to lives saved by using a case fatality ratio for sub-Saharan Africa of 0.3%.<sup>43</sup>

The results based on the modelling are described below.

***There has been a substantial health impact through 3GIRS that would not have materialised in the absence of the NgenIRS project. Based on estimates in the central case scenario, the NgenIRS project contributed to averting an additional 16.7m [5.7m – 34.2m] malaria cases and saved 49,967 [16,952 – 102,608] lives through 3GIRS across 2016-24***

---

<sup>39</sup> Based on gathered evidence from stakeholder consultations, we assumed that some countries would have continued to use or introduce 3GIRS, albeit at a lower scale (e.g. Ghana, Zambia and, to a lesser extent, Tanzania). Other countries would have more likely continued to rely predominately on non-pyrethroid IRS (e.g. Ethiopia and Uganda) whilst others may have stopped using IRS altogether (e.g. Kenya). For the project duration, we assumed that in the central case scenario, 40% would have still been covered by 3GIRS, 30% would instead be covered with other non-pyrethroid IRS and 30% would have not received any IRS coverage. Due to restricted IRS product options and the resulting insecticide resistance issues, it has been assumed that going forward less people would have been covered by 3GIRS (25%) and by non-pyrethroid IRS (20%) with an increasing proportion being not covered at all (55%).

<sup>40</sup> The conservative case scenario uses those input assumptions that would lead to the lowest feasible impact of the NgenIRS project, while in the best-case scenario the opposite input assumptions were chosen.

<sup>41</sup> The national malaria incidence rate was calculated by dividing the estimated malaria cases by the total population at risk in a country. The upper-case estimates from the WMR report were used to reflect the fact that IRS campaigns have predominately been used in high burden areas. This choice is supported by comparing the “*cases averted per person covered by 3GIRS per year*” of the model with those of the studies in Ghana, Mozambique, Uganda and Mali. Appendix K.2.1 provides further details.

<sup>42</sup> Based on the gathered evidence by the NgenIRS project, an effect size between 20% to 40% was used for 3GIRS and, based on data from Uganda, it was assumed that a single campaign of non-pyrethroid IRS would have half the impact of an equivalent 3GIRS campaign.

<sup>43</sup> Based on the case fatality ratio used by IVCC in their impact modelling exercise.

The estimates of the public health impact of the NgenIRS project are outlined in Table 4.5 below, separated out between direct, indirect and total impact. The table also presents the conservative and best-case estimates in square brackets as well as the public health impact in the factual scenario.

*Table 4.5: Overview of the public health impacts (KPI 4.1. – increasing public health impact)*

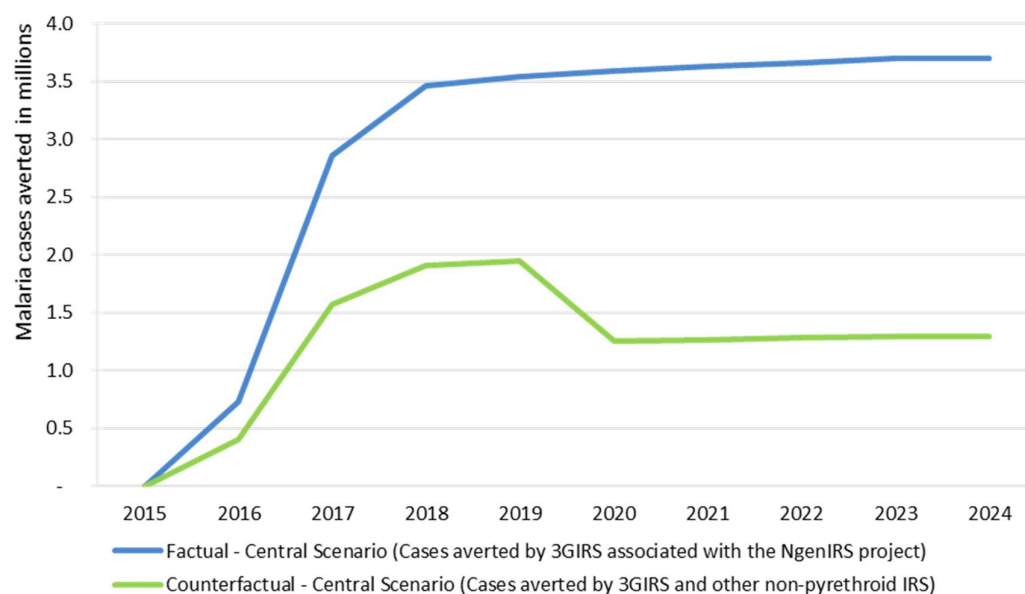
	Direct impact (2016-19)	Indirect impact (2020-24)	Total impact (2016-24)
Additional lives saved [conservative – best case]  <i>(Total lives saved by 3GIRS in factual)</i>	14,314 [4,624 - 25,548]  <i>(31,810)</i>	35,653 [12,328 – 77,060]  <i>(54,850)</i>	49,967 [16,952 – 102,608]  <i>(86,660)</i>
Additional malaria cases averted [conservative – best case]  <i>(Total cases averted by 3GIRS in factual)</i>	4.8m [1.5m – 8.5m]  <i>(10.6m)</i>	11.9m [4.1m - 25.7m]  <i>(18.2m)</i>	16.7m [5.7m – 34.2m]  <i>(28.8m)</i>
Additional people covered with 3GIRS [conservative – best case]  <i>(Total people covered by 3GIRS in factual)</i>	71m [58m – 83m]  <i>(118m)</i>	169m [129m – 256M]  <i>(225m)</i>	240m [187m – 339m]  <i>(343m)</i>

Based on the model estimates in the central case scenario, the NgenIRS project is estimated to avert an additional 16.7m [5.7m – 34.2m] malaria cases and save 49,967 lives [16,952 – 102,608] through 3GIRS across 2016-24. The majority of the impact through the NgenIRS project is estimated to be achieved over the upcoming five years as it is assumed that the IRS market would have developed differently without the project, leading to a lower overall IRS market and 3GIRS market share.

In the factual scenario over the project period, it was estimated that around 10.6m malaria cases have been averted by 3GIRS campaigns that benefited from the NgenIRS project. Of the 10.6m malaria cases in our factual scenario, the model estimates that 4.8m malaria cases would not have been averted through 3GIRS without the NgenIRS project. Based on the current assumptions around the future development of the 3GIRS market (discussed in under Question 8), the model estimated that 3GIRS could avert another 18.2m cases in the selected sub-Saharan African countries, of which 11.9m malaria cases would have not been averted without the project.

The additional impact of the NgenIRS project over time is depicted in Figure 4.2 below.

Figure 4.2 Additionally of the NgenIRS project in terms of malaria cases averted through 3GIRS in sub-Saharan Africa



As Figure 4.2 shows, the factual scenario describes the cases that were averted by 3GIRS campaigns associated with the NgenIRS project. With the expansion of project countries (especially in 2017), the public health impact rapidly increased over the project time period and is expected to be maintained over the next five years. In contrast, in the absence of the NgenIRS project, some countries would have still used 3GIRS products, or non-pyrethroid IRS but at a lower scale. As a result, many of the public health benefits that have materialised through the use of 3GIRS, or are likely to materialise in the future, would not have done so in the absence of the NGenIRS project.

### Economic impact (KPI 4.2)

The economic impact of the NgenIRS project has been assessed by estimating the difference in the costs and benefits between the factual and counterfactual scenario. The economic benefits are captured by calculating the averted treatment costs of malaria cases and by monetising the public health impacts achieved. Averted treatment costs are differentiated by mild and severe malaria cases. The public health impacts are monetised using a “full income” approach which values the additional life-years gained set out by the Lancet Commission.<sup>44</sup> This approach has been used for previous Unitaaid modelling work and therefore we have used the same input assumptions for our estimation.

***There are substantial economic impacts of the project, due almost exclusively to the monetisation of the public health impacts***

Table 4.6 provides an overview of the economic impacts of the project in which the total additional economic benefit is estimated to be US\$ 9,853m [1,178m - 20,108m]. Similar to the public health impacts, the majority of the economic benefits accrue over the next five years after the project ends.

Table 4.6: Overview of the economic impacts (all figures in US\$ 2018)

	Direct impact (2016-19)	Indirect impact (2020-24)	Total impact
Additional economic benefits	3,071m [389m - 5,485m]	6,782m [789m -14,625m]	9,853m [1,178m - 20,108m]

<sup>44</sup> Jamison et al. (2013) Global health 2035: a world converging within a generation, *The Lancet*

The economic impacts are nearly entirely driven by the monetisation of the public health impacts which represent over 99% of the economic benefits. While such a high proportion is not unusual for public health interventions, it means that the economic impact findings are predominately driven by the modelling approach and the input assumptions around the monetisation of public health impacts.<sup>45</sup>

## Resistance management

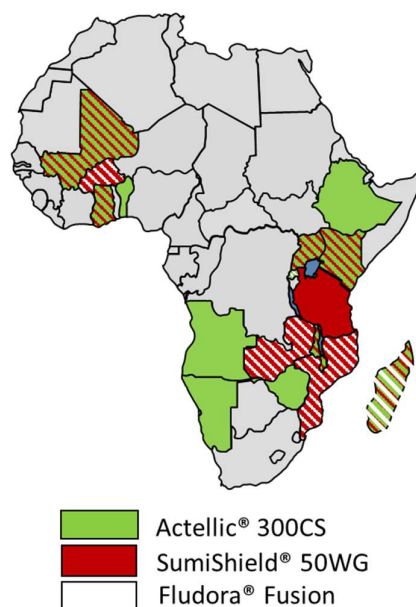
***The introduction of new classes of insecticides has been crucial for aiding the implementation of insecticide resistance management with 10 out of 16 NgenIRS partner countries spraying multiple 3GIRS products in 2019***

As noted in Question 1, insecticide resistance threatened gains made in malaria control at the start of the project which if unchecked, could have reduced the progress made through vector control initiatives and result in thousands of new malaria cases and additional malaria-related deaths. Given the wide-spread resistance to pyrethroids as well as some resistance to carbamates (E.g. Uganda), the project has been of significant importance in aiding insecticide resistance management, as was emphasised by stakeholders.

The project's support for the uptake of Actellic 300CS was very important as countries wanted to switch/ expand coverage of organophosphate products. Stakeholders also emphasised that without the introduction of the new 3GIRS, it would have been impossible to implement insecticide resistance management strategies with just Actellic 300CS. In addition, in some countries in which Actellic 300CS had been used for a number of years, the first signs of resistance building were already detected in some districts. For example, Ghana switched from Actellic 300CS to SumiShield 50WG in Obuasi district after resistance data showed that Actellic 300CS was becoming less effective due to resistance (more information is provided in Appendix G). To a lesser degree, a small potential benefit of the project is also the potential preservation of the efficacy of Propoxur in Ethiopia given the possibility to undertake further product rotations.

The demand for new products for the implementation of insecticide resistance management can also be seen in the procurement data with 10 out of 16 NgenIRS partner countries spraying multiple 3GIRS products in 2019 (Figure 4.3).

*Figure 4.3: IVCC project countries by used insecticide for their IRS campaigns*



Source: IVCC (2019)

<sup>45</sup> While our approach is based on suggestion by *the Lancet*, there remains a debate in the health economic landscape as to what is the most appropriate approach to monetising public health impacts.

## Summary findings

Key issue/ theme	Findings	Robustness rating and explanation	
Public health impact (KPI 4.1.)	<ul style="list-style-type: none"> <li>There has been a substantial health impact through 3GIRS that would not have materialised in the absence of the NgenIRS project - based on estimates in the central case scenario, the NgenIRS project contributed to averting an additional 16.7m [5.7m – 34.2m] malaria cases and saving 49,967 [16,952 – 102,608] lives through 3GIRS across 2016-24</li> </ul>	Good	The model uses the latest available data from the WMR (2019) and includes the most up-to-date impact evidence generated by the project. Some inherent uncertainty remains around the counterfactual assumptions, future market developments and the appropriate malaria incidence rate.
Economic impact (KPI 4.2)	<ul style="list-style-type: none"> <li>There are substantial economic impacts of the project, due almost exclusively to the monetisation of the public health impacts</li> </ul>	Good	We followed an approach endorsed by the Lancet commission and applied inputs used in other Unitaid impact assessments. Nevertheless, there remains a debate in the literature with regard to the monetisation of public health impacts and what approach is the most suitable.
Resistance management	<ul style="list-style-type: none"> <li>The introduction of new classes of insecticides has been crucial for aiding the implementation of insecticide resistance management with 10 out of 16 NgenIRS partner countries spraying multiple 3GIRS products in 2019</li> </ul>	Strong	Based on global and country stakeholders and the document review.

### 4.3.3. Evaluation Question 7

#### 7. Does the Unitaid investment in this project demonstrate value for money?

Within this evaluation question, we consider the return on Unitaid’s investment under KPI 4.3 (Delivering positive returns).

#### Quantitative assessment

As part of the modelling effort described under Question 6, we also estimated the additional costs for the expansion of the 3GIRS coverage between the factual and counterfactual scenario. The modelled costing included the different insecticide commodity costs, 3GIRS campaign operational costs<sup>46</sup> as well as the NgenIRS project costs itself. In the factual scenario, we used commodity prices of US\$15 during the project period and also assumed that the same

<sup>46</sup> Operational costs (i.e. all non- IRS commodity costs) were assumed to be the same across countries and IRS campaigns. Based on the PMI IRS costing reports, we estimated the average operational costs to be US\$4.04 per person covered.

price will be sustained going forward (discussed further under Question 8).<sup>47</sup> We used these costs to construct a benefit-cost ratio as well as the cost per case averted for the NgenIRS project.

***The NgenIRS project delivers positive returns with a benefit cost ratio of around 12.1 [3.3 – 13.6] across 2016-2024 indicating that the project offered value for money as an Unitaid investment***

Table 4.7 below provides an overview of the additional economic benefits, costs and the benefit cost ratio of the NGenIRS project. Based on the model estimates, the project has a positive benefit-cost ratio across both past and future time periods. In the central scenario, it is estimated to have a benefit-cost ratio of 12.1. However, the benefits would also still outweigh the costs by 3.3 to 1 in the conservative case scenario, highlighting even then that the benefits outweigh the costs. The benefit-ratio demonstrates that the NgenIRS project offers value for money as an Unitaid investment.<sup>48</sup>

*Table 4.7: Overview of the benefits and costs of the NgenIRS project*

Cost/benefit	Direct impact (2016-19)	Indirect impact (2020-24)	Total impact
Additional economic benefits in US\$2018	3,071m [389m - 5,485m]	6,782m [789m -14,625m]	9,853m [1,178m - 20,108m]
Additional costs in US\$2018	240m [111m – 358m]	575m [250m – 1,125m]	815m [361m – 1,482m]
Benefit cost ratio	12.8 [3.5 -15.3]	11.8 [3.2 – 13.0]	12.1 [3.3 – 13.6]
Cost per additional case averted in US\$2018	59 [97 – 47]	48 [61 – 44]	53 [77 – 45]

This is also in line with the emergent evidence for 3GIRS more broadly that has been generated by the NgenIRS project and was presented at the ASTMH annual meeting in November 2019. The evidence suggested that, despite significant variability in cost and effectiveness across countries, 3GIRS is expected to be cost-effective or highly cost-effective in most sub-Saharan African settings based on World Health Organization thresholds.<sup>49</sup>

The model results indicate that the additional cost per case averted (i.e. the additional costs / additional malaria cases averted) is around US\$ 48 across the full time period. The cost per case varies considerably between countries which is driven by their different malaria incidence rate per person. The cost per case averted calculated here does not include other interactions such as the funding and impact of standard of care malaria interventions at the same time. The generated evidence through the NgenIRS project took these interactions into consideration and calculated the incremental cost-effectiveness ratios for adding 3GIRS finding that the cost per case avert could range between US\$ 3.20 and US\$ 118.00.<sup>50</sup>

## **Qualitative assessment**

***The project represents value for money for Unitaid, especially with regards to the progress made in addressing the main three market barriers***

<sup>47</sup> For the counterfactual, it was assumed that some price reductions could have been achieved through the entry of other products and set the 3GIRS price at US\$ 20 for the whole time period. Non-pyrethroid IRS was set at US\$ 10 assuming that the prices somewhat declined from US\$ 12.5 in 2014/15.

<sup>48</sup> However, we note that other Unitaid projects (such as the Seasonal Malaria Chemoprevention project) that used a similar approach to monetising the public health impact had a higher benefit-cost ratio.

<sup>49</sup> Yukich et al (forthcoming, not yet published), Cost and cost-effectiveness of third-generation indoor residual spraying in sub-Saharan Africa: Results of data collection and analysis in the Next Generation IRS project. (Abstract for the ASTMH 2019)

<sup>50</sup> Ibid



More broadly, we consider qualitatively whether this project has been a good investment for Unitaid considering both the public health impact as well as the market impact of the project. Some of the main achievements of the project are as follows:

- The NgenIRS project has significantly helped to re-prioritise 3GIRS. Stakeholders consider that previously there was a risk of decreased investment but that this is not a significant risk anymore. Stakeholders consider the “*injection of funds for the co-payment [the activity with the largest budget allocated] is likely to increase the funding overall for 3GIRS in the long term*” given that the market is not considered to be at high risk of shrinking;
- The NgenIRS project has aided a price reduction for 3GIRS products which has meant that additional areas have been able to be sprayed with 3GIRS. As one stakeholder noted, “*The key deliverable and outcome was making new products ‘affordable’ at a very timely point in a country’s vector control programme. We would have seen upsurges in countries where they were limited with the products they had and had resistance.*”

In addition, stakeholder opinion at the global and country level is very positive in terms of whether the project represents value for money for Unitaid with virtually all project stakeholders considering it to represent value for money.

The project’s intended outcome was to “create a sustainable, competitive and growing market for effective 3GRIS products at affordable prices”. In terms of the extent to which the project has overcome market barriers, we consider there to be significant progress against the market access barriers of supply and delivery, affordability and demand and adoption – although there is still room for further progress around all three of these. In particular, while the market has grown during the project, it is not currently expected to grow a lot further in the near future. However, that is considered to be due primarily to the role of IRS in relation to broader malaria prevention efforts and existing funding envelopes rather than a reflection of the performance of the project. Overall, we therefore consider that the project represents value for money for Unitaid.

## Summary findings

Key issue/ theme	Findings	Robustness rating and explanation	
KPI 4.3 (Delivering positive returns)	<ul style="list-style-type: none"> <li>• The NgenIRS project delivers positive returns with a benefit cost ratio of around 12.1 [3.3 – 13.6] across 2016-2024 indicating that the project offered value for money as an Unitaid investment</li> </ul>	Good	Based on the impact modelling and the document review
Value for money	<ul style="list-style-type: none"> <li>• The project represents value for money for Unitaid, especially with regards to the progress made in addressing the main three market barriers</li> </ul>	Good	Based on stakeholder consultations, country case studies and the document review

## 4.4. SUSTAINABILITY

### 4.4.1. Evaluation Question 8

#### 8A. What are the prospects for scaling up the market for 3GIRS products?

This evaluation question provides a high-level assessment of the funding support for 3GIRS and analyses the prospect for the 3GIRS market going forward. Following the methodology used by Unitaid, we have focused on the scalability over the next five years after project end.

#### Funding security for the 3GIRS market (KPI 3.1)

*The current use of 3GIRS is highly dependent on external funding from the Global Fund and PMI with very little government support for 3GIRS commodity purchases*

The majority of the funding for IRS comes from PMI and the Global Fund. In 2018 and 2019, the annual PMI budget for IRS was slightly above US\$ 90m.<sup>51</sup> No equivalent numbers are readily available for the Global Fund spending on IRS. The use of government funding for IRS remains small and mostly outside of the 3GIRS market. For example, Zambia used local funds to support the use of DDT and Ethiopia also used its own funds for the use of Propoxur. Government funds to 3GIRS is mostly in relation to the operational costs, although this contribution is still much smaller than that of donors.

***The successful Global Fund replenishment, as well as projected PMI budgets, suggest that the overall funding envelope for malaria vector control interventions will remain stable over the next two years***

The documentation review and stakeholder consultations suggest that there are unlikely to be major changes to the available donor funding for malaria vector control interventions. In particular, the successful replenishment of the Global Fund in October 2019 indicates that the overall funding envelope for malaria control interventions are possible to remain the same rather than for reductions in funding to be needed. The PMI budgets are confirmed and disbursed on an annual basis, and as such it is not possible to firmly predict the funding envelope for the next few years. However, the forward budget projections suggest that the funding for IRS will remain stable in 2020 and into 2021 (with minor variations depending on carry-over of unspent funds, residual stocks or additional money that becomes available).<sup>52</sup> Stakeholders also suggested that, while some uncertainty naturally remained, the political process around the U.S. budget process (including key roles for the House of Representative) increased the likelihood that the PMI budget would be closely aligned with its projections. Therefore, in general it is expected that the overall funding envelope for malaria vector control interventions will remain stable over the next few years.

The interaction between different vector control interventions and potential shifts in donor funding across these interventions is discussed in more detail in the scale-up section below. However, a small number of stakeholders discussed that there might be slightly more support for 3GIRS from the Global Fund than there has been in the previous grant application process three years ago.

An increase of government contributions to 3GIRS, especially with regard to commodities costs was seen as unlikely in most countries. Though there are some first steps across countries (i.e. in Uganda the government supported Pilgrim Africa), the overall contributions are expected to remain small or to be in-kind (i.e. logistical support, community mobilisation etc.).

## **Scaling up Coverage (KPI 3.2)**

***The 3GIRS market is expected to successfully maintain the gains made under the NgenIRS project but not to substantially expand over the short-to-medium term***

The preliminary estimates from one of the IVCC forecast workshops in 2020 suggested that around 4.7m doses of 3GIRS will be procured in 2020.<sup>53</sup> This would be an increase of around 17.5% compared to the 4m doses in 2019. Most country and global stakeholders did not expect that the 3GIRS market in Africa will substantially grow over the next few years but rather that it will maintain the gains that were made under the NgenIRS project over the last years.<sup>54</sup> Many stakeholders already considered it to be a success if the market manages to maintain the gains made over recent years. In addition to the stability in overall funding for malaria vector control interventions outlined above, there are a range of other underlying factors that suggest that a consolidation of the market is likely over the next two to three years:

- ***Prices are expected to stay stable in the short-to-medium term around the negotiated price caps.*** While the price caps rely on firm consolidated country demand forecasting, and manufacturers sustaining their

---

<sup>51</sup> IVCC (2019) NgenIRS Transition and Sustainability Plan (Draft)

<sup>52</sup> IVCC (2019) NgenIRS Transition and Sustainability Plan (Draft).

<sup>53</sup> IVCC (2019) NgenIRS semi-annual review meeting. The meetings also suggested that there is expected to be a switch away from Actellic 300CS towards neonicotinoids-based products (especially Fludora Fusion).

<sup>54</sup> One exception is Ethiopia where an expansion in 3GIRS use could provide a boost to the overall market in Africa. This is discussed further below.

commitment to prices most global stakeholders familiar with the 3GIRS market as well as the manufacturer themselves do not expect any drastic price changes in the next two to three years. The entry of Fludora Fusion at under US\$ 15 was hereby seen as a key signal that suggests that the underlying costs structure allows at least some of the manufacturers to be profitable around the target price of US\$ 15 (although recognising that the products have different costs behind their development). Stakeholders also commented that there might potentially be further cost reductions, especially due to the competition of Fludora Fusion and SumiShield 50WG that use the same mode of action and, thus, are direct substitutes for one another, as well as the potential entry of generics. The introduction of BASF's Sylando could lead to further price pressure, especially as the product is expected to be highly cost competitive as it is already produced and used for agricultural purposes.<sup>55</sup> However, most would expect that price reductions would be more likely after 2021. The stabilisation or decline of the prices will be key as country level stakeholders from Ethiopia, Ghana Mali and Uganda all commented on this risk to both maintain their current 3GIRS coverage as well as challenges with insecticide resistance management should the products become prohibitively expensive.

In the long-run, global stakeholders familiar with the 3GIRS market, as well as manufacturers, consider that further price reductions are possible in the market. Under the current composition, many considered a price around US\$ 12 possible for the neonicotinoid IRS products but thought it was unlikely that Actellic 300CS would substantially reduce its price unless there are products with new mode of actions entering the market, thus increasing the price competition and provide another alternative to Actellic 300CS whilst rotating between insecticides.

- ***The private market was seen as having potential but not to be able to shift 3GIRS demand in the short-to-medium term.*** There is only very sparse data on the size and growth of the private sector 3GIRS market which makes any reliable forecasting difficult. Some country and global stakeholders considered the private sector as an important option for the sustainability of 3GIRS in the long-term that could play a role in decreasing the reliance on external donor funding. However, over the next few years it was not expected that the private sector will substantially shift the take up of 3GIRS. The Ghana and Ugandan case studies in Appendixes G and H provide further details on this. In Ghana, AngloGold Ashanti Malaria Control Limited (AGAMAL) emerged from the localised IRS spraying of the company AngloGold and is now a key service provider for IRS campaigns. However, their main funding sources comes for the Global Fund which was key in enabling them to expand their coverage. Other extractive industries have undertaken some private IRS spraying, but these are very localised in nature. In contrast in Uganda, stakeholders did not consider it likely that the private sector would play a large role in supporting IRS in the near future.
- ***3GIRS uptake in project countries is likely to stay relatively stable with the exception of Ethiopia.*** The stakeholders in most country case studies suggested that countries generally support the use of 3GIRS and will expand or contract their 3GIRS coverage depending on the available external funding and the commodity prices for 3GIRS. In Ghana, the 3GIRS coverage was expanded due to the cost savings from the NgenIRS co-payment. However, any commodity cost-savings were used not have to finance the additional 3GIRS volumes but also the operational costs of running IRS campaigns in the additional districts. Given that operational costs often make up a significant proportion of total IRS campaign costs (approximately two thirds) as noted above, this means that future changes in commodity prices alone will not shift the 3GIRS market substantially. Similarly, in the country case studies it was not expected that a modest reduction in commodity prices would trigger new external funding though it might increase the share of Global Fund funding used for 3GIRS. Countries, such as Uganda and Ghana are considering alternative delivery models which may reduce the operational costs of IRS spray campaigns, but this is not expected to make a significant difference to the overall budget envelope available for IRS.

An important exception is Ethiopia that so far has predominately used their locally manufactured IRS product, Propoxur. The gathered evidence suggests that there is discussion to move away from Propoxur given that

---

<sup>55</sup> However, at this stage it is not clear if or when Sylando will receive PQ approval. It has been understood that the mode of action used by the insecticide makes it harder to show effectiveness with the common WHO cone tests. As result, there have been additional data needs and a prolonged application process.

it does not have WHO PQ and that resistance to it is building up. Stakeholders stated that the speed and magnitude of the switch to 3GIRS is largely determined by the pilot results for Fludora Fusion and SumiShield 50WG that are currently being conducted.

- ***Some market growth is possible through the expansion into new countries such as non-project countries of the Elimination 8 or Yemen but expansion to high burden and high population countries seems less likely.*** The increases in the past few years were predominately driven by the inclusion of new project countries and also the projected increase in 2020 is partly driven by the planned inclusion of Cote d'Ivoire, Senegal and Sierra Leone. Further gains could be made if the use of 3GIRS was to be expanded in other countries. IVCC has already started to support Yemen by facilitating them access the discounted price<sup>56</sup> and also distributed previously products from Madagascar to E8 countries (i.e. Eswatini, Namibia) that might also continue spraying. Sudan might be another potential adopter with a decent IRS market size. However, the likelihood of introductions in the short term in countries with a high burden and high population seems less likely at this stage. For example, there is no advanced discussion around a substantial use of 3GIRS in Nigeria or the Democratic Republic of Congo.
- ***The impact of new ITNS (PBO nets or dual AI nets) is likely to vary between countries but is unlikely to substantially shift the 3GIRS market over the next few years.*** Most stakeholders did not believe that the 3GIRS market would be altered considerably over the short-to-medium term through the emergence of other vector control interventions, including new nets. In many of the case study countries there remained a strong support for IRS which stakeholders believed would not shift over the next few years. For example, even countries like Tanzania that have recently increased their intake of PBO-nets, do not plan to reduce 3GIRS until 2022 unless there is strong evidence of the efficacy of PBO-nets as well as confirmed high coverage and usage rates. Apart from the cost-effectiveness components related to new nets, one of the aspects which may encourage countries to shift from 3GIRS to new nets is the consideration around the need for long term financing for IRS or a clear exit strategy given the risk of upsurges when IRS is withdrawn, as previously seen in Uganda.

***The future of the 3GIRS market is more uncertain over the long-term and a contraction of the market is possible in case of a substantial reduction in new nets prices and additional evidence on their effectiveness***

After 2022, there is considerably more uncertainty with regard to the size and stability of the 3GIRS market. While most consultees did not consider that prevention interventions such as vaccines would play a large role, they were less sure around the interplay between new nets and 3GIRS. In general, most stakeholders commented that there should be a move away from a single vector control intervention towards a more holistic approach that uses different interventions based on the available evidence on the local context. While most stakeholders agreed that there will be an important role for 3GIRS, a number of consultees considered that the overall market would contract in the long run, especially if new nets provide additional evidence on efficacy, and if their price is lowered.

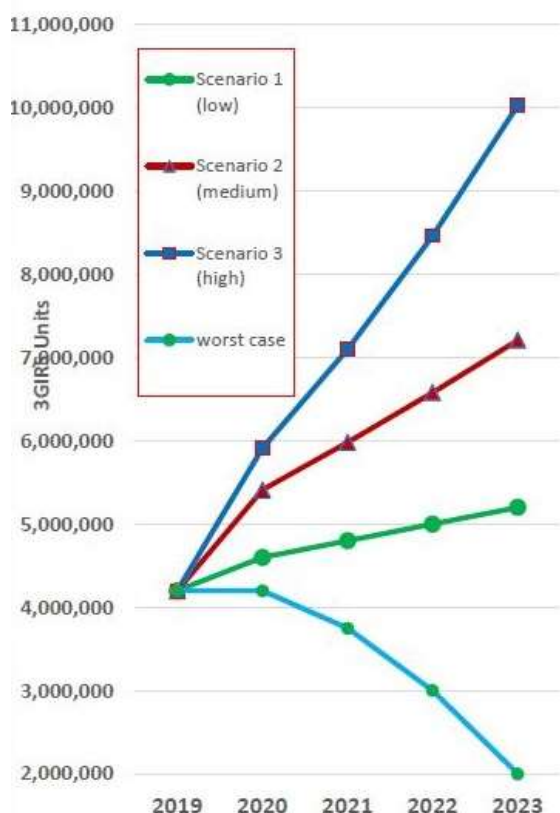
***Based on the available evidence, a scenario which is a bit more conservative than the IVCC “low scenario” forecast seems the most likely with regards to predictions regarding future uptake of 3GIRS***

IVCC developed a range of market scenarios on the future of the 3GIRS market. These are presented in Figure 4.4 below and the input assumptions behind each scenario are outlined in Appendix K.4.1. IVCC varied some key factors between the scenarios including: (i) a continuation of the NgenIRS project; (ii) the median 3GIRS price; (iii) uptake in Ethiopia; (iv) market growth in other markets; and (v) donor resources shifting towards / away from 3GIRS.

---

<sup>56</sup> However, given the current security situation in Yemen it is not possible to assess the sustainability of these activities.

Figure 4.4: IVCC developed investment scenarios for 3GIRS market growth



Source: IVCC (2019)

Based on the available evidence on the underlying factors outlined above, a scenario that is a bit more conservative than the IVCC “low scenario” seems to best capture the future development on the 3GIRS market. The medium and high case scenarios that IVCC developed assumed a continuation of the NgenIRS project as well as substantial price reductions which do not seem likely based on the evidence collected in this evaluation. The worst-case scenario is also unlikely but does capture the risks that funding may shift away towards new nets in the later years. Based on the gathered evidence, we would expect 3GIRS market in sub-Saharan Africa that moves between 4m to 5m doses. We reflected this evidence in our impact model and projected that annually around 45m people will be covered with 3GIRS in sub-Saharan Africa between 2020-24.

## 8B. What is the likelihood of the project activities being sustained?

### *The transition of project activities should have been introduced earlier*

Whilst the Project Plan outlined transition activities, the view held by a number of stakeholders at both the global and country level, as well as that of the evaluators, is that the transition of project activities should have been better planned for and that the activities were not introduced early enough. Some examples include:

- Whilst there was a plan for transition activities in the Project plan, the more formal Transition and Sustainability Plan was only available from 2019 – the final year of the project – and as such we consider it to be introduced too late into the project cycle;
- Project activities could have introduced a more substantial ‘sustainability lens’ from earlier on in the project and included other organisations in light of this, especially to ensure a successful handover of certain activities. For example, RBM could have been included in the forecasting from the start; the Global Fund procurement team could have been more engaged in the procurement side of the project; further involvement of WHO GMP could have been useful regarding evidence obtained through the project etc.;

- Many country level stakeholders are unaware of the price cap agreement for the upcoming two years and as such have significant concerns regarding the product price potentially increasing and have not been planning around the current product price points. In addition, a number of country level stakeholders were surprised to learn in August 2019 that the project was ending at the end of 2019. This indicates that communication of these aspects related to the ending of the project and transition initiatives put in place were not that effective.

Based on the points noted above (as well as points reflecting the sustainability of specific activities below), we therefore consider that the planning for transition and sustainability should have been introduced earlier on in the project. We do note that under the new strategy and operating model, Unitaid considers these aspects upfront and plans further for this and as such is a lesson that they are already incorporating into current projects. In addition, lessons learnt such as additional engagement with Global Fund have already been incorporated into the Unitaid supported new Nets project under which the Global Fund has a dedicated procurement staff member for the new dual AI nets.

***There may have been some benefits to extend the project timeframe but overall the timeframe was sufficient to achieve the project objectives***

A number of stakeholders have the perspective that it might have been beneficial for the project timeframe to have been extended. This is mostly because (i) given that SumiShield 50WG received WHO PQ status at the end of 2017 and Fludora Fusion received it at the end of 2018, Syngenta was the primary beneficiary of the co-payment under the project. Stakeholders have queried whether the project duration had been extended and the co-payment used to support the other products, whether this could have potentially aided a further reduction in product prices as well as been a more 'fair' distribution of the co-payment across manufacturers; and (ii) some stakeholders consider that a longer timeframe might have allowed more evidence to have been obtained under the project (especially relating to cost-effectiveness, including in relation to comparison to other vector control interventions<sup>57</sup>) and for uptake of 3GIRS to potentially have been further facilitated under the project.

However, in order for Unitaid to approve a project extension, there would need to be strong market shaping rationale or clear value for money rationale given Unitaid's mandate is to catalyse a market. As noted in Question 5, whilst there is still room for the market access barriers to be further reduced, the main aspects within these barriers have been overcome. In addition, the broader vector control market has evolved during the course of the project with new nets and other tools coming onto the market which has resulted in there currently being less of a need to be further investing in IRS. Therefore, our assessment is that the timeframe of the project was sufficient.

***There are no clear market shaping components for IRS that Unitaid should be funding in the near future***

Flowing on from the point above, when stakeholders were asked whether their opinion on areas that Unitaid could potentially be investing in within IRS in the near future, no clear market shaping needs were identified. Some areas which are considered to warrant consideration for investment within IRS include, (i) innovation around improving the spraying technology to potentially reduce operational costs of IRS; (ii) support for more evidence generation, especially regarding cost-effectiveness studies regarding the interaction with new vector control interventions. However, in terms of the market more broadly, stakeholders considered that the role of IRS is shifting and needs to be more strongly understood as one available tool in the wider vector control toolbox. As such, it will be important to understand the interaction of 3GIRS with other intervention and to also ascertain the evidence regarding the use and effectiveness of next generation nets before further large-scale investment in market shaping activities for IRS are made.

***Sustainability of forecasting capacity is somewhat uncertain, but the forecasting tool is expected to be used following the end of the project***

The main area of the project which focused on capacity building is in relation to the forecasting of 3GIRS at country level, especially in relation to the forecasting tool developed by IVCC. As discussed in Question 2/3, country level stakeholders have reported that the workshops and training have been useful to aid their forecasting skills. However,

---

<sup>57</sup> This feedback was obtained before the cost-effectiveness studies were completed so this may be more of a timing issue.

as the orders are still quite different from the forecasts, there appears to still be room for further capacity building (although it is also recognised that the discrepancy in the orders and forecasts may also be due to other reasons).

In terms of the tool that IVCC have introduced to aid the forecasting, country level stakeholders have considered that the tool has been very useful and reported expecting to use it in the future. However, a number of stakeholders, especially at the global level, voiced concerns that the tool is too siloed focusing on just one malaria control intervention, therefore raising concerns regarding sustainability. In addition, many stakeholders consider that there should have been more attempt to integrate the forecasting with existing procurement activities of the Global Fund and PMI as some in order to integrate quantification efforts in terms of using the same data, approaches etc (as some see this tool as duplicative to these existing initiatives).

There have been more recent efforts made to address this through integrating the beneficial elements of the tool into existing mechanisms – including RBM/ Country Regional Support Partner Committees to ensure that IRS is now rolled into the gap analysis process along with other commodities; PMI Vectorlink has committed to support the forecasting through vector control advisory groups and PMI and the Global Fund will work together to improve coordination on the forecasting. These are positive steps to avoid the siloed approach, although the risks to sustainability still remain to some extent at present.

***The consolidation of country level forecasting is an important activity to be sustained. Some additional funding from DFID is expected to assist with the transition of this activity***

An activity which all stakeholders consider to have been very important is the role that IVCC has played in terms of consolidating country forecasts and then providing these as annual volume guarantees to manufacturers. There have been concerns regarding the sustainability and transition plans for who will coordinate this role going forward, especially as the price caps agreed with manufacturers through to 2021 are contingent upon an organisation providing an annual firm forecast by October for the following year. In order to ensure transition of this activity, IVCC has obtained funding from DFID to continue supporting activities for 2020 and 2021. It has been agreed with manufacturers that they will accept separate forecasts from PMI and Global Fund and RBM will also provide support through adding IRS into their gap analyses. During a two-year transition period, IVCC will provide technical assistance and logistical support to aid transition. We note that this is a positive step towards sustainability of these important activities and that an appropriate solution towards transition has been found. However, in hindsight it would have been beneficial for this to be more fully implemented earlier in the project, including integration with existing partner activities.

***Some aspects relating to the evidence generated and communication and advocacy activities are expected to be continued going forward but in general more needed to be done during the project in terms of knowledge sharing***

As noted above, whilst the project has garnered more awareness and support for 3GIRS during the project, many stakeholders consider that more could have been done in this area in order to further ensure these activities under the project are sustained going forward. In particular, it was highlighted that: (i) it is unclear how the evidence generated under the project will be used to inform decision making at the country levels – especially for countries which were not included within the project; (ii) many global level stakeholders consider that there is a need for further sharing of the evidence obtained during the project and for this to be better fed into the ‘malaria community discussions’. As one stakeholder articulated it, “*the one flaw was there was more of a need to feed into discussions within the malaria community so there is more of a natural transition in a coordinated way*”. A few stakeholders highlighted that an end of project dissemination meeting could be a useful means to further engage with stakeholders and the wider malaria community.<sup>58</sup> Some of the key communication activities which have benefited stakeholders, and is expected to continue to benefit them going forward however is the knowledge sharing regarding the different products as well as an improved understanding regarding the need for timely consolidated country demand forecasts for 3GIRS.

---

<sup>58</sup> This is planned for March 2020.

## Summary findings

Key issue/ theme	Findings	Robustness rating and explanation	
Funding security for the 3GIRS market (KPI 3.1)	<ul style="list-style-type: none"> <li>The current use of 3GIRS is highly dependent on external funding from the Global Fund and PMI with very little government support for 3GIRS commodity purchases</li> </ul>	Strong	Supported by stakeholder consultations and documentation review
	<ul style="list-style-type: none"> <li>The successful Global Fund replenishment, as well as projected PMI budgets, suggest that the overall funding envelope for malaria vector control interventions will remain stable over the next two years</li> </ul>	Good	Supported by stakeholder consultations
Scaling up Coverage (KPI 3.2)	<ul style="list-style-type: none"> <li>The 3GIRS market is expected to successfully maintain the gains made under the NgenIRS project but not to substantially expand over the short-to-medium term</li> </ul>	Strong / Good	Supported by stakeholder consultations, country case studies and documentation review. However, some uncertainty remains especially with regard to the uptake in Ethiopia.
	<ul style="list-style-type: none"> <li>The future of the 3GIRS market is more uncertain over the long-term and a contraction of the market is possible in case of a substantial reduction in new nets prices and additional evidence on their effectiveness</li> </ul>	Strong	Supported by stakeholder consultations and country case studies
	<ul style="list-style-type: none"> <li>Based on the available evidence, a scenario which is a bit more conservative than the IVCC “low scenario” forecast seems the most likely with regards to predictions regarding future uptake of 3GIRS</li> </ul>	Strong / Good	Supported by stakeholder consultations, country case studies and documentation review. However, some uncertainty remains especially with regard to the uptake in Ethiopia.
Sustainability of project activities	<ul style="list-style-type: none"> <li>The transition of project activities should have been introduced earlier</li> </ul>	Strong / Good	Supported by stakeholder consultations and country case studies
	<ul style="list-style-type: none"> <li>There may have been some benefits to extend the project timeframe but overall the timeframe was sufficient to achieve the project objectives</li> </ul>	Poor	Supported by only a few consultations
	<ul style="list-style-type: none"> <li>There are no clear market shaping components for IRS that Unitaid should be funding in the near future</li> </ul>	Good	Supported by majority of consultations
	<ul style="list-style-type: none"> <li>Sustainability of forecasting capacity is somewhat uncertain, but the forecasting tool is expected to be used following the end of the project</li> </ul>	Limited	Supported by small number of consultations
	<ul style="list-style-type: none"> <li>The consolidation of country level forecasting is an important activity to be sustained. Some additional funding from DFID is expected to assist with the transition of this activity</li> </ul>	Good	Supported by majority of consultations, country case studies and limited documentation
	<ul style="list-style-type: none"> <li>Some aspects relating to the evidence generated and communication and advocacy activities are expected to be continued going forward but in general more needed to be done during the project in terms of knowledge sharing</li> </ul>	Limited	Supported by some consultations and country case studies



## 5. Conclusions, lessons learnt and recommendations

In this section, we present conclusions based on the corroborated findings, as well as recommendations.

### Conclusions

The main **conclusions** based on the evaluation are as follows:

- The project is considered to be closely aligned with Unitaid’s strategy and was well aligned with global malaria prevention priority evidence and operational needs - in particular, relating to the important requirement for additional classes of insecticides to be introduced/ further adopted in order to aid insecticide resistance management.
- On a process and management level, the project has performed well to date and either met, or surpassed, most of the project targets. This was also notably achieved within budget and within the timeframes of the project plan. The allocation of project tasks between actors was seen as appropriate overall and has worked well with some lessons being learnt and the associated learning applied over the course of the project, such as IVCC’s means to engage with countries (e.g. through regional coordinators) and ways of working with the Global Fund which became clearer during the project.
- In relation to progress made against specific outputs and the impact on overcoming the market access barriers, we note the following:
  - **Uptake of 3GIRS:** the large proportion of the budget being allocated to co-payments has had a significant impact on the success of the project – especially as it has aided an increase in uptake of 3GIRS.
  - **Improved consolidation of country forecasts for 3GIRS products:** consolidation of country forecasting has improved over the course of the project with most of the annual targets being met. The consolidation of these forecasts and presenting them to manufacturers has aided the price reduction of 3GIRS products. In contrast, country level demand forecasting efforts failed to meet the project target which poses some risks to sustainability of the consolidated country forecasts going forward.
  - **New quality assured products available from several manufacturers on the market:** The project met its target by having three different products pre-qualified (PQ) by WHO at the end of 2019. This has aided competition in the market and helped to reduce the price of 3GIRS products, especially in the latter two years of the project.
  - **3GIRS products are reduced in price:** There have been continuous price reductions throughout the project reaching the project logframe targets as well as the target median price of US\$ 15 for 2020 to 2021. The use of the demand underwriting mechanism was appropriate for the project especially during the first three years when there was no competitive 3GIRS market and high fluctuation in demand. However, it may not have been appropriate to have the full US\$ 11.1m demand underwriting reserve fund (18% of the project budget) for the whole duration of the project due to the opportunity costs of the unutilised funding and thus would have benefited from review during the project.
  - **Documentation and dissemination of evidence showing cost-effectiveness of 3GIRS:** activities under this output have included evidence generation and dissemination (regarding cost-effectiveness and other studies) as well as broader communication activities around 3GIRS products. In general, the dissemination of evidence and broader communication activities conducted under the project were considered useful for country level stakeholders, although this was not uniform across countries and could have been further strengthened. In general, however, communication efforts have been less effective at engaging some global level stakeholders to date. Although the project exceeded its process target on disseminating evidence around the public health impacts and cost-effectiveness of 3GIRS products, there is still a need for further dissemination so as to further impact

on demand and adoption. It is noted though that a number of key studies conducted under the project have only recently been completed, boosting the evidence soon to be available, which will need to be effectively disseminated.

- Overall, solid progress has been made against the three market access barriers, with good progress made against the supply and delivery barrier and strong progress in particular made against the affordability and demand and adoption barriers. In particular:
  - Good progress has been made against the market access barrier of **supply and delivery** through an increase in the number of suppliers on the market. Whilst not appearing to encourage manufacturers to initially decide to develop products to enter the market, the project has encouraged manufacturers to continue proceeding to enter the market once they had started their product development, thus boosting the number of suppliers in the market. As there are now three products on the market, the market is seen to be more competitive and sustainable. However, as per effective insecticide resistance management plans and the associated need to ideally have at least three classes of products to aid insecticide resistance management through rotation of multiple chemicals, there is still need for at least one additional product. In addition, the project has aided supply and delivery in a number of other ways, such as ensuring reliable supply through further consolidation of country forecasts and enabling products with recently acquired WHO PQ status to become accessible to countries quickly.
  - The project has significantly helped to overcome the market access barrier of **affordability**, but the reduced price of US\$ 15, together with the high operational costs for IRS, remain barriers for further expansion of the 3GIRS market – especially given the cost in relation to other vector control interventions. Together these costs prevent uptake despite the project recently determining that 3GIRS is cost effective by WHO standards. The primary influences on the price at the start of the project was the demand underwriting (based on forecasting), the higher volumes due to the co-payment and more reliable forecasting to a lesser degree. The primary influence on the price later on in the project was supplier competition.
  - The project has made strong progress towards overcoming the market barrier of **demand and adoption**. The increase in uptake of 3GIRS has mainly been within areas that were previously covered by IRS and a slight increase in uptake of IRS more broadly from a previously shrinking market. There has been little expansion in uptake in 3GIRS into areas/ countries that did not previously use IRS, although there have been some examples more recently. This is likely to be due in part to a need for further dissemination of evidence to inform decision making, especially relating to cost-effectiveness (which is the focus of recently completed studies under the project), as well as the cost of the 3GIRS products and programmes in a relatively fixed funding envelope.
- There has been substantial public health impact through 3GIRS that would not have materialised without the NgenIRS project. Based on model estimates, the NgenIRS project contributed to averting an additional 16.7m [5.7m – 34.2m] malaria cases and to saving 49,967 [16,952 – 102,608] lives through 3GIRS across 2016-2024. There are also substantial economic impacts of the project which are driven by the monetisation of the public health impacts. Using the “full income” approach to value the additional life-years gained, it is estimated that the project contributed to additional economic benefits of around US\$ 9,853m [1,178m - 20,108m].
- In terms of the prospects for scale up in the short term, the current use of 3GIRS is highly dependent on external funding from the Global Fund and PMI with very little government support for 3GIRS commodity purchases. The support from the Global Fund and PMI is expected to remain at approximately the same levels for the next two years, to be reviewed thereafter. The 3GIRS product prices are also expected to stay stable in the short-to-medium term around the negotiated price caps of around US\$ 15. This together indicates that the 3GIRS market will maintain the gains made under the NgenIRS project and may expand slightly but is not expected to substantially expand over the short-to-medium term. The future of the 3GIRS market is more uncertain over the long-term and a contraction of the market may be possible in case of a substantial reduction in new nets prices and additional evidence on their effectiveness.

- Project transition activities could have had more traction (in terms of sustainability of project progress) had they been introduced earlier and with further integration with existing activities being undertaken by partners such as PMI, Global Fund and RBM.

The project aimed to “create a sustainable, competitive and growing market for effective 3GRIS products at affordable prices”. There has been significant progress against the market access barriers of supply and delivery, affordability and demand and adoption, although there is still room for further progress relating to all three of these. While the market has grown during the project, it is not currently expected to grow a lot further in the near future. This is primarily due to the role of IRS in relation to broader malaria prevention efforts and existing funding envelopes rather than a reflection of the performance of the project. Overall, we consider that the project represents value for money for Unitaid.

## Recommendations

In this section we present recommendations for Unitaid to consider based on lessons learnt under the project. We note that some of these aspects **have already been incorporated within the NgenIRS project** following process learning during the project, or have already been applied in subsequent Unitaid projects, but remain useful for Unitaid to consider going forward. These include:

- In terms of project coordination, if grantees are not in-country project implementers then it would be useful for Unitaid to ensure that the project team configuration and partner coordination activities take this into consideration. In particular:
  - Project team personnel should consider including regional coordinators or similar positions within the project teams.
  - Engagement with key organisations such as the Global Fund should be clearly established at the start of the project – particularly relating to a clear point of contact, ways of working and opportunities for integration of activities after project end.
- In instances where a key component of the project includes evidence generation, project activities should include close engagement with relevant WHO departments, especially at the outset, in order to ensure the evidence generated is as relevant as possible in targeting key gaps useful for addressing of furthering programmatic or policy decisions. In addition, communication activities should leverage existing subject area groups (e.g. within the wider malaria community) in order to facilitate dissemination of evidence. Dissemination should be as direct and specific as possible to encourage strong engagement from partners. To aid this, an evidence generation and dissemination plan should be developed from the outset and reviewed at points in line with insight generated on the findings being generated.
- Unitaid should consider use of a demand underwriting mechanism in projects with similar market scenarios. However, this should include review points during the project timeframe to assess its continued relevance.

Some **additional aspects to be considered in future Unitaid projects** include:

- Some projects could benefit from having clear phases and for progress to then be reviewed against specific indicators at a pre-defined interval at the end of the phase. Funds could potentially be reallocated at defined phase point(s) in line with focused review and decision making around the most relevant activities in line with the overall aims of the project.
- There is a strong need to focus on transition and sustainability components from the outset. This should entail strong analysis in order to feed into considerations regarding how project activities can be sustained and transitioned. For example, this could be through integration into existing structures already implemented by partners and country governments, rather than potentially creating parallel systems.
- Continue to consider using co-payments for other products with comparable market scenarios. However, as far as possible, Unitaid should ensure that there is sufficient commitment from manufactures who have received a lot of support through the co-payment mechanism, to make commitments regarding the supply and pricing of their product to reduce risk and aid sustainability of project gains.

## **Appendix A LIST OF REFERENCES**

This appendix outlines the key documents reviewed for this evaluation.

### **Grant documents**

IVCC, PMI, Abt Associates, PATH MACEPA (2015). Market intervention to accelerate uptake of new vector control tools. Project Plan.

IVCC (2019) Original Logframe, May 2019

IVCC (2015) NgenIRS Methodology and Value for Money

### **Progress reports and Unitaid assessments**

IVCC (2017) NgenIRS 2016 Annual Report Final

IVCC (2018) NgenIRS 2017 Annual Report Final

IVCC (2019) NgenIRS 2018 Annual Report Final

IVCC (2017) Supplementary disbursement for IVCC NgenIRS project commodity co-payment (Q2-Q3/2017)

IVCC (2016) Second disbursement to IVCC NgenIRS project for the period July to December 2016 plus rolling advance from January to April 2017

IVCC (2017) NgenIRS Grant Brief Analysis and Overview

IVCC (2018) NgenIRS Grant Brief Analysis

IVCC (2018) NgenIRS Grant Brief Overview

IVCC (2019) NgenIRS End of Project Evaluation

IVCC (2019) Building an Evidence Base

### **Grant operational updates**

IVCC (2016) NgenIRS Grant Update

IVCC (2017) NgenIRS Grant Update

IVCC (2016) NgenIRS GRC Update

IVCC (2019) NgenIRS Grant Update

IVCC (2019) NgenIRS Semi-Annual Review

IVCC (2019) NgenIRS Semi-Annual Review Communications Update

IVCC (2019) NgenIRS Semi-Annual Review Programmatic Update

IVCC (2019) NgenIRS Semi-Annual Review Financial Update

IVCC (2019) NgenIRS Semi-Annual Review Output 3

IVCC (2019) NgenIRS Semi-Annual Review Market Scenarios

PATH (2019) Semi-Annual Review, Output 5

### **PMI reports**

PMI (2018) 2018 Mali End of Spray Report

PMI (2017) 2017 Ethiopia End of Spray Report

PMI (2018) 2018 Tanzania End of Spray Report

### **Evidence on public health impact**

IVCC (2019) Evidence Summary – Impact and Cost-Effectiveness in Africa

IVCC (2019) Evidence Snapshot: Third Generation IRS in Segou Region, Mali

Alonso et al. 2019. "The economic burden of malaria on households and the health system in a high transmission district of Mozambique". *Malaria Journal* 2019; 18:360

Chaccour et al. 2018. "Combination of indoor residual spraying with long-lasting insecticide-treated nets for malaria control in Zambezia, Mozambique: a cluster randomised trial and cost-effectiveness study protocol". *BMJ Global Health* 2018; 3:e000610

Wagman et al. 2018. "An observational analysis of the impact of indoor residual spraying with non-pyrethroid insecticides on the incidence of malaria in Ségou Region, Mali: 2012–2015". *Malaria Journal* 2018; 17:19

Jamison et al. 2013 Global health 2035: a world converging within a generation, *The Lancet*

### **Other**

Altea Cico, Benjamin Johns. September 2017. PMI IRS Country Programs: 2016 Comparative Cost Analysis. Bethesda, MD. PMI Africa Indoor Residual Spraying Project, Abt Associates Inc.

Benjamin Johns, Altea Cico. August 2016. PMI IRS Country Programs: 2015 Comparative Cost Analysis. Bethesda, MD. PMI Africa Indoor Residual Spraying Project, Abt Associates Inc.

CHAI (2017) Price Elasticity of Demand for 3GIRS

Cardno (2018) External Verification Agent Report – IVCC NgenIRS Grant

IVCC (2018) Evolution of Forecasted Volumes

PATH (2019) NgenIRS Vector Control Recommendations

Johns, Benjamin and Altea Cico Sitruk. May 2019. PMI IRS Country Programs: 2018 Comparative Cost Analysis. Rockville, MD. PMI VectorLink Project, Abt Associates Inc.

WHO (2019), Guidelines for Malaria Vector Control. Guidelines for malaria vector control. Geneva: World Health Organization

Yukich et al (forthcoming, not yet published), Cost and cost-effectiveness of third-generation indoor residual spraying in sub-Saharan Africa: Results of data collection and analysis in the Next Generation IRS project. (Abstract for the ASTMH 2019)

### **Unitaid Strategy**

Unitaid (2016), Unitaid 2017-21 Strategy

### **Ghana specific documentation**

Afoakwah, C., Deng, X., & Onur, I. (2018). Malaria infection among children under-five: the use of large-scale interventions in Ghana. *BMC public health*, 18(1), 536

Abuaku, B., et al. (2018). Impact of indoor residual spraying on malaria parasitaemia in the Bunkpurugu-Yunyoo District in northern Ghana. *Parasites & vectors*, 11(1), 555

Coleman, S. et al. (2017). A reduction in malaria transmission intensity in Northern Ghana after 7 years of indoor residual spraying. *Malaria journal*, 16(1), 324

Dadzie, S. (2018). Insecticide resistance profile of *An. Gambiae* s.l. in Obuasi and Wa, Ghana

PMI (2019). Ghana Abbreviated Malaria Operational Plan FY 2019

PMI (2019). Ghana Malaria Operational Plan FY 2018

PMI (2019). ITN Access and Use Report – 2019

PMI (2019). PMI Vector Link end of spray report 2019

PMI (2018). PMI Vector Link end of spray report 2018

PMI (2017). PMI Vector Link end of spray report 2017

PMI (2018) PMI Country Programmes: 2018 comparative cost analysis

PMI (2017) PMI Country Programmes: 2017 comparative cost analysis

**Uganda specific documentation**

Abt Associates Inc (2016), Uganda Indoor Residual Spraying Project Phase II. End of Spray Reports 2015 - 2019

Abt Associates (2019), Uganda NgenIRS Country Implementation Plan

IVCC (n.d). Evidence slides

PMI VectorLink (2019) Insecticide Susceptibility Studies Report

PMI VectorLink (2019) Annual Entomology Report

Uganda National Malaria Control Programme (2019) Annual workplan for Uganda Malaria Reduction Strategy (2019-2020)

Uganda Malaria Indicator Survey 2009 and 2014

Uganda National Malaria Control Program (2014) The Uganda Malaria Reduction Strategic Plan 2014-2020

Uganda National Malaria Control Program (2017) Insecticide Resistance Management Plan for Malaria Vectors in Uganda

Uganda National Malaria Control Programme, Ministry of Health (2018) National Malaria Control and Elimination Policy Second Edition (Draft). Towards a malaria - free Uganda

Uganda National Malaria Control Programme (2019) Annual workplan for Uganda Malaria Reduction Strategy (2019-2020)

Ugandan Ministry of Health (2017), Mid Term Review of the Uganda Malaria Reduction Strategic Plan 2014 - 2020

Muhindo, M.K., Kakuru, A., Natureeba, P. et al. Reductions in malaria in pregnancy and adverse birth outcomes following indoor residual spraying of insecticide in Uganda. *Malar J* 15, 437 (2016) doi:10.1186/s12936-016-1489-x

Tonny Odokonyero (2019), Financing Indoor Residual Spraying for Malaria prevention in Uganda: Options for cost minimization powerpoint presentation

## Appendix B CONSULTEE LIST

This appendix provides an overview of all interviews that have been conducted for this evaluation. Section B.1. outlines the consultations conducted in the inception phase and Section B.2. those conducted in core phase.

### B.1. CONSULTATIONS CONDUCTED DURING THE INCEPTION PHASE

Table B.1: Stakeholder consultations undertaken in the inception phase

Stakeholder group	Organisation	Name	Position
Unitaid	Unitaid	Philippe Duneton	Deputy Executive Director
		Janet Ginnard	Director of Strategy
		Vincent Bretin	Director of Results
		Ana Alvarez	Programme Manager
		Katerina Galluzzo	Technical Officer
		Pablo Vega Rojas	Programme Officer
		Denitza Andjelic	Monitoring & Evaluation Manager
		Nargiza Mazhidova	Data Manager
		Ross Leach	Value-for-money manager
		Nicole Patterson	Impact assessment officer
		Donors	Global Fund
Mark Saalfeld	Fund Portfolio Manager (FPM) for Ghana		

### B.2. CONSULTATIONS CONDUCTED DURING THE CORE PHASE

This section provides a list of consultees that have been interviewed during the core phase of the evaluation including stakeholders on the global level (Section B.2.1), from the country case studies (Section B.2.2) and from the remote country case studies (Section B.2.3).

#### B.2.1. Global level consultees

Table B.2: Global level stakeholder consultations undertaken in the core phase

Stakeholder group	Organisation	Name	Position
Unitaid	Unitaid	Ana Alvarez	Programme Manager
		Katerina Galluzzo	Technical Officer
		Gelise McCullough	Programme Officer
		Ambachew Yohannes	Programme Manager
		Alexandra Cameron	Senior Technical Manager
		Denitza Andjelic	Monitoring & Evaluation Manager
		Nargiza Mazhidova	Data Manager
		Kristen Dorman	Legal Officer
Project grantee	IVCC	David McGuire	Project Director
		Tom Mclean	Head of Access
		Andrew Saibu	Africa Regional Coordinator
	Abt Associates	Brad Lucas	Director, VectorLink
		Mariandrea Chamorro	Operations Director, VectorLink

Other project implementers/ donors	BMGF	Helen Jamet	Deputy Director Vector Control
	USAID/PMI	Allisson Belemvire	Malaria Technical Advisor
	Global Fund	Susie Nasr	Senior Disease Advisor
	PATH	Molly Robertson	Senior Evidence Lead
Manufacturers	Bayer	Justin Mcbeath	Co-chair of the Vector Control Working Group
	Syngenta	Robertus Vink	Head Western Europe & Sub Saharan Africa
	Sumitomo Chemical	John Lucas	Technical Consultant
	BASF	Susanne Stutz	Professional & Specialty Solutions, Public Health
Other	WHO	Jan Kolaczinski	Coordinator, Entomology and Vector Control Unit
	RBM	Joshua Levens	Advocacy & Resource Mobilization Partner Committee (ARMPC) Manager
		Melanie Renshaw	Chief Programme Officer
		Gen Kaka Mudambo	Sub Regional Network Coordinator for East and Southern Africa
	Goodbye Malaria	Sherwin Charles	Executive Director
	NMCP Ghana59	Kezia Malm	NMCP Manager in Ghana, Co-chair of the Vector Control Working Group
	LSHTM	Natasha Protopopoff	Independent Academic
	Malaria Consortium	Tarekegn Abeku	Senior Vector Control Specialist
	Project Director MAPS	Halima Mwenesi	Chair of Expert Advisory Committee IVCC

### B.2.2. Country case study consultees

Table B.3: In-person country level stakeholder consultations undertaken in the core phase

Country	Organisation	Name	Position
Uganda	NMCD/MoH	Dr Jimmy Opigo	Assistant Commissioner NMCD
		Dr Catherine Maiteki	IRS focal person, IVM Chair
	Abt Associates Vector Link (IRS) Project	Okia Michael	Entomology Technical Manager
		Asaph Muhanguzi	Deputy Chief of Party
	USAID/PMI	Kassahun Belay	Senior Resident Malaria Advisor
		Joel Kisubi	Program Management Specialist/Malaria

<sup>59</sup> Interviewed as a global and country level stakeholder



	DFID	Robinah Lukwago	Health Advisor
	Global Fund	Saman Zamani	Fund Portfolio Manager
	Pilgrim Africa	Dr Dorothy Echodu	CEO
		Wycliff Odude	IRS Coordinator
	Malaria and Childhood Illness NGO Secretariat (MACIS)	Mathias Mulumba	Member of network
	Makerere University	Dr Adoke Yeka	Lecturer/ Researcher
	Malaria Consortium	Dr Anthony Nuwa	Technical Programme Coordinator, Uganda
Ghana	NMCP	Dr Kezia Malm	Head of Operations
		Otubea Owusu Akrofi	IRS focal person, entomologist, MaVCOC chair
		Christian Atta Obewa	Vector Control Technical Officer
	AGAMAL	Malik Kofi Assan	Head of Operations
		Joyce Mawuse Tawiah	Data Manager
	Global Fund	Mark Saalfeld	Fund Portfolio Manager
	IVCC	Andrew Saibu	West African Regional Coordinator
	NMMIR	Dr Samuel Dadzie	Entomologist/Researcher
	Abt. PMI Vector	Lena Kolyada	Chief Party
		Dr Yemane Yihdego	Regional Entomologist (including Ghana)
	USAID / PMI	Dr Jon Eric Tongren	CDC/PMI Advisor
	WHO	Dr Felicia Owusu-Antwi	NPO-Malaria/NTDs
International Public Health Advisors	Jessica Rockwood	Independent Consultant	

### B.2.3. Remote country case study consultees

Table B:4: Remote country stakeholder consultations undertaken in the core phase

Country	Organisation	Name	Position
Ethiopia	Global Fund	George Sakvarelidze	Fund Portfolio Manager
	PMI Vectorlink	Dr Peter Mumba	Chief of Party
Mali	PMI Vectorlink	Dr Desire Boko	Chief of Party
		Djoulde MamadouBah	M&E Manager

	NMCP/ PMI	Dr Fomba Seydou	Research professor
Tanzania	USAID	Naomi Kaspar	Malaria focal point
	PMI Vector Link	Mubita Lifwatila	Chief of Party
	NMCP	Winfred Mwafongo	IRS focal person
Zambia	NMCP	Reuben Zulu	IRS focal person
	Global Fund	Paul McCarrick	Fund Portfolio Manager
	VectorLink Project	Nduka Iwuchukwu	Chief of Party

## **Appendix C INTERVIEW GUIDES**

In this appendix we include interview guides for global and country level consultees. The global interview guides are separated out between (i) Unitaid Secretariat and project partners, (ii) manufacturers and (iii) other global level stakeholders.

### **C.1. INTERVIEW GUIDES – GLOBAL-LEVEL CONSULTEES (UNITAID SECRETARIAT AND PROJECT PARTNER STAKEHOLDERS)**

A short introduction to the evaluation has been provided to consultees. The following is a list of questions that were discussed with the Unitaid Secretariat and project partners, although specific questions have been selected/emphasised based on the background and role of the consultee in the project.

#### ***Relevance***

1. To what extent has the project been relevant and aligned with Unitaid's 2017-21 strategy?
2. To what extent, and how, has the project has been relevant in the context of contributing to global malaria prevention efforts and priority identified needs?

#### ***Efficiency and effectiveness***

3. To what extent has the project enabled each of the following outputs? Would these have progressed in the absence of the project? What factors have driven the achievement and non-achievement?
  - a. Uptake of 3GIRS products;
  - b. Forecasting for 3GIRS products;
  - c. Number of quality assured products from different manufacturers on the market;
  - d. Price reductions of 3GIRS products;
  - e. Documented and disseminated evidence of the impact and cost-effectiveness of 3GIRS products.
4. To what extent have project's outputs and activities been achieved/ completed as planned? Have these been on time and budget? What factors, if any, have affected efficient and effective implementation of key project activities?
5. How well were the grant activities managed by IVCC and Unitaid? If there were any weaknesses, were these addressed during the project?
6. To what extent were the chosen activities, outputs and related targets appropriate to reach the project outcome of "a sustainable, growing and competitive market for effective 3GIRS products at affordable prices"? Aspects in particular include:
  - a. The chosen target on the number of countries introducing 3GIRS and the volume sales in each country;
  - b. Was the use of the demand underwriting mechanism appropriate to help manufactures to enter the market and lower product prices? What circumstances of the 3GIRS market and the NgenIRS project made the use of a demand underwriting mechanism more/ less appropriate than other market-shaping activities? Is this an appropriate method to undertake again for Unitaid projects?
  - c. Was the support for demand forecasts an appropriate activity to achieve the project outcomes?
  - d. Was the price of US\$ 15 for 3GIRS products appropriate and what was the methodology of choosing it?
  - e. How effective has the co-payment mechanism been? Would alternative approaches have been as effective in increasing the market for 3GIRS products?
  - f. The communication/ advocacy around 3GIRS by IVCC and how appropriate the content and volume of these activities were to achieve the objectives of the project.
7. Have the project consortium members (IVCC, Abt Associates, PATH) and partners (GF, PMI) delivered on their roles and responsibilities? Was the allocation of project tasks appropriate between project stakeholders? To what extent has the collaboration/coordination between actors contributed to achievement of outcomes? What have been key issues in this regard and has the project adopted appropriate risk mitigation strategies to address these?

## ***Impact***

8. What do you think were the main market constraints that previously limited the development of the market for 3GIRS products? To what extent do you consider the project to have addressed these? Can the success / failure be attributed to the NgenIRS project or what other factors played a key role? In particular:
  - a. *Affordability:*
    - i. To what extent is the new price for 3GIRS products (i.e. US\$ 15) affordable?
    - ii. What key factors influenced the price decreased (e.g. supplier competition, firm forecasts, higher volumes, impact of demand underwriting, the value in the price elasticity study in setting target prices and role in volume guarantee negotiations)?
  - b. *Supply and delivery:*
    - i. Have global forecasts for 3GIRS products aided supply?
    - ii. To what extent are global forecasts considered sufficiently reliable?
    - iii. To what extent has country capacity to plan and forecast IRS needs improved and what factors have influenced this?
    - iv. What role has the project had on improving supply and instilling confidence in new manufacturers?
    - v. What criteria might manufacturers consider when deciding whether or not to enter this market?
    - vi. The impact had underwriting of demand had on enabling manufacturers to enter the market and lower product prices?
  - c. *Demand and adoption:*
    - i. To what extent has uptake and coverage of 3GIRS increased?
    - ii. What have been/ are the drivers for countries to choose or not to choose to introduce/ scale up IRS? Has the co-payment mechanism influenced this?
    - iii. To what degree does the evidence of impact and cost-effectiveness influence country decisions?
    - iv. What considerations do countries have regarding the mix of vector control interventions, and the rotation of those that they choose?
9. What has been impact of the project from a public health perspective? How may the project have helped to address resistance challenges by allowing countries to rotate between classes of insecticides?

## ***Sustainability***

10. What are the prospects for scaling-up the market for 3GIRS products further? Specific aspects to consider include:
  - a. How is the investment in 3GIRS expected to change going forward, and what are the drivers for this? What are the risks that funders and countries will de-prioritise IRS in favour of new nets?
  - b. To what extent may lower product prices impact scale up and sustainability given the high operational costs and complexity of the intervention?
  - c. Is the current market truly competitive and sustainable? To what extent is four manufacturers considered to be sufficient and/ or necessary given the market size?
11. Should Unitaid still be investing in IRS, and if so in what areas, or is there more incremental benefit to investing in IRS?
12. Are the overall positive effects of the project sustainable? E.g. Is the price reduction to US\$ 15 sustainable for manufacturers and sufficient to support continued demand?

## ***Overall***

13. Do you think the project represents value for money for Unitaid in terms of considering the overall benefits and costs? Why?
14. What other reflections or overall recommendations do you have?

## **C.2. INTERVIEW GUIDES – GLOBAL-LEVEL CONSULTEES (MANUFACTURERS)**

A short introduction to the evaluation has been provided to consultees. The following is a list of questions that were discussed with 3GIRS manufactures, although specific questions were selected/ emphasised based on the background and role of the consultee in the project.

1. What do you think were the main market constraints that previously limited the development of the market for 3GIRS products? To what extent do you consider the project to have addressed these? Can the success/failure be attributed to the NgenIRS project or what other factors played a key role? In particular:
  - a. *Affordability:*
    - i. To what extent is the new price for 3GIRS products (i.e. US\$ 15) affordable?
    - ii. What key factors influenced the price decrease (e.g. supplier competition, firm forecasts, higher volumes, impact of demand underwriting, the value in the price elasticity study in setting target prices, role in volume guarantee negotiations, production processes)?
  - b. *Supply and delivery:*
    - i. Have global forecasts for 3GIRS products aided supply?
    - ii. To what extent are global forecasts considered sufficiently reliable?
    - iii. What role has the project had on improving supply and instilling confidence on new manufacturers? Would you have entered the market regardless even in the absence of the project?
    - iv. What criteria might manufacturers consider when deciding whether or not to enter this market?
    - v. The impact underwriting of demand had on enabling manufacturers to enter the market at lower product prices?
  - c. *Demand and adoption:*
    - i. To what extent has uptake and coverage of 3GIRS increased?
2. What improvements and/ or challenges has your organisation faced in countries for the sale of its 3GIRS product?
3. What are the prospects for scaling-up the market for 3GIRS products further? Specific aspects to consider include:
  - a. How is the investment in 3GIRS expected to change going forward, and what are the drivers for this? What are the risks that funders and countries will de-prioritise IRS in favour of new nets?
  - b. To what extent may lower product prices impact scale up and sustainability given the operational costs and complexity of the intervention?
  - c. Is the current market truly competitive and sustainable? To what extent is four manufacturers considered to be sufficient and/ or necessary given the market size?
  - d. Do you foresee any quantity constraints going forward?
  - e. How are other vector control interventions (i.e. PBO nets, vaccine etc.) currently expected to impact on the future demand of 3GIRS?
  - f. What potential do you think the private sector (e.g. extractive industries) have to shape demand in the future?
4. Is the price reduction to US\$ 15 sustainable for manufacturers and sufficient to support continued demand?
5. What other reflections or overall recommendations do you have?

## **C.3. INTERVIEW GUIDES – GLOBAL-LEVEL CONSULTEES (EXTERNAL STAKEHOLDERS)**

A short introduction to the evaluation has been provided to all consultees. The following is a list of questions that were discussed with the global level stakeholders (i.e. RBM, WHO etc) external to Unitaaid, although specific questions have been selected/ emphasised based on the background and role of the consultee in the project.

### ***Relevance***

6. What do you know about the NgenIRS project? To what extent do you think it contributes to addressing priority needs in terms of malaria prevention efforts at global and national levels? Why/ why not?

### ***Efficiency and effectiveness***

7. What do you know about what the project achieved in terms of outputs and outcomes? What factors have driven the achievement and non-achievement of the following:
  - a. Uptake of 3GIRS products;
  - b. Forecasting for 3GIRS products;
  - c. Number of quality assured products from different manufacturers on the market;
  - d. Price reductions of 3GIRS products;
  - e. Documented and disseminated evidence of the impact and cost-effectiveness of 3GIRS products.
8. Based on your knowledge of the project, do you think the project adopted the most effective approach(es) considering the aim of creating “a sustainable, growing and competitive market for effective 3GIRS products at affordable prices”? Please explain. Could the project have adopted alternative approaches that may have been more effective? What could these have been? What alternative outcomes could these potentially have had?

### ***Impact***

9. What do you think were the main market constraints that previously limited the development of the market for 3GIRS products? To what extent do you consider the project to have addressed these? Can the success/failure be attributed to the NgenIRS project or what other factors played a key role? In particular:
  - a. *Affordability:*
    - i. To what extent is the new price for 3GIRS products (i.e. US\$ 15) affordable?
    - ii. What key factors influenced the price decreased (e.g. supplier competition, firm forecasts, higher volumes, impact of demand underwriting, the value in the price elasticity study in setting target prices, role in volume guarantee negotiations)?
  - b. *Supply and delivery:*
    - i. Have global forecasts for 3GIRS products aided supply?
    - ii. To what extent are global forecasts considered sufficiently reliable?
    - iii. To what extent has country capacity to plan and forecast IRS needs improved and what factors have influenced this?
    - iv. What role has the project had on improving supply and instilling confidence on new manufacturers?
    - v. What criteria might manufacturers consider when deciding whether or not to enter this market?
    - vi. The impact underwriting of demand has had on enabling manufacturers to enter the market and lower product prices?
  - c. *Demand and adoption:*
    - i. To what extent has uptake and coverage of 3GIRS increased?
    - ii. What have been/ are the drivers for countries to choose or not to choose to introduce/ scale up IRS? Has the co-payment mechanism influenced this?
    - iii. To what degree does the evidence of impact and cost-effectiveness influence country decisions?
    - iv. What considerations do countries have regarding the mix of vector control interventions, and the rotation of those that they choose?
10. What has been the impact of the project from a public health perspective? How may the project have helped to address resistance challenges by allowing countries to rotate between classes of insecticides?

### ***Sustainability***

11. What are the prospects for scaling up the market for 3GIRS products further? Specific aspects to consider include:
  - a. How is the investment in 3GIRS expected to change going forward, and what are the drivers for this? What are the risks that funders and countries will de-prioritise IRS in favour of new nets?
  - b. To what extent may lower product prices impact scale up and sustainability given the operational costs and complexity of the intervention?
  - c. Is the current market truly competitive and sustainable? To what extent is four manufacturers considered to be sufficient and/ or necessary given the market size?
  - d. Should Unitaid still be investing in IRS, and if so in what areas, or is there more incremental benefit to investing in IRS?

12. From what you know of the project, are the overall positive effects of the project sustainable? E.g. Is the price reduction to US\$ 15 sustainable for manufacturers and sufficient to support continued demand?

### **Overall**

13. What other reflections or overall recommendations do you have?

## **C.4. INTERVIEW GUIDE – COUNTRY LEVEL CONSULTEES**

A short introduction to the evaluation has been provided to all consultees. The following is a “long list” of questions that were discussed with country stakeholders, although specific questions have been emphasised based on the background and role of the consultee in the project.

1. How has the NgenIRS project been useful in responding to specific vector control needs in your country? To what extent has the project contributed to your country’s malaria elimination strategy and/or resistance management?
2. What would you say are the key achievements of the NgenIRS project? What factors may have driven the achievement and non-achievement of specific aspects of the project?
3. To what extent has the project enabled the following in your country and would these have progressed in the absence of the project?
  - a. *Uptake of 3GIRS*
    - i. To what extent has uptake and coverage of 3GIRS increased in your country?
    - ii. What are the main reasons why your country might or might not adopt or increase 3GIRS? What might it take to decide to switch products (e.g. level of resistance, change management, price)? Who makes the decisions around adoption vector control interventions?
    - iii. To what extent has the price of 3GIRS products been a deterrent to starting or increasing the uptake for 3GIRS? To what extent do you think the new price for 3GIRS products (i.e. \$15) is affordable? Was there enough evidence to inform any decisions on this?
    - iv. How did IVCC or Abt Associates help with the planning around 3GIRS use?
  - b. *In-country demand forecasting:*
    - i. Are you aware of the tool developed by IVCC to improve the demand forecasting? If so, has this been useful? How helpful has the training been? How could the tool be improved further?
    - ii. To what extent has do you think capacity at a country level to plan and forecast IRS needs may have improved and what factors have influenced this?
    - iii. What are key factors that still challenge accurate demand forecasting for 3GIRS?
    - iv. How is the demand forecasting and reporting going to be undertaken after the project? How will this be supported?
  - c. *Evidence on 3GIRS*
    - i. What evidence regarding 3GIRS did IVCC distribute to you in-country?
    - ii. What evidence has been generated in your country?
    - iii. To what degree does the evidence of impact and cost-effectiveness influence country decisions?
    - iv. What other evidence on the impact and the cost-effectiveness of 3GIRS would support decision-making regarding use of 3GIRS in your country?
    - v. What considerations does your country have regarding the mix of vector control interventions, and the rotation of those that your country chooses?
4. From your perspective, how well has the coordination of the project implementers (IVCC, Abt Associates, PATH MACEPA) and partners (GF, PMI) and the allocation of the tasks worked?
5. What would you say has been the impact of the project from a public health perspective?
6. What differences do you see between the use of the different 3GIRS products? How are they different to the products that have been previously used?

7. How may the project have helped to address resistance challenges by allowing countries to rotate between classes of insecticides for IRS?
8. What has been the added value of the project, in terms of activities and results which would not have happened without this project?
9. What current plans does your country have in terms of introducing/ scaling up/ de-prioritising 3GIRS? What factors may affect these plans (either positively or negatively)? How does your country currently plan to rotate different insecticides and/ or prioritise malaria vector control efforts?
10. What sustainability challenges do you see for maintaining or increasing the use of 3GIRS in your country?
11. How do you expect IRS will be prioritised alongside LLINs in the future? What factors will influence this?
12. What other reflections or overall recommendations do you have?



## Appendix D REMOTE COUNTRY CASE STUDY SELECTION

As shown in Table D.1, a range of factors have been considered for the selection of the remote country case studies.

Table D.1: Project countries 2016-18 and key characteristics for the remote country selection

Country	Region (African Union)	Project start date	Malaria high impact country	Market size of 3GIRS (2018)	Market share of 3GIRS (2018)	Products used (2018)	Evidence generated in-country	Involved Partners (2018)
Benin	West Africa	2017	No	37,905	100%	Actellic	No	PMI
Burkina Faso	West Africa	2018	Yes	73,008	100%	Actellic, SumiShield	No	PMI
Ethiopia	East Africa	2016	No	141,416	5% <sup>60</sup>	Actellic, Propoxur	No	PMI
Ghana	West Africa	2017	Yes	226,341	100%	Actellic, SumiShield	Yes	PMI, GF, AgaMal
Kenya	East Africa	2017	No	284,807	100%	Actellic, SumiShield	No	PMI
Madagascar	East Africa	2017	No	28,137	100%	Actellic, SumiShield	No	PMI, GF/PSI
Malawi	Southern Africa	2018	No	59,768	100%	Actellic	No	PMI, Mulanje
Mali	West Africa	2016	Yes	34,573	100%	Actellic, SumiShield	Yes	PMI
Mozambique	Southern Africa	2017	Yes	612,400	100%	Actellic, SumiShield	Yes	GF
Rwanda	East Africa	2016	No	382,986	100%	Actellic	No	PMI, GF/GOR
Tanzania (Mainland)	East Africa	2017	Yes	316,843	100%	Actellic, SumiShield	No	PMI
Uganda	East Africa	2017	Yes	601,193	100%	Actellic	Yes	PMI
Zambia	Southern Africa	2016	No	251,162 <sup>61</sup>	100%	Actellic, SumiShield	Yes	PMI, GF, GRZ
Zimbabwe	Southern Africa	2017	No	523,028	92%	Actellic	No	PMI, GF

<sup>60</sup> Ethiopia is the only project country that uses a locally produced product. Propoxur is a 2<sup>nd</sup> Generation IRS product and had the majority of the market share between 2016-18. Ethiopia has overall the largest market for IRS.

<sup>61</sup> The market in Zambia has been larger but due to outstanding payment-terms discussions not all campaigns were conducted in 2019.

Based on these country characteristics, we proposed to include the following countries in order to obtain a representation across the selection criteria:

### **Ethiopia**

- Market size: Very large IRS market which will have a key impact on scalability of the 3GIRS,
- Products: Only country using a domestically produced IRS product (Propoxur - 2nd Generation) and as result the market share for 3GIRS has not been as high; this also impacted on the target of shifting IRS demand towards 3GIRS
- Region: East Africa
- Project start date: 2016
- High impact malaria country: No
- Evidence: No studies conducted

### **Mali**

- Market size: smaller market to ensure there is a mix
- Products: Planned use of Actellic 300CS and SumiShield 50WG in 2018
- Region: West Africa
- Evidence: Study was conducted recording the impact of switching from pyrethroid to 3GIRS and of removing 3GIRS from one year to the next
- Funders: PMI
- Project start date: 2016
- High impact malaria country: Yes

### **Zambia**

- Market size: large market although there was a big variation in the demand for 2018 (driven by outstanding payment-terms discussions – the volume will instead be used for 2019)
- Products: Actellic 300CS and SumiShield 50WG in 2018
- Region: South Africa
- Evidence: Study was conducted on impact of 3GIRS
- Funders: GF and PMI
- Project start date: 2016
- High impact malaria country: No

### **Tanzania**

- Market size: medium market size – demand fluctuations in 2018
- Products: Actellic 300CS and SumiShield 50WG in 2018
- Region: East Africa
- Evidence: No
- Funders: PMI
- Project start date: 2017
- High impact malaria country: Yes

## Appendix E PROJECT LOGFRAME AND ACHIEVEMENTS

Table E.1: Project logframe and progress to-date

Result level	Description	Baseline (Year)	Grant to target	start end	Total date (2019)	to (Q3)	% Achievement
<b>Goal</b>	<b>Increased use of 3GIRS products in Insecticide Resistance Management (IRM) programmes</b>						
G1	Number of persons protected in Africa through 3GIRS	8.35 million (2014)	84.4m		119.5m		142%
G2	Proportion of volume of IRS that is 3GIRS in Africa	16.7% (2014)	52%		TBD		TBD
<b>Outcome</b>	<b>A sustainable, growing and competitive market for effective 3GIRS products at affordable prices</b>						
P1	Aggregated Volume of 3GIRs products by unit in project partner countries, with and without co-payment support	723,247 (2014)	10,047,686		12,453,318		124%
P2	Number of countries procuring 3GIRS	8 countries (2014)	18		31		172%
P3	Proportion of volume of IRS that is 3GIRS in the Project Countries	23% (2014)	87%		TBD		TBD
<b>Output 1</b>	<b>Accelerated uptake of 3GIRS</b>						
O1.1	Number of countries adopting 3GIRS in partnership with the project	0/15 countries (2014)	15		20		133%
<b>Output 2</b>	<b>Improved global forecast<sup>62</sup> for 3GIRS products</b>						
O2.1	Proportion difference in volume of consolidated forecast for project countries with actual orders procured	50% (2015)	5%		± 5%		100%
O2.2	Proportion of countries' orders that are within 10% of annual forecast	0 (2015)	90%		53.5%		59%
<b>Output 3</b>	<b>New quality assured products available from several manufacturers on the market</b>						
O3.1	Number of WHO approved products included in donor/country procurements	1 (2015)	3		3		100%
<b>Output 4</b>	<b>3GIRS products are reduced in price</b>						
O4.1	Median ex-works price of 3GIRS by unit	US\$ 23.50 (2016)	US\$ 15.00		US\$ 15.00		100%
<b>Output 5</b>	<b>Document and disseminate evidence showing cost-effectiveness of 3GIRS</b>						
O5.1	Number of consolidated results reports presented at meetings with key country level stakeholders to disseminate research results	0 (2016)	26		32		123%

<sup>62</sup> Termed global forecast in the project documents but referred to as consolidated country forecasts in this report

O5.2	Number of presentations at national and international conferences	0 (2016)	6	17	283%
------	---	----------	---	----	------

## Appendix F BUDGET ANALYSIS

This appendix presents an overview of the budget by outputs and other activities (Table F.1) and by stakeholders receiving the funding (Table F.2).

*Table F.1. Budget analysis by output and other activities (using the updated 2019 budget)*

Activity	US\$	%
Output 1 - Expanded uptake of 3GIRS	38,608,507	61.2%
Output 2 - Forecast and demand underwriting	12,079,631*	19.2%
Output 3 - New products entering the market	-	0.0%
Output 4 - Price reductions	426,040	0.7%
Output 5 - Evidence generation and dissemination	2,842,527	4.5%
Staff costs	5,563,806	8.8%
Common costs	3,439,489	5.5%
Audit costs	103,370	0.2%
<b>Total</b>	<b>63,063,370</b>	<b>100%</b>

\* Of this amount, US\$ 11,072,000 represents the demand underwriting which has not been used during the project.

*Table F.2. Budget analysis by partner and other actors (using the updated 2019 budget)*

Partner / actor	US\$	%
IVCC	5,974,039	9%
Underwriting reserve fund	11,072,000	18%
ABT Associates	1,963,499	3%
PATH	6,080,121	10%
Commodity manufacturers	37,973,711	60%
<b>Total</b>	<b>63,063,370</b>	<b>100%</b>

## Appendix G GHANA CASE STUDY

### G.1. COUNTRY CONTEXT

Ghana has a long history in using IRS as a malaria vector control intervention. The country started large scale-IRS spraying in 2005. The implementation of IRS is funded by the Global Fund and PMI. The Global Fund funding goes to AGAMAL (a public private partnership that emerged from the spraying activities of the private company AngloGold Ashanti) as primary recipient. PMI currently uses Abt Associates/Vector Link as an implementer in-country.

The Malaria Vector Control Oversight Committee (MaVCOC), overseen officially by the National Malaria Control Programme (NMCP), is a multi-stakeholder group which informs and guides malaria vector control efforts in Ghana. Established around 2008, it convenes researchers, funders (PMI, USAID), technical partners (WHO), implementers (Abt Associates / Vector Link, AGAMal), ministries (NMPC, EPA, food and drug authority) and commercial partners (i.e. Bayer).

As per WHO malaria vector control guidance, Ghana's malaria control strategy supports both IRS and ITNs. Districts usually benefit from either LLINs or IRS, but rarely both simultaneously. Where possible, IRS is implemented in the same districts consecutively, targeting those with the highest malaria prevalence (i.e. in the north of Ghana).

Ghana received NgenIRS co-payment for the first time in 2017 for the purchase of Actellic 300CS. Since 2018, the country has also received co-payment support for the purchase of SumiShield 50WG.

The previous external verification report summarised the IRS implementation scope and context prior to the introduction of NgenIRS as follows<sup>63</sup>:

- *“Prior to the NgenIRS grant, IRS coverage was decreasing, and rotation was not occurring. AGAMal and VectorLink implement IRS in Ghana; the NMCP does not conduct IRS on its own. AGAMal started IRS in 2005 in Obuasi district and expanded IRS to cover a peak of 22 districts by 2013. PMI started IRS in 2008 in five districts and expanded to nine districts over the following years. Faced with growing insecticide resistance to pyrethroids, carbamates, and organophosphates, the NMCP (in consultation with the Malaria Vector Control Oversight Committee (MaVCOC)) switched to Actellic 300CS in 2014. Actellic 300CS has been used exclusively for IRS, each year, through 2017. In 2016, both AGAMal and PMI reduced IRS from 22 to 10 and from nine to five districts, respectively, due to high cost of Actellic 300CS.”*

#### G.1.1. Qu 3: To what extent were the chosen activities, outputs and related targets appropriate to reach the intended project goal?

##### Global and in-country demand forecasts for 3GIRS products

The forecasting workshops were reportedly well received by the stakeholders that participated (NMCP, Abt Associates, AGAMal). It was considered that the workshops provided a useful platform that allowed the exchange of ideas and facilitation of cross-learning between countries. The workshop also encouraged countries to contribute information on their resistance profile, boosting country capacity and understanding of the impact of different product choices. They were also seen as useful in terms of improving forecasting capacity. In 2019, Ghana had a very accurate country demand forecasting that was within 1% of actual procurement.<sup>64</sup> Though some stakeholders commented that Ghana already had a strong capacity prior to the workshops/NgenIRS, they all acknowledged that the workshops improved capacity further in this regard. That Ghana have consistently sprayed in the same districts with the same service providers was also likely to do contribute to effective demand forecasting accuracy.

The new forecasting Excel-based tool was seen as very helpful for being simple to use whilst including all key information. Involved stakeholders remarked they would continue to use the tool going forward and felt that they

---

<sup>63</sup> Cardno (2018) External Verification Agent Report – IVCC NgenIRS Grant

<sup>64</sup> IVCC forecasting data for 2019

acquired all the necessary capacity to successfully forecast their country demand (including any difficulties arising from insecticide rotations through the IRM implementation).

There have been mixed views on whether the forecasts should have been included in the RBM gap analysis or integrated into the demand quantification of other malaria products. A majority of stakeholders thought that having such a narrow focus on 3GIRS allowed the workshops to be more effective especially at a stage when not many countries had a strong knowledge on the topic. This may now offer a useful basis for integrating the quantification with other malaria vector control interventions going forward – many stakeholders agreed with this.

Stakeholders also felt that platform for cross-country sharing offered by the workshops will be missed. They suggested that a way should be found to offer these meetings going forward – one example was by using the annual RBM gap analysis meetings as a starting point and then to stay on to discuss 3GIRS specific issues. Many stakeholders felt that these transition and sustainability aspects could have been better addressed from the start of the project.

### **Evidence creation**

There appeared to have been similar creation of evidence before and after the project with regard to entomological and resistance data. For example, prior and throughout the project PMI and to some extent Global Fund funded researchers from the Noguchi Memorial Institute for Medical Research (NMIMR) to collect and analyse resistance data. Their work is presented regularly in the MaVCOC and reportedly drives IRS decision-making.

While it was acknowledged that more public health impact and cost-effectiveness data would be helpful (given more evidence is generally considered useful), most stakeholders in the MaVCOC already felt that the decision-making process was working well around resistance / entomological data.

IVCC / PATH produced and presented further evidence on the public health impact of 3GIRS, but many stakeholders could not directly recall what was presented with regard to the public health impact and how it was taken further / what the impact of the presentation were. Stakeholders generally recalled that the presented material was not directly put forward by the NMCP as a basis for any decision-making, which may reflect a sense that in-country stakeholders already considered IRS to be working well in Ghana. For example, they often cited that national data on reduced malaria incidence and therefore prevalence as a justification for the effectiveness of IRS in the northern districts and so most national stakeholders were keen to continue to push for the use of IRS provided funding was available. Another potential reason may have been that many of the stronger pieces of evidence around the public health impact and cost-effectiveness have not yet been published.

In contrast to presentation on the public health impact, stakeholders generally had a good understanding of the NgenIRS project and the role of IVCC. They also recalled presented information around the available products and their characteristics and issues related to resistance management.

## **G.2. RELEVANCE**

This section discusses country specific evaluation findings for Ghana against the evaluation framework.

### **G.2.1. Qu 1: To what extent has the project been relevant and aligned with Unitaids' strategy, as well as needs identified in terms of priority global malaria prevention efforts?**

#### **Global malaria prevention efforts and IRM**

Stakeholder saw the NgenIRS project as highly relevant with regard to the malaria prevention efforts and IRM in Ghana. The project was seen as crucial in enabling the rotation of different insecticides to respond to growing resistance issues to Actellic 300CS. Specifically, Ghana has been using Actellic 300CS in some districts for over 5 years and found the first signs of resistance in Obuasi and some northern districts.<sup>65</sup> As a result, they eagerly awaited the

---

<sup>65</sup> Dadzie, S. (2018). Insecticide resistance profile of *An. Gambiae* s.l. in Obuasi and Wa, Ghana

availability of SumiShield 50WG, a neonicotinoid insecticide, that offered a new mode of action and was used in the spraying campaign in 2018.

It was emphasized by stakeholders that the NgenIRS project had come in at a time when Ghana's IRS programme had to make previous cuts in the 3GIRS coverage due to external funding reductions as well as higher commodity costs for 3GIRS. Thus, the project was seen as highly relevant that invigorated and enhanced the 3GIRS use in the country.

### **G.3. EFFICIENCY AND EFFECTIVENESS**

#### **G.3.1. Qu 2: To what extent have project's outputs and activities been achieved/ completed as planned and on time and budget? What factors have driven achievement/ non-achievement?**

*Questions around project activities, outcomes and impact are discussed directly and in more depth under question 3 and 5.*

#### **G.3.2. Qu 4: Was the allocation of project tasks appropriate between project stakeholders and to what extent has the collaboration/coordination between actors contributed to achievement of outcomes?**

Collaboration between stakeholders reportedly worked well in Ghana. This appears to be well supported by the existing MaVCOC structure that is well used and appears to function effectively as a strong platform to make transparent decisions with regard to malaria vector control interventions.

IVCC was seen as integrating well into the existing MaVCOC structure with the delivery of presentations at the meetings and resultant discussions, for example. They have been credited in really enhancing capacity of stakeholders around understanding demand / supply issues as well as the pricing of different IRS products.

Having a regional coordinator with ample experience in Accra was also seen as very positive. Andrew Saibu, IVCC West African Regional Coordinator, was seen as knowledgeable, well connected and as someone with the local networks and advocacy/communication skills that supported the prioritisation of the 3GIRS agenda in the country. For example, his support in terms of getting FDA approval of the insecticides in Ghana was emphasised as were his engagement and presentation of the MaVCOC.

### **G.4. IMPACT**

#### **G.4.1. Qu 5: To what extent has the project contributed to addressing critical access barriers that had previously limited the development and uptake for 3GIRS products? What may have happened in the absence of the project to the 3GIRS market?**

##### **Affordability**

The affordability of the 3GIRS product was indeed previously considered a key issue in Ghana. Prior to the NgenIRS project, there had been a reduction in the use of IRS in Ghana in both 2014 and 2015. This was linked to the switch from pyrethroid IRS to the much more expensive Actellic 300CS, necessary due to the prevalent pyrethroid resistance in Ghana. Thus, the reduction in the use of IRS was directly linked to the high costs of non-pyrethroid IRS. This illustrates that the high commodity prices and the related affordability issues had been a key market barrier for the expansion of the 3GIRS market.

However, it should be noted that the reductions in IRS coverage after 2012 were also impacted by a reduction in Global Fund funding and therefore the contraction of covered districts cannot be fully attributed to costing issues. This underlines that both availability of donor funding as well as commodity prices are really the key factors behind the use of 3GIRS.

##### **Affordability of \$15?**

For most stakeholders, this depended on the comparator price. It was considered to be very affordable compared to the US\$ 25 (previously Actellic 300CS) but less affordable than pyrethroid products. Overall, most stakeholders considered the price of US\$ 15 sufficient to keep the current IRS coverage but not to allow for any expansion. Stakeholders voiced their concerns about a future price increase after the end of the project and that this would mean to once again reduce the coverage of 3GIRS.

### Supply and delivery

#### Extent to which country capacity to plan and forecast IRS has improved, and any key positive or negative influencing factors

Ghana has been already good in forecasting 3GIRS prior to the NgenIRS project but stakeholders felt that have improved further due to the provided workshops and the provided tool.

### Demand and adoption

#### Extent to which uptake and coverage of 3GIRS products has increased

There has been an expansion in the coverage of 3GIRS products that can be directly linked to the co-payment of the NgenIRS project. The money that was saved due to the cost reduction was used to fund the operational costs as well as additional commodities needed for the expansion. Since 2017, the following districts were sprayed due to the NgenIRS project:

- PMI expanded their spraying activity from five to seven districts and one of those districts (Karage) was added due to savings from the NgenIRS co-payment. Karage was also sprayed in 2018 and 2019 and is expected to be sprayed in the 2020 round.
- AGAMaL expanded their spraying activity from 10 to 13 districts (now 16 districts due to further subdivides of districts) with all three additions due to cost-savings from the NgenIRS co-payment. The three districts added were Buisla North, Buisla South and Kassena Nankana West.

The additional population covered which can be directly attributed to the NgenIRS project is detailed in Table G.1 below.

Table G.1 Additional population covered through NgenIRS

<i>Districts</i>	<i>Funder</i>	<i>Population in 2017 (% of total population covered by funder)</i>	<i>Population in 2018 (% of total population covered by funder)</i>	<i>Population in 2019 (% of total population covered by funder)</i>
Karage	PMI	103,160 (12%)	99,561 (11%)	94,426 (11%)
Buisla North; Buisla South; Kassena Nankana West	GF	176,055 (17%)	175,729 (17%)	176,497 (16%)
Total	PMI / GF	279,215 (15%)	275,290 (15%)	270,923 (14%)

The analysis clearly shows that across the other two funders, the NgenIRS project helped to expand IRS coverage by around 15% between 2017-19, covering around an additional 275,000 people. Stakeholders stressed that this addition is directly linked to NgenIRS and would have not happened without the project's co-payment.

After successful use of SumiShield 50WG in the Obuasi district in 2018, both AGAMaL and PMI used SumiShield 50WG as part of the IRM efforts in 2019. They are expected to continue to rotate between insecticides and are aiming to use Flurdora Fusion or SumiShield 50WG in the next years in districts that used Actellic 300CS over the last few years. The stable commodity prices and funding availability are expected to enable this.

#### Drivers for countries to choose or not to choose to introduce/ scale up IRS (evidence, co-payment mechanism, broader considerations regarding the mix of vector control interventions and rotation)



The available commodity price and the funding envelope ultimately determine how many districts can be sprayed with IRS, once the decision has been made in country to prioritise this vector control approach. Within the country there is a clear separation between districts receiving IRS and ITNs, and a strong conviction that high endemic districts that previously received IRS should continue to do so. Most stakeholders referred to the rebound of malaria prevalence after IRS had to be scaled back in 2013 as clear evidence of the negative effects of pulling out IRS (i.e. rebound effect was seen in Tolon Kumbungu district published also in a peer-reviewed study).<sup>66</sup>

Overall, stakeholders considered Ghana to have good insecticide resistance data due to the work by the Noguchi Memorial Institute for Medical Research (NMIMR). This is part of the National Insecticide Resistance Monitoring Partnership (NIRMOP) which annually collects entomological and insecticide resistance data across 20 sentinel sites (2 in each of 10 regions). The number of sentinel sites is expanded further to 30 sites next year as part of the administrative boundary changes in Ghana. The NIRMOP will enable the MaVCOC to continue to take decisions based on the effectiveness of the different products (as far as they are relating to resistance issues).

There also was clear support for IRS in the MaVCOC and it was not seen as likely that ITNs would replace 3GIRS as long as the price and available funding stayed stable. This was also considering:

- Some stakeholders felt this was more effective than ITNs due to lower coverage especially in urban areas – in a recent report by PMI (2019), urban net usage was stated as 44% (rural net usage is higher at 74%).<sup>67</sup>
- Some studies seem to suggest that there has been a bigger effect of IRS in terms of reducing malaria prevalence in Ghana compared with ITNs (especially in household in which the mother had a low education, which is seen as a key factor in influencing ITN usage).<sup>68</sup>
- Some stakeholders commented that the use of community workers for spraying / engagement also helped to bring money into some remote communities, a welcomed side-effect of IRS.

As mentioned previously, the decisions on priority spray locations and the products to use are taken within the MaVCOC. Stakeholders emphasised that the decisions are transparent and aim to be evidence based, at least with regard to resistance data or the effectiveness of products (the use of effective products was the first priority for stakeholders with regard to data needs). For example, the MaVCOC decided that they needed to use different IRS products after resistance data showed that Actellic 300CS was becoming less effective in the Obuasi district. As result, they used SumiShield 50WG in this district.

Overall, countries did not have a preference between the products and emphasised that decisions were based on resistance and effectiveness (with price or implementation concerns being secondary). They also stated that implementation concerns can vary on the ground. For example, some households may complain about the smell and colouring of Actellic 300CS whereas others have been concerned about the odourless and colourlessness of SumiShield 50WG (with a delayed impact as well they were afraid that their house was not sprayed at all). An implementation concern raised however was the supply delays with Actellic 300CS which was noted as disappointing given the high price of the product.

### **What might have happened in the absence of project (counterfactual)**

The expansion of IRS would have not happened as described above. However, the country is likely to have continued to use Actellic 300CS in the meantime with the existing funding. They maybe would have been some reduction in

---

<sup>66</sup> Coleman, S. et al. (2017). A reduction in malaria transmission intensity in Northern Ghana after 7 years of indoor residual spraying. *Malaria journal*, 16(1), 324

<sup>67</sup> PMI (2019). ITN Access and Use Report – 2019

<sup>68</sup> Afoakwah, C., Deng, X., & Onur, I. (2018). Malaria infection among children under-five: the use of large-scale interventions in Ghana. *BMC public health*, 18(1), 536

case of a later entrance of SumiShield 50WG into the market given the emergence of some resistance to Actellic 300 CS. However, this is difficult to quantify clearly.

#### **G.4.2. Qu 6: What has been the public health and economic impact of the project?**

##### **Direct and indirect (future)**

The direct public health impact is the expansion of IRS to the additional districts. At this stage, they do not have the resources to disentangle the public health impact for each different malaria intervention. However, the existing national data shows a reduction in malaria prevalence in the districts that used IRS. There also were studies conducted independently of the NgenIRS project which showed the impact of IRS above new net interventions.<sup>69</sup>

##### **Addressing resistance challenges by allowing countries to rotate between classes of insecticides**

The project was seen as crucial for the rotation of different insecticides. Specifically, Ghana has been using Actellic 300CS in some districts for over 5 years and found the first signs of resistance in Obuasi.<sup>70</sup> As result, they eagerly awaited the availability of SumiShield 50WG that offered a new mode of action as neonicotinoid-based insecticide. They credited IVCC with the introduction of SumiShield 50WG as well as help in getting Ghanaian FDA approval. By now, Ghana is using both SumiShield 50WG and Actellic 300CS and is also planning to rotate Actellic 300CS out in other districts that have used it for the last few years.

The availability of new products also means that Ghana has now committed to resistance management through sub-national, pre-emptive IRS rotation and is currently finalising their IRM strategic plan as recommended by the GPIRM (though it should be noted that this has been in draft form for around three years). However, stakeholders felt that an earlier entry of SumiShield 50WG and Fludora Fusion would have enabled the project to bring out further benefits.

#### **G.4.3. Qu 7: Does the Unitaid investment in this project demonstrate value for money?**

##### **Bringing together the public health and market impact achieved today as well as its potential going forward**

While this is difficult to assess, the stakeholders definitely considered the NgenIRS project to be successful and saw clear value adds around: (i) expansion of coverage, (ii) reduction in prices; (iii) improved forecast, (iv) in-country understanding around 3GIRS products and the market. Additionally, they all considered IRS to be highly effective and, thus, based on these grounds would consider the project to have offered value for money.

### **G.5. SUSTAINABILITY**

#### **G.5.1. QU 8. What are the prospects for scaling up the market for 3GIRS products? What is the likelihood of the project outcomes being sustained?**

##### **Scalability**

Overall, most stakeholders expected the uptake of 3GIRS to stay stable over the coming years and, thus, to maintain the gains in coverage which were enabled by the NgenIRS co-payment. There remains a high commitment in the NMCP and MaVCOC to use 3GIRS, but ultimately the use will be driven by the availability of donor funding as well as the commodity price. With a constant price at around US\$ 15, as well as constant donor support, it is expected that the same of amount IRS will be sprayed. Any changes in price or funding would directly translate into reduction or expansion of IRS.

---

<sup>69</sup> Afoakwa, C., Deng, X., & Onur, I. (2018). Malaria infection among children under-five: the use of large-scale interventions in Ghana. *BMC public health*, 18(1), 536

<sup>70</sup> Dadzie, S. (2018). Insecticide resistance profile of *An. Gambiae* s.l. in Obuasi and Wa, Ghana

## **Funding security**

The support currently comes from the Global Fund (for AGAMal) and PMI (for Abt Associates) with limited support in-kind from the government for the operations of the campaigns.

Most stakeholders thought it was likely that the prices and donor funding will remain more or less stable over the next few years. The biggest risk is regard to Global Fund funding – the next grant application will be soon prepared, and only then will there be more clarity regarding the overall budget envelope. Positive is that the Global Fund managed to successfully replenish, but Ghana's move to a middle-income country as well as not meeting their co-financing obligation may impact negatively on the funding that they will receive. PMI funding is expected to be largely stable in 2020 at US\$ 5.6m (the same as in 2019).<sup>71</sup>

The use of government co-financing for IRS would be key in terms of sustainability and further scale-up. However, while the government might increase its support in-kind for the IRS campaign (i.e. providing storage for products, logistical support, community engagement) it is unlikely that they will start financing IRS directly over the next few years.<sup>72</sup>

## **Scaling-up: private sector market**

There has been some involvement of the private sector in IRS in Ghana. Most importantly, AGAMal is a PPP that emerged from the engagement of the gold mining company, AngloGold. They started using IRS to spray the housing of their workers and their family. They were able to show the impact and subsequently became a service provider that receives Global Fund funding to conduct IRS large scale. AGAMal continues to receive some funding from AngloGold but the majority of funding is provided by the Global Fund. This transition from a private company that supported localised spraying to a large-scale service provider for IRS appeared to have worked well in Ghana. However, stakeholder cautioned that this is not necessarily a concept that work easily would in other countries.

There are also some localised IRS campaigns by other private companies in the extractive industry (Newmonts; Chirano Goldmines). The engagement is quite small scale but definitely something that they would recommend taking forward more and that could also be an option in other countries. It was seen as an important contribution both for scalability and sustainability.

There might also be room for spraying outside of the national malaria control plan such as additional spraying in prisons (conducted already by AGAMal) or potentially private hospitals and schools. AGAMal also is currently working on a resource mobilisation plan to find funding in addition to GF and AngloGold.

## **Number of products is considered to be to be sufficient and/ or necessary**

There is a high appreciation of having another class of insecticides so as to enable a boost in rotation between insecticides and to start implementation of the IRM. However, stakeholder emphasised that really at least three different classes of insecticide would be needed for an effective application of the IRM draft plan.

Stakeholders also did not consider there to be a risk that a manufacturer would cease to exist or produce the same products (i.e. Actellic 300 CS). For example, while they have switched away from Actellic 300CS they are likely to revert back to the product in the next few years in the districts that used Fludora Fusion and SumiShield 50WG. Given that the IRM implementation and resistance profile takes precedent over commodity price, stakeholders expected Actellic 300CS to stay in the market.

## **Overall market expectations (especially impact of new ITNs)**

Most stakeholders did not consider that new ITNs would impact on the use of 3GIRS over the next few years due to the separated use of them across districts. Additionally, as described above, there are also concerns regarding the

---

<sup>71</sup> Draft Transition and Sustainability Plan - IVCC

<sup>72</sup> Although the government currently supports ZoomLion, a private waste management company, to conduct larva source management activities. Thus, it could be feasible that with the right advocacy efforts the government may become more involved in IRS funding in the long-term.

low usage of nets in urban areas. Thus, it is unlikely that there will be a complete shift of in-country preference / demand from 3GIRS towards PBO-nets or dual AI nets.

However, the use of PBO-nets has been welcomed by most stakeholders and PMI has started to fund them for the first time this year at a low scale. Research suggested that they would be more effective than previously understood and some researchers suggested that they could also help in the long-run with resistance management as they are using an additional insecticide class.

### **Cost-effectiveness, including operational costs**

The operational costs have to be taken into consideration when assessing the cost-effectiveness of IRS as well as the impact that a reduction in commodity pricing can have. For example, the PMI IRS comparative cost analyses<sup>73,74</sup> showed that the costs of insecticides were around 25% in 2017 and 2018. AGAMaL stated that the share of commodity costs could be higher especially in areas that have already been sprayed previously (as there are fewer fixed costs in follow-up years).

Cost-effectiveness data is not really readily available in country, as mentioned above. At the current funding levels, there was no expectation that new costing data would result in a radical shift in their current demand in 3GIRS. Some argued that also the cost-effectiveness of ITNs would need to be revisited given low net usage rates in urban areas.

### **Sustainability of project activities**

#### **Forecasting**

The main concern has been around the sustainability of the global demand forecasting – i.e. what actor can ensure that the country specific demand is bundled and then communicated to manufacturers, and related, who would use the global demand forecast to negotiate further price reductions.

It was suggested that sustainability, from the perspective of sharing learning across settings / countries to boost strategic decision making, could be boosted by a workshop or another such platform. It was suggested that the RBM Vector Control Working Group meetings could also be helpful in this regard.

In contrast, country specific forecasting was seen as less of a concern as stakeholders felt that there was sufficient country capacity and a good forecasting tool to successfully forecast 3GIRS demand across the different products.

#### **Capacity building**

It was felt that the project was successful in building in-country capacity that will be used further (i.e. forecasting, understanding on pricing and demand/supply, understanding of IRS products).

#### **Use of evidence**

So far, the evidence provided directly through the project did not make a clear difference for in-country decision-making. This might change after the additional publication after the end of the project.

---

<sup>73</sup> PMI (2018) PMI Country Programmes: 2018 comparative cost analysis

<sup>74</sup> PMI (2017) PMI Country Programmes: 2017 comparative cost analysis

# Appendix H UGANDA CASE STUDY

## H.1. COUNTRY CONTEXT

Uganda is the fifth highest contributor to the global malaria cases at 4% of global cases and the ninth highest contributor to the global malaria deaths at 3% of global deaths.<sup>75</sup> Malaria is highly endemic in most of the country with all year transmission in over 95% of the country.<sup>76</sup> Malaria transmission in Uganda has transitioned from largely high transmission with parasite prevalence average of 42% in 2009 to moderate transmission with average parasite prevalence of 19% in 2014 and 9% in 2018.<sup>77</sup>

As per WHO guidelines for countries with similar levels of malaria, LLINS and/ or IRS are the two main interventions to be deployed to achieve universal population coverage with malaria vector control. Larval Source Management (LSM) is another key intervention to be deployed in areas where appropriate.<sup>78</sup> IRS is very popular in Uganda – especially as it does not need to rely on social and behaviour change communication strategies and people changing their behaviour and does not have the disadvantage of wear and tear of nets. However, the government does not have the resources and therefore is highly dependent on donor funding (especially PMI whose funding envelope can be variable year on year).

Uganda has been using IRS since 2006. From 2009 to November 2014, Uganda implemented IRS in eleven districts in Northern Uganda that contributed to reduction in malaria prevalence from 63% to 7.5% in the implementing districts.<sup>79</sup> Following the cessation of IRS in these districts, an upsurge in malaria cases resulted and persisted through 2015 and 2016. In 2016/2017, with support from Global Fund, the MoH supported these 11 districts to conduct IRS as part of the epidemic response. This upsurge in malaria post the cessation of IRS has served as a lesson learnt both for Uganda, and other countries, around the importance of sustainable financing for IRS and/ or having a strong exit strategy following the withdrawal of IRS.

The Uganda Malaria Reduction Strategic Plan targeted to scale up and sustain indoor residual spraying (IRS) in 50 contiguous districts from the initial 10 districts at baseline. It was expected by 2017, 25 districts would be covered by IRS. However, in 2014, the original 10 districts were discontinued, and the programme moved to 14 new districts in North and Eastern Uganda. Hence, there has not been the planned increase in the number of districts covered by IRS over the review period, with the plans from the Uganda Malaria Reduction Strategic Plan, including the planned IRS expansion not being realised. The absence of expansion in the number of districts covered by IRS was due to lack of financing.<sup>80</sup> As noted in the lessons learnt from implementing the Uganda Malaria Reduction Strategic Plan, "If Uganda is to implement IRS in all its districts, the estimated cost would be US\$ 340 million annually".<sup>81</sup>

IRS is currently being conducted in 16 districts in Eastern and Northern Uganda.<sup>82</sup> The implementation of IRS is being funded by PMI who is covering 10 districts and DFID is covering the rest. Funds from the Global Fund have only been

---

<sup>75</sup> World Malaria report 2018

<sup>76</sup> Uganda National Malaria Control Programme (2019) Annual workplan for Uganda Malaria Reduction Strategy (2019-2020)

<sup>77</sup> Uganda Malaria Indicator Survey 2018

<sup>78</sup> Uganda National Malaria Control Programme, Ministry of Health (2018) National Malaria Control and Elimination Policy Second Edition (Draft). Towards a malaria - free Uganda

<sup>79</sup> Uganda National Malaria Control Programme (2019) Annual workplan for Uganda Malaria Reduction Strategy (2019-2020)

<sup>80</sup> Ugandan Ministry of Health (2017), Mid Term Review of the Uganda Malaria Reduction Strategic Plan 2014 - 2020

<sup>81</sup> Ugandan Ministry of Health (2017), Mid Term Review of the Uganda Malaria Reduction Strategic Plan 2014 - 2020

<sup>82</sup> These were previously 14 districts but two districts duplicated so the number of households covered is still the same

used to cover one round of IRS under the Global Fund epidemic response in 2016/2017 (i.e. this was not covered by the malaria grant).

Uganda was considered important to include in the project given that it makes up a relatively high proportion of the global procurement (one of the five biggest procurers), therefore making it important for manufacturers' volumes. Uganda received co-payment over the course of the project mostly for Actellic 300CS and then for SumiShield 50WG as well towards the end of the project.

## **H.2. RELEVANCE**

### **H.2.1.Qu 1: To what extent has the project been relevant and aligned with Unitaid's strategy, as well as needs identified in terms of priority global malaria prevention efforts?**

#### **Global malaria prevention efforts and IRM**

Overall the project has been seen as highly relevant in Uganda given the priority afforded to IRS within the country alongside the emerging resistance to carbamate resulting in a high need for 3GIRS products. The Insecticide Resistance plan notes that there is widespread resistance to DDT and pyrethroids and some isolated incidences of resistance to carbamates. The IRM therefore notes that there is a need to country needs to rotate two effective chemicals (e.g. a Carbamate with an Organophosphate).<sup>83</sup> In general, the stakeholders thought this was a very useful project at the global level in terms of market shaping interventions (especially through aiming to reduce the price of 3GIRS).

In addition, a perspective from the country level is that there is a need for 3GIRS products to be introduced and trialled in different country settings given a number of factors which affect efficacy of 3GIRS. In addition, there is a sense that IRS is not that well understood globally and therefore having the opportunity to further consider (and where possible obtain evidence) regarding country specific factors such as prevalence, coverage, materials used in household structures etc was considered important.

## **H.3. EFFICIENCY AND EFFECTIVENESS**

### **H.3.1.Qu 2: To what extent have project's outputs and activities been achieved/completed as planned and on time and budget? What factors have driven achievement/ non-achievement?**

#### **Time frame**

The first 3GIRS products were introduced in September 2017 and there were no particular delays reported. The main feedback from stakeholders was that it was considered that the project duration was too short. Some stakeholders considered that if the project lasted for longer, it may have furthered having a competitive market. As one stakeholder commented, "*The project is just starting, and only just got other chemicals to compete but now the project is stopping.*" Some stakeholders considered that if the project duration was extended, then other products may have benefited more from the subsidy (instead of Actellic 300CS being the primary product supported) and this may have aided a price reduction.

#### **Factors that have driven achievement/ non-achievement**

Linked to the fact that the project primarily supported Actellic 300CS in Uganda, it was noted that in terms of the project's efforts to stimulate demand for 3GIRS this may have had a negative effect to a small degree. For example, a number of stakeholders noted that Actellic 300CS has a number of undesired effects (such as an unpleasant smell, wall staining, and apparent "proliferation" of bed bugs related to Actellic 300CS) and perhaps more could have been

---

<sup>83</sup> Uganda National Malaria Control Program (2017) Insecticide Resistance Management Plan for Malaria Vectors in Uganda.

done to mitigate these upfront. There was resistance from a number of organic farmers in the country and more broadly acceptability varied in communities (however in general the coverage rate was similar to Bendiocarb around 90-92%). In addition, Actellic 300CS has the unique operational consideration that it uses bottles rather than sachets. This posed some operational logistics challenges (e.g. transportation, storage and disposal) that would not have been there with another 3GIRS products including reportedly increasing the operational costs.

### **H.3.2. Qu 3: To what extent were the chosen activities, outputs and related targets appropriate to reach the intended project goal?**

#### **Demand underwriting mechanism appropriate to help manufacturers to enter the market and lower product prices**

Not that many stakeholders were aware of the demand guarantee but those who were aware of it, thought that it did help manufacturers to lower product prices. The majority of stakeholders considered the global volume forecasting to be a more important component in terms of lowering prices and considered this to have been a key benefit of the project.

#### **Support for improving the global and in-country demand forecasts for 3GIRS products an appropriate activity**

The country demand forecasts were considered to be useful for a number of reasons. The tool itself was noted to be easy to use, including to enable quantification across different insecticides. In particular, the forecasting exercises were considered to have benefited coordination across stakeholders and aided planning as stakeholders using IRS from Abt Associates, NCMP and Pilgrim Africa all attended training. Given that the country has not had a shortage of supply for insecticides, stakeholders considered that quantification was done well. However, as evaluators we recognise that that may also have meant wastage of the product (although the shelf life is not short) and that quantification should be assessed in terms of both over and under supply.

Something that many stakeholders highlighted to be useful was the cross-country learning around the multi-country workshops which was also highlighted in the 2016 Annual Report. Through the workshops in which different countries presented their plans, the importance around the need to quantify the right orders as well as the need for advanced planning was better understood. In addition, it was considered to have helped with uniformity in forecasting across countries (including in relation to the timeframe). Stakeholders also noted that they were able to benefit and learn from the IVCC Regional Coordinators' technical expertise.

#### **Target for the 3GIRS product price of US\$ 15 and the methodology for its selection at the start of the project**

From country stakeholders' perspective, the decrease in product price to US\$ 15 from US\$ 23.50 is noted as positive but US\$ 15 is still considered to be too much and therefore it is seen as an insufficient target. It was raised whether the US\$ 15 price point adequately factored in the other products (i.e. SumiShield 50WG and Fludora Fusion) which are cheaper to produce than Actellic 300CS. Stakeholders were of the opinion that efforts should have been made to reduce the price further with activities potentially including: (i) using more of the co-payment subsidy on other products to further reduce the price and (ii) including additional countries which could potentially have facilitated a further increase in uptake in a number of countries, thus facilitating economies of scale. Stakeholders thought countries not already spraying could have been included in addition to those already spraying. In general, a number of stakeholders consider that US\$ 8-10 would be a better price point.

#### **Communication/ advocacy activities around 3GIRS implemented by IVCC and how useful these were in terms of increasing demand for IRS**

The main ways in which stakeholders benefited from communication and advocacy activities around 3GIRS was from information received at the workshops as well as a monthly package of information regarding IRM. This included quantification training, understanding of the market.<sup>84</sup> Information was then reportedly shared with the IRM technical working group.

---

<sup>84</sup> It was not possible to obtain further details about these activities.

Stakeholders highlighted that the workshops were useful to aid learning from other countries, as well as across Ugandan stakeholders given they were convened in the same location.

However, many stakeholders consider that more needs to be done in terms of advocacy for 3GIRS at the country level as well as globally. At the country level, stakeholders thought it would be beneficial for evidence to be shared more directly with malaria programmes. In addition, it was suggested that the most effective advocacy would need to be country, or otherwise regionally led. There is an opinion that the 'nets lobby' has done a better job of advocating than IRS which is considered to have resulted in less funds to be available globally for IRS. Generally, stakeholders considered that advocacy needs to be a key area requiring focus, especially if countries are aiming for malaria elimination given the part IRS is expected to play within this.

### **Evidence creation**

Under the project, an observational study was conducted in Uganda based on secondary data.<sup>85</sup> Stakeholders consider that there is a high need for evidence for IRS, including country specific evidence on effectiveness - so this component of the project was seen as positive. Stakeholders also consider that there a need for more evidence to inform WHO guidance where possible and recognise that evidence from countries would be useful for this, thus linking back to the understanding in country that IRS is misunderstood globally.

Evidence from other countries regarding the impact of 3GIRS on malaria programmes was also shared at the cross-country workshops. While stakeholders considered this to be useful, dissemination of evidence within country beyond the workshop attendees relied on the attendees disseminating it further to relevant individuals. Stakeholders were not sure that this was extensively done.

Many stakeholders noted the high need for more evidence regarding cost-effectiveness of 3GIRS. This is considered to be a significant factor in terms of limiting potential scale up of 3GIRS and to be of importance in terms of prioritising across products as well as informing resistance management decisions. For example, stakeholders would have appreciated further evidence as to whether 3GIRS products are cost saving in contrast to Bendiocarb given the duration of effect for 3GIRS is longer than that of Bendiocarb.

### **H.3.3.Qu 4: Was the allocation of project tasks appropriate between project stakeholders and to what extent has the collaboration/coordination between actors contributed to achievement of outcomes?**

The project is considered to have been well coordinated with clear tasks across stakeholders with one stakeholder noting that "*it's felt as if IVCC have been part of the team*". Whilst IVCC has not worked extensively in country, they have been noted to be very responsive and stakeholders considered that they brought project stakeholders together well (e.g. Pilgrim, NMCP etc.). IVCC helped to assist in obtaining the MoU at the start of the project which was noted to be extremely valuable. One minor issue which stakeholders suggested for next time is that it would have been beneficial for IVCC to further sensitise the government stakeholders regarding IVCC's mandate and their aims for the project, in particular that IVCC was not working for profit, as this apparently was not clearly understood.

### **IVCC leading the forecasting**

No concerns were raised regarding the fact that IVCC led the forecasting. The main criticism noted regarding the forecasting role is that the transition of this role/ oversight of the tool was noted to be too brief (discussed further below in sustainability).

---

<sup>85</sup> CEPA has received the preliminary results of the study (outlined in K.4). The full publication is forthcoming in 2020.



## **H.4. IMPACT**

### **H.4.1.Qu 5: To what extent has the project contributed to addressing critical access barriers that had previously limited the development and uptake for 3GIRS products? What may have happened in the absence of the project to the 3GIRS market?**

#### **Affordability of US\$ 15?**

##### **Product cost**

The affordability of 3GIRS products is considered to be the main barrier to scale up in Uganda. Stakeholders recognised that US\$ 15 was a much better price than US\$23.50. In addition, the importance of comparing the total cost of spraying was noted (i.e. durability of the product, the operational costs associated with the number of times spraying was required etc) rather than focusing more narrowly on product price. However, stakeholders considered US\$ 15 to be too high and “*still not affordable*” and another stakeholder commented that “*where the project has reached, 3GIRS is still not affordable, US\$ 15 is still too high*”. Stakeholders thought that a price point of US\$ 8 or US\$ 10 would be more affordable and make a big difference in terms of the number of districts which would be possible to cover.

For example, one stakeholder considered that the alternative option of carbamates was still more affordable from their opinion as even when the operational costs for additional rounds of spraying are factored in, carbamates are considered to be 50% of the alternative cost for 3GIRS.

Price was a big factor in terms of considering domestic resources but also in considering what interventions the country may request from donors, especially the Global Fund, where IRS was not included in the last funding request, primarily because of cost.

A significant concern at the country level is whether the price of US\$ 15 may increase again in the near future (even though the project has secured a price cap of US\$ 15 at least for two years). Stakeholders also recognised the risk that with more manufacturers in the market, this may result in a smaller market share for each of the manufactures which may reduce economies of scale for the manufacturers. A concern for them is whether these costs may then be passed on to countries in the product price.

##### **Operational costs**

Based on a study conducted, operational costs make up 34% of IRS programmes while the insecticide (Actellic 300CS) is 66% of the costs.<sup>86</sup> Therefore the cost of the product is significant with other stakeholder noting, “*anyone who has run an IRS project knows that the biggest cost is the product*”. It currently costs approximately US \$30 per household to spray. There are potentially ways to reduce the operational costs which could perhaps aid scale up of 3GIRS (discussed further in the scalability section).

In relation to the use of Actellic 300CS in particular, there were differing views as to the impact on costs which using bottles had. Some stakeholders noted that because bottles were used instead of sachets, spray operators could not reach as many householders per day (eight with bottles instead of ten with sachets) and reportedly this had significant effects on the ability to expand coverage. However, others did not think bottles should have increased operational costs much and that 10-12 structures per day could be reached.

##### **Factors influencing the decrease in price?**

In general, stakeholders considered the main factors influencing the decrease in price to be (i) the co-payment which resulted in higher volumes from countries and (ii) the demand underwriting (which was further supported by firmer forecasts) and (iii) competition across the three 3GIRS products on the market.

---

<sup>86</sup> Tonny Odokonyero (2019), Financing Indoor Residual Spraying for Malaria prevention in Uganda: Options for cost minimization PowerPoint presentation

## H.4.2. Supply and delivery

### Extent to which country capacity to plan and forecast IRS has improved, and any key positive or negative influencing factors

Stakeholders reported that the capacity to forecast has improved, especially in relation to (i) quantification across different 3GIRS products and (ii) coordination and associated planning to ensure timely quantification across stakeholders. Stakeholders recognised there has been a much better understanding of the importance of timely forecasts at the country level to lead into consolidated country demand forecasts and clearer deadlines to submit country level forecasts.

In 2017 Uganda forecast a 16% higher than expected procurement of Actellic 300CS.<sup>87</sup> In 2018, the forecast was more accurate with procurement being a bit higher than need (10%)<sup>88</sup> but stakeholders did not consider this to be an issue as the excess insecticide could be used in subsequent years and it was considered more important than having a stockout.

## H.4.3. Demand and adoption

### Extent to which uptake and coverage of 3GIRS products has increased

Demand for IRS, including 3GRIS given resistance challenges, is a very high in Uganda. If cost was not an issue, stakeholders indicated that IRS would definitely be the preferred vector control intervention. However, adoption of 3GIRS has not increased as much as initially expected over the course of the project.

Actellic 300CS was introduced for the first time in Uganda in 2016 by Abt Associates under the Vectorlink Project.<sup>89</sup> With the co-payment under the NgenIRS project, it was hoped that IRS coverage would increase to another two districts (in addition to the existing 15 districts) based on the cost savings on the product in comparison to Bendiocarb. However, whilst the cost-saving did mean that the same coverage of IRS (for 3GIRS instead of Bendiocarb) could be maintained, it was reportedly not possible to spray additional districts beyond those in which Abt Associates was already spraying in due to the additional operational costs of spraying Actellic 300CS. However, the fact that coverage was able to be maintained in all districts (instead of otherwise having to scale back in some districts due to the higher product cost) was noted to be due to the co-payment.

### Drivers for countries to choose or not to choose to introduce/ scale up IRS (evidence, co-payment mechanism, broader considerations regarding the mix of vector control interventions and rotation)

#### Insecticide rotation

The Insecticide Resistance Management plan highlights the need to rotate two effective chemicals<sup>90</sup> and notes concerns regarding using one product for too long in case of resistance. As such stakeholders all recognise the key advantage that the project has offered in terms of facilitating the use of additional products, especially as the country is now planning to switch from Actellic 300CS to Fludora Fusion (a decision made by the MoH).

#### Decision making criteria

Stakeholders in Uganda considered the following to be the most important aspects to consider in terms of **choice of insecticide**:

- The primary reason is levels of resistance with stakeholders noting, “*otherwise the insecticide is useless*” and “*we really don’t want resistance to increase*”.

---

<sup>87</sup> 2017 NgenIRS Project Annual Report

<sup>88</sup> 2018 NgenIRS Project Annual Report

<sup>89</sup> Abt Associates Inc (2016), Uganda Indoor Residual Spraying Project Phase II. End of Spray Report April – July, 2016

<sup>90</sup> Uganda National Malaria Control Program (2017) Insecticide Resistance Management Plan for Malaria Vectors in Uganda

- Cost and cost-effectiveness of products.
- Degree of knowledge about 3GIRS and its benefits especially in relation to resistance.
- Degree of knowledge about positive and negative attributes of 3GIRS products and “*national politics*” given different manufacturers are competing for share of the market.
- Acceptability at a community level. Whilst uptake remained above 90% (generally between 92-95%), some issues in terms of uptake that were experienced included:
  - Smell of Actellic 300CS was an issue for some communities;
  - The residual stain on the walls that Actellic 300CS left;
  - A perception amongst organic farmers who thought their crops may be compromised post spraying (this has not been proven and is now less of an issue).
  - The fact that Actellic 300CS irritated bed bugs so they became more apparent, but it did not eradicate them like some other insecticides. In contrast, stakeholders consider positive attributes for Fludora Fusion and SumiShield 50WG to be the fact that they are odourless and kills bed bugs.

In addition to the points raised above, in terms of **decisions to scale up IRS**, these are reportedly based on:

- The entomological situation, i.e. burden of disease, transmission rates, biting rates etc.
- Availability and cost-effectiveness of other vector control interventions (e.g. nets) at a country specific level.
- Acceptability of IRS in the country more generally (which is it noted to generally be acceptable and appreciated). Stakeholders consider that in general where people have access to IRS, they consider it to be more appreciated than nets given that “*people are still disturbed by mosquitoes with nets but if your house has been sprayed, you are not*”.
- The ability to sustain the intervention for a long period of time and/ or the tools available to ensure a strong exit strategy which does not allow for the resurgence of malaria.
- Issues of cross-border transmission and the risks that this might pose.
- Political will and government commitment to IRS long term. Recognise need for government support in the long term.
- Expertise in country – are the NMCP able to lead the implementation as well as entomological surveillance for pre and post IRS monitoring etc.?

#### **What might have happened in the absence of project (counterfactual)**

The main value add of the project is considered to include:

- Maintaining coverage of the insecticide due to the reduced cost of the insecticides.
- Introduction of 3GIRS which will help significantly with issues of resistance, especially given emerging carbamate resistance.
- The benefit offered through the workshops to learn about other 3GIRS which helped Uganda to make an informed decision to switch products.

#### **H.4.4. Qu 6: What has been the public health and economic impact of the project?**

##### **Direct and indirect (future)**

Through the co-payment for the insecticide, it has been possible to reach additional districts and individuals with 3GIRS than it would have been possible to reach without the co-payment. Reportedly this is approximately two to three districts that otherwise would not have received 3GIRS as the budget would have remained constant. In 2019, approximately 260,169 additional structures were to be targeted. This represents a 19% increase as compared to the

number of structures targeted without co-payment. With the co-payment, approximately 842,870 additional people were expected to be protected.<sup>91</sup> However as noted above, this did not result in additional districts being covered by IRS in comparison to spraying under Bendiocarb, which was initially expected.

The retrospective evaluation in Uganda undertaken within the NGenIRS project which assessed the effectiveness of IRS in 2015 and 2016 across Northern and Eastern Regions, demonstrated a 38% reduction in malaria cases after 3GIRS compared to non-IRS districts in 2016. In addition, the effect of one round of 3GIRS was similar to the effect of two or three rounds of Bendiocarb.<sup>92</sup> More broadly, a number of positive effects of IRS (rather than 3GIRS) have been noted in Uganda such as a study which showed the IRS helped to combat malaria in pregnancy and for improving birth outcomes.<sup>93</sup> In addition IRS was noted to be beneficial for targeting other vectors and thus the general health condition of the household can be improved.

#### **Addressing resistance challenges by allowing countries to rotate between classes of insecticides**

Stakeholders consider the project to have significantly benefited resistance management efforts in the country, especially given the high resistance to pyrethroid and emerging resistance to carbamates. In addition, the Insecticide Resistance Management Plan stipulates that given financial constraints, in Uganda, the change of an insecticide will routinely be carried out every 3 years.<sup>94</sup> Districts will be stratified to allow proper planning and implementation of interventions (IRS and LLINs). The plan suggested the need for Organophosphates (before neonicotinoids were an option) and therefore stakeholders consider the project to have been very beneficial in facilitating access to more insecticides in the market. As one stakeholder commented, “*we knew they needed to shift to 3GIRS because of resistance and we knew already that it was time to rotate from carbamate and this came at just the right time.*”

#### **H.4.5.Qu 7: Does the Unitaid investment in this project demonstrate value for money?**

##### **Bringing together the public health and market impact achieved today as well as its potential going forward**

Overall stakeholders considered that the project demonstrated value for money. Specific aspects noted include: (i) additional coverage of 3GIRS (although not in comparison to IRS); (ii) enhanced learning, including from other countries at meetings, (iii) quantification for IRS has been aided by an easy to use tool.

### **H.5. SUSTAINABILITY**

#### **H.5.1.QU 8. What are the prospects for scaling up the market for 3GIRS products? What is the likelihood of the project outcomes being sustained?**

##### **Scalability**

Overall stakeholders other than donors remain committed to IRS being scaled up in Uganda and for IRS to be conducted in 50 districts as per the national implementation plan. However, this would primarily be dependent on donor commitments as well as the product price which is currently limiting scale up. Therefore, it is considered unlikely that IRS will be scaled up much in the short term.

##### **Secure funding: Funding support there is from country governments and donors currently**

---

<sup>91</sup> Abt Associates (2019), Uganda NGenIRS Country Implementation Plan

<sup>92</sup> IVCC (n.d.). Evidence slides

<sup>93</sup> Muhindo, M.K., Kakuru, A., Natureeba, P. et al. Reductions in malaria in pregnancy and adverse birth outcomes following indoor residual spraying of insecticide in Uganda. *Malar J* 15, 437 (2016) doi:10.1186/s12936-016-1489-x

<sup>94</sup> Uganda National Malaria Control Program (2017) Insecticide Resistance Management Plan for Malaria Vectors in Uganda

Support for 3GIRS currently is from PMI (ten districts) and DFID (six districts) and these funds are all channelled through PMI to Vectorlink. Given the majority of funding is from PMI which works on annual budgets, this makes it hard to plan ahead. There has only been a small amount of support from the government for IRS operational aspects.

### **Secure funding: Funding support there is from country governments and donors expected in future**

Recommendations from the Mid-term review of the Uganda Malaria Reduction Strategic Plan 2014-2020 included prioritisation of hot spot districts in the country with IRS alongside rolling it out across a wider geographic coverage in a cost effective manner.<sup>95</sup> As one stakeholder noted, “*IRS is extremely popular politically and from the public*” (especially given that it does not need to be linked to additional behaviour change strategies etc.) and as such there is high potential for scale up. Stakeholders are also considering prioritising hot spots at the sub-district level and recognise the value that IRS offers in potentially responding very quickly to malaria outbreaks if it is not possible to spray more widely. However, the main barrier remains the limited funding envelope in which the government is currently reliant on donors for support.

Currently, the 3GIRS forecasts are 650k for 2020 and 630k for 2021 which is similar to previous years. Uganda has chosen to shift the product of choice to Fludora Fusion as it was considered appropriate to change products to avoid potential development of resistance to Actellic 300CS. However, for 2020, Uganda plans to be spray in 16 districts of which 13 districts will be covered by Fludora Fusion and Actellic 300CS will be used in two districts and SumiShield 50WG in one from the balances left over from 2019.

### ***Plans for scale up***

Whilst the Malaria Reduction Strategy has ambitious plans for scale up of 3GIRS, an interim goal reportedly is to scale up to 20 districts in the next few years. However, this will be significantly dependent on the provision of support from donors. PMI is seen as the most likely to continue to fund IRS. Support from DFID for IRS is being withdrawn over the next few years with plans to withdraw funding from two districts in 2021 and to fully withdraw support by the end of 2022. This is reportedly not due to a specific withdrawal of support for IRS but rather DFID’s shift away from disease specific support to cross-cutting aspects such as HSS. Whilst the transition plan has not been confirmed, there have been initial discussions with PMI, Global Fund and the Government of Uganda around potential to take on this support as well as whether hot spots may be prioritised instead of the whole districts once detailed stratification has been undertaken.

The Global Fund funding request process is due to start in January 2020 and therefore funding for IRS from the Global Fund is unknown. However, given that IRS was not included in the malaria grant in the past two years, it is currently not expected that it would be a large component of the funding request. There is a perception that the Global Fund has not have much appetite to support IRS with one stakeholder commenting that “*the Global Fund doesn’t touch IRS, just PMI and DFID*”.

Stakeholders do not think it will be likely to get an increased commitment from the government, NGO involvement is likely to be limited, and as such it is recognised that scale up is likely to happen in the short term.

More broadly, sustainable financing is an important aspect that stakeholders in Uganda are aware of factoring into decisions to scale up IRS given the previous upsurge post IRS withdrawal. Therefore, stakeholders recognise IRS needs to be able to be continued or a clear exit strategy needs to be developed.

### **Scaling up Coverage:**

#### **Potential for new ways to increase market – NGOs**

In 2019, Pilgrim Africa an NGO ran IRS operations with some financial support from the NMCP. The government is now exploring other models to engage NGOs/ private sector including Pilgrim Africa. This is seen as a potential option going forward but one of the issues (not specific to Pilgrim Africa) is that there are concerns regarding issues of safety and environmental compliance when contracting NGOs. Stakeholders understand the importance of having a well-

---

<sup>95</sup> Ugandan Ministry of Health (2017), Mid Term Review of the Uganda Malaria Reduction Strategic Plan 2014 - 2020

run programme which are quality-assured, and this often means that they are relatively expensive – which is considered to be a prohibitive factor for larger scale scale-up with NGOs.

### **Potential for new ways to increase the market – private health sector or private sector**

In terms of potential for scale up through the private sector, whilst some opportunities are considered, in general it is not expected to be particularly likely. The following barriers and opportunities noted:

- Some stakeholders consider that the private market could be an option, especially as pumps are currently available on the market. However, the primary concern is the existing weak system to monitor the quality of insecticides (not 3GIRS) that are used for IRS in the private sector. The weak system of quality assurance has led to application of unapproved or poor-quality insecticides for households that would want to use private IRS operators.<sup>96</sup> Therefore stakeholders are concerned regarding insufficient quality assurance of 3GIRS products and the potential for counterfeit insecticides.
- Larger private companies such as oil and tea estates have reportedly expressed some interest in providing support for IRS in their communities. Based on activity from some large companies (e.g. Kakira sugar company) which have invested in malaria, they could be useful for spraying of their work buildings and staff buildings. However, in general these are not considered to be reliable options for the long term. In addition, challenges around coordination to pool resources for economies of scale for procurement were highlighted.
- Options that are recognised as being more viable include spraying in boarding schools, hospitals, prisons and other institutions. There is potential for the impact in these places to be far reaching, and for this to be easier to coordinate.

Overall stakeholders considered that while the private sector could provide some opportunities for 3GRIS, it is unlikely to significantly increase coverage.

### **New ways to maximise budget envelope**

The NMCP is exploring ways to potentially reduce operational costs such as potentially using community-based structures.<sup>97</sup> Reportedly Vectorlink uses US\$ 1m per district but there are estimates that a community led approach can be 50% cheaper and therefore coverage could potentially be increased within same budget envelope.

### **Number of products is considered to be to be sufficient and/ or necessary**

As noted above, stakeholders consider it to be extremely important to now have two classes of 3GRIS insecticide and are also grateful that there are two options within the neonicotinoids class between Fludora Fusion and SumiShield 50WG.

### **Overall market expectations (especially impact of new LLINs)**

In general, stakeholders were much more positive about the role of IRS in terms of vector control rather than LLINs. Without strong evidence around PBO nets and LLINs, most country stakeholders anticipate that the market will not increase significantly for nets at the country level. However, given that vector control activities are heavily supported by donors, the main reason why stakeholders considered that nets may be scaled up instead is if that is the intervention which donors prefer to support.

---

<sup>96</sup> Ugandan Ministry of Health (2017), Mid Term Review of the Uganda Malaria Reduction Strategic Plan 2014 - 2020

<sup>97</sup> Tonny Odokonyero (2019), Financing Indoor Residual Spraying for Malaria prevention in Uganda: Options for cost minimization powerpoint presentation

## **H.6. SUSTAINABILITY**

### **Sustainability of project activities**

#### **Transition generally**

A number of stakeholders did not know that the project was ending as they were surprised when the project's end date was announced with one stakeholder stating that “*transition issue not handled early enough as it only came in this year and it should have come in last year*” It was considered that a number of countries were not prepared for the exit, as there had been an understanding that IVCC would continue to help them with the forecasting and engaging with manufactures for longer. In addition, as noted above, country level stakeholders were also not aware of the price cap of US\$ 15 (procurement volumes dependent) for the upcoming two years.

#### **Capacity building**

Through workshops and ongoing training, stakeholders consider their capacity to have been built with regards to IRS planning, insecticide choice and use of entomological studies. Some stakeholders also noted that capacity has been strengthened for the MoH and for districts around conducting IRS including around areas beyond vector control such as SBCC and IEC.

Another main area of capacity building is around IRS product forecasting which most stakeholders consider to have been done well.

#### **Forecasting and product price**

As noted above, a concern at country level is what might happen to the market without IVCC being involved and whether prices may then increase – which many stakeholders think they are likely to do so. In particular this is linked to a concern about the coordination of the consolidation of country forecasts and if countries put in orders separately, whether US\$15 could still be guaranteed. Therefore, a key area for concern around who will undertake the role around the global consolidation of forecasts. It is not currently known whether RBM may take on this role. Linked to that, most stakeholders thought the forecasting tool was likely to continue to be used but this was not certain, especially if the organisation who takes over the forecasting may require a different tool.

#### **Use of evidence**

There was a sense that the evidence generated through the project has not been widely used, although it has not been possible to validate this given the limited information about the study.

## Appendix I KEY FINDINGS FROM THE REMOTE COUNTRY CASE STUDIES

This appendix presents the key findings from the remote country case studies in Ethiopia, Mali, Tanzania and Zambia. These are based on a document review as well as a limited number of remote interviews with key stakeholders.<sup>98</sup>

Table I.1: Key findings from remote country case studies

Evaluation Question	Ethiopia	Zambia	Mali	Tanzania
<i>Q1: To what extent has the project been relevant and aligned with Unitaids strategy, as well as needs identified in terms of priority global malaria prevention efforts?</i>	NgenIRS project helped raise awareness of existence of alternative products.	Developed elimination strategy to blanket-spray all districts in 2019.	Stakeholders stressed the project greatly contributed to expanding IRS coverage.  Improved insecticide resistance management by disseminating information and enabling the adoption of a second kind of 3GIRS.	Tanzania has been using two different types of insecticides as part of their IRM implementation efforts.
<i>Q2: To what extent have project's outputs and activities been achieved/ completed as planned and on time and budget? What factors have driven achievement/ non-achievement?</i>	Targets for conversion of overall demand of IRS to 3GIRS not achieved by 2019.  Government prefers non-3GIRS insecticides locally produced and packaged as it supports local manufacturer.	Able to procure additional bottles of Actellic 300CS in 2017 without co-payment at the discount price of \$19.30 under the volume guarantee agreement.	Spray coverage achieved was 95.9% of structures identified.  Security concerns and a shortage of insecticide due to practice of double spraying hindered 100% completion.	Coverage has not expanded in Tanzania despite cost savings due to the reduction in PMI funding for IRS over the same period.  There has been high variation in the demand forecasting for mainland Tanzania (i.e. actual usage was 54% below the forecast in 2018 and 57% above in 2017).  One reason for the high variation has been the switch of target districts (in part due to resource constraints)
<i>Q3: To what extent were the chosen activities, outputs and related targets appropriate to</i>	Evidenced produced in-country revealed 3GIRS products other than Actellic 300CS are not as effective as expected but more trials are underway.	Computer-based tool assisted capacity building by helping with meetings, quantification of products and costing.	Cost reduction was key to expanding IRS coverage.  The project improved forecasting activities by making it easier to consolidate data.	The forecasting workshops were seen as useful by stakeholders, but they did so far not allow to overcome the forecasting variance (figures for 2019 are still outstanding).

<sup>98</sup> Interviews with three country stakeholders were completed for Tanzania and Zambia. Two interviews were completed for Ethiopia and Mali and therefore the findings are less robust.



<p><i>reach the intended project goal?</i></p>	<p>Stakeholders expressed need to create forum to aid countries in decision making to change choice of 3GIRS products.</p> <p>Forecasting tool has been useful, especially to aid coordination across country stakeholders but further capacity building is needed.</p> <p>Attendance of relevant stakeholders at workshops supported knowledge sharing across stakeholders (government and others).</p>	<p>Project facilitated receiving programme and government forecasts early, which enabled more accurate planning.</p> <p>A remaining challenge is that forecasts may come in early, but government fund allocation is variable and additional commitments from donors are needed.</p>		<p>Interviewed stakeholders did not recall any presentation on the public health or economic impact of 3GIRS through the NgenIRS project.</p> <p>US\$ 15 was seen as an appropriate price target though a better knowledge of supplier costs could have enabled to push for an even lower price.</p>
<p><i>Q4: Was the allocation of project tasks appropriate between project stakeholders and to what extent has the collaboration/coordination between actors contributed to achievement of outcomes?</i></p>		<p>Project coordination with Abt. Partners and IVCC was successful and information was disseminated in good time.</p>	<p>Effective and close collaboration between partners, subcontractors, and government authorities at the national, regional and district levels was appropriate, and stakeholders considered it a key factor in improving technical capacity and expertise.</p>	
<p><i>Q5: To what extent has the project contributed to addressing critical access barriers that had previously limited the development and uptake for 3GIRS products? What may have happened in the absence of the project to the 3GIRS market?</i></p>	<p>In 2017, 28 of 36 districts covered by IRS programme transitioned from Bendiocarb to Actellic.</p> <p>Government interested in scaling up IRS using Fludora Fusion and SumiShield 50WG given perception of long durability (6-8 months) but consider further evidence to be needed.</p> <p>Slow overall adoption of 3GIRS</p> <p>Price of USD\$ 15 is seen as more affordable and encouraged stakeholders to somewhat expand 3GIRS.</p>	<p>Procured significantly larger volumes of insecticide thanks to price reduction.</p> <p>There is demand for IRS through political willpower to fund IRS and find ways to decrease costs such as community-based implementation.</p>	<p>\$15 is not seen as a sufficiently low price to maintain coverage after the project ends, given that stakeholders find it hard to prioritise on a cost-effectiveness basis when ITN coverage could be significantly expanded instead.</p>	<p>The co-payment and price reductions to US\$15 have been seen as key achievement of the project.</p> <p>Without the project, 3GIRS use would have seriously contracted especially given also cuts to the PMI budget.</p> <p>In short-term, 3GIRS use may have reduced to half (i.e. going down from 7 to only 3 or 4 districts). In long-run, the price of US\$ 23.50 would have made IRS campaigns unsustainable.</p>
<p><i>Q6: What has been the public health and economic impact of the project?</i></p>	<p>Increased coverage by 36% (265,971 structures) in the target districts thus protecting some 675,776 persons</p>	<p>Additional 988,000 people protected by 3GIRS in first year (2016), representing a 61% increase relative</p>	<p>The use of 3GIRS has led to a 32% reduction in malaria cases, averting a total number of 350,000 in 3 years.</p>	<p>There has been a general understanding that IRS use helped with reducing malaria incidence in sprayed districts.</p>

	<p>who would otherwise have not received this intervention.</p> <p>Pilot planned to trial introduction of new 3GIRS products SumiShield 50WG and Fludora Fusion after 2019 which may support rotation strategies.</p> <p>Rotation strategies are expected to preserve the effectiveness of the country's preferred insecticide – Propoxur.</p>	<p>to projected 3GIRS coverage without co-payment.</p> <p>Enabled information exchange on vector control and resistance management alternatives, as well as testing of resistance profiles.</p> <p>Now able to better manage resistance challenges of using pyrethroid nets and IRS with 3GIRS Actellic 300CS was sprayed for 5 years so project was critical to resistance management by making it possible to switch completely to other types of highly effective molecules.</p>		<p>However, additional information around the specific public health impact and cost-effectiveness of 3GIRS would have been useful, especially in the context of the reduced PMI funding envelope and the increased use of PBO nets.</p>
<p><i>Q7: Does the Unitaid investment in this project demonstrate value for money?</i></p>			<p>Recent evidence generated by IVCC/PATH shows that 350,000 cases were averted at a cost of \$6.76 per case, which is considered cost-effective by WHO standards.</p>	<p>Stakeholders lack sufficient evidence on cost-effectiveness to comment directly on the value for money of the project.</p>
<p><i>Q8: What are the prospects for scaling up the market for 3GIRS products? What is the likelihood of the project outcomes being sustained?</i></p>	<p>Essential to generate local evidence considering water and soil characteristics that government will trust.</p> <p>Scale up is strongly contingent on price and if it were to increase after the project, it would reportedly be prohibitively expensive.</p> <p>Country was able to conduct accurate forecast in 2018 and procured 100% of validated volume of Actellic 300CS.</p> <p>Actellic 300 CS has now been registered in Ethiopia for public health purposes.</p>	<p>Became large consumer of 3GIRS with plans to use 3 insecticides in 2020 campaign</p> <p>Plans are in place to deploy IRS in 50% of districts in 2020 and 2021, and provide 60% with nets (ie 10% overlap)</p> <p>Interest from mining companies to participate in public private partnerships can support continued funding.</p> <p>VCTWG active and meet quarterly, includes sub-committee on resistance management.</p> <p>Stakeholders expressed end-of-project meetings would be valuable to disseminate evidence, lessons learnt and recommendations.</p>	<p>There are no domestic financing plans for IRS, so project activities and outcomes are dependent on PMI funding.</p> <p>Annual approval of plans by donors discourages domestic commitment to finance IRS as there is no guarantee external funds will cover a proportion of demand.</p>	<p>Tanzania recently rolled out PBO-nets in four regions and is expected to cover the other regions over the next few years. Depending on usage data and a successful rollout of PBOs over the next years, the use of 3GIRS may be scaled back after 2021.</p> <p>In the short-term, 3GIRS is likely to remain at current coverage levels (given current price) but overall use is ultimately driven by available donor funding. PMI's budget has stabilised at lower levels, but the use of Global Fund money during the next budget cycle could boost coverage beyond current levels.</p> <p>There will be continued use of 3GIRS products.</p> <p>Further capacity building for national staff for forecasting and quantification seen as needed for after the project ends.</p>

## Appendix J ASSESSMENT OF ROBUSTNESS OF FINDINGS

This appendix outlines our approach to assess the robustness of our findings.

Robustness of findings is based on both the underlying quality of the evidence, as well as triangulation, or quantity, of the evidence.

- In terms of quality, we will review the quality of the documentation and feedback by considering aspects such as reliability of the data and information (where possible/ relevant), significance of the consultee providing feedback for a specific issue (e.g. implementers are conflicted to provide positive rather than critical feedback, etc.).
- In terms of quantity, we will assess the extent to which findings can be triangulated across the sources of information. While measuring quantity, we carefully consider whether the documents only state the issue or provide details/ evidence in support of the stated issue. In terms of consultations, we will consider how many consultees responses supported the same view, or instances in which views might have been contradictory.

Bringing together these aspects of quality and quantity, we have adopted a four-point scale for the robustness rating as described in Table J.1 below. The relative balancing of the different aspects determining a specific rating can be evaluation question specific (e.g. whether all aspects need to be fulfilled or one or more aspects need to be fulfilled).

*Table J.1: Robustness rating for emerging themes/ main findings*

Rating	Description
Strong	<ul style="list-style-type: none"> <li>• The finding is supported by data and/or documentation which is categorised as being of good quality; and/ or</li> <li>• The finding is supported by majority of consultations, with relevant consultee base for specific issues at hand</li> </ul>
Good	<ul style="list-style-type: none"> <li>• The finding is supported by majority of the data and /or documentation with a mix of good and poor quality; and/ or</li> <li>• The finding is supported by majority of the consultations responses</li> </ul>
Limited	<ul style="list-style-type: none"> <li>• The finding is supported by some data and/or documentation which is categorised as being of poor quality; or</li> <li>• The finding is supported by some consultations as well as a few sources being used for comparison (i.e. documentation)</li> </ul>
Poor	<ul style="list-style-type: none"> <li>• The finding is supported by various data and/or documents of poor quality; or</li> <li>• The finding is supported by some/ few reports only and not by any of the data and/or documents being used for comparison; or</li> <li>• The finding is supported only by a few consultations or contradictory consultations</li> </ul>

All robustness rankings will be relative robustness rankings, based on careful consideration and are ultimately judgement-based.

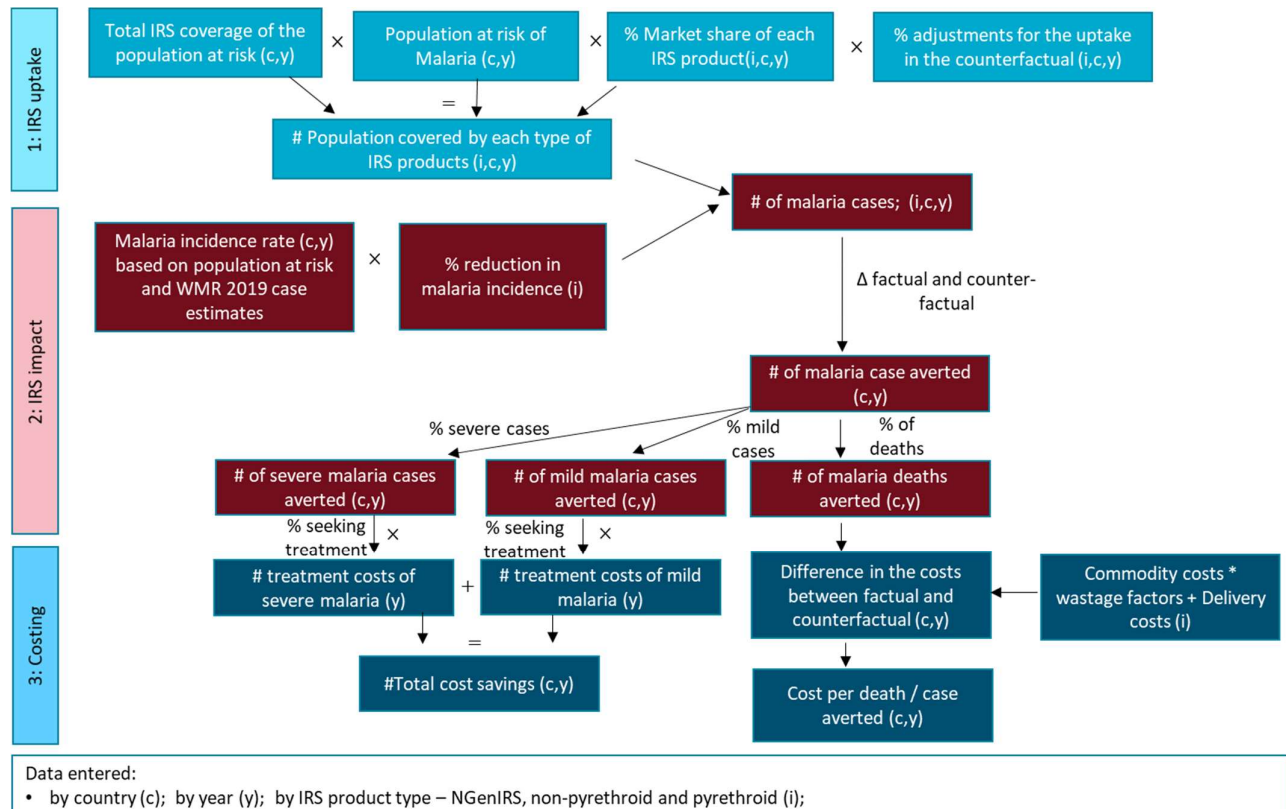
# Appendix K PUBLIC HEALTH AND ECONOMIC IMPACT MODEL

This appendix provides the background to the public health and economic modelling undertaken for this evaluation. It includes the model design (Section K.1), input sources and level of robustness (Section K.2) and the detailed input assumptions for each scenario (Section K.3). Lastly the final section also provides some background data on the health impact evidence and market forecasting conducted by IVCC (Section K.4)

## K.1. MODEL DESIGN

Figure K.1 below sets out the model framework of the NgenIRS impact model. The model calculations are differentiated into three parts: (i) IRS uptake, (ii) IRS impact and (iii) costing.

Figure K.1: Model framework of the NgenIRS impact model



## K.2. LEVEL OF ROBUSTNESS

Table K.1 describes the sources for the key input data and levels of robustness for each of the input assumptions. Overall, the quality of the data has some limitations which is reflective of the inherent challenges to gather accurate data on malaria cases, as well as the coverage and costing of IRS campaigns. In order to capture the uncertainty underlying most of these input assumptions, we varied the values across the developed conservative, central and best-case scenarios (see sub-section K.3. below).<sup>99</sup> Overall, we consider the inputs sufficiently robust to provide an accurate range for the impact of the NgenIRS project.

<sup>99</sup> Green represents inputs that are considered to be robust (though inherent uncertainty may remain). Yellow represents inputs that are considered to have some limitation and need to be considered with care. Red represents inputs that would not be considered robust.

Table K.1: Level of robustness of key input assumptions

Input	Description	Source	Robustness of evidence for inputs
Countries included	Countries that already use 3GIRS through the NgenIRS project or other African countries considered as likely to introduce 3GIRS in the future.	Based on data and expert opinion from Unitaid and IVCC	Countries covered by the NgenIRS project are known. Other countries likely to introduce 3GIRS can be known with reasonable confidence based on expert advice. Uncertainty will remain around introduction of 3GIRS in non-project countries.
Population at risk and coverage of IRS	Based on the World Malaria Report (WMR) 2019. Where necessary, figures were adjusted to reflect further insights from IVCC.	WMR 2019	There are some inherent inaccuracies in the WMR data. Where possible, these have been corrected following IVCC advice.
Malaria incidence rate	This has been calculated based on the estimated malaria cases (upper bound) and the population at risk in each country from the WMR (2019).	WMR 2019	The upper-case estimates from the WMR (2019) have been used to reflect that IRS is predominately used in high burden areas. The choice was also made based on the available evidence from the country studies (explained further below in K.2.1). Uncertainty remains as to whether the use of a national malaria incidence rate is the most appropriate.
3GIRS efficacy	The public health impact of 3GIRS products has been based on available evidence on the reduction of the malaria incidence rate in four country studies (in Mozambique, Ghana, Uganda and Mali).	Evidence generated through the NgenIRS project	While most of the evidence has not yet been published in peer-reviewed journals, it offers the most up-to-date and robust evidence on the public health impact of 3GIRS that is based on in-country data.
IRS product market share	Most project countries already had a market share of 100% for 3GIRS in 2018. It was assumed that this would continue over the period going forward. It was assumed that for the selected countries with a high likelihood of introducing 3GIRS, the market share would reach 50% by 2023.	NgenIRS project data and evaluator analysis based on expert opinion and data from Unitaid and IVCC	Current market shares are known for project countries and estimable for non-project countries, based on expert advice. Market share projections are inherently uncertain and are subject to sensitivity testing across the scenarios.
3GIRS in the counterfactual scenario	Determines whether people that have been covered with 3GIRS in the factual scenario would (i) still be covered with 3GIRS; (ii) be covered with non-pyrethroid IRS (i.e. carbamate-based IRS) or (iii) not be covered by any IRS product.	Evaluator analysis based on stakeholder consultations	Expert opinions from global and in-country stakeholders were used to create likely scenarios of what would have happened in the absence of the project. There is inherent uncertainty in determining a hypothetical counterfactual and as such the inputs have been subject to sensitivity testing across the scenarios.

Costing	PMI IRS costing analysis was used to estimate average operational costs per person covered as well as the average number of people covered per 3GIRS sachet / bottle.	Evaluator analysis based on PMI costing report and internal Unitaaid data	The cost inputs only reflect PMI countries and do not differentiate the costing between countries.
Inputs to monetarize health impact	In the central case scenario, the same inputs were used as in the seasonal malaria chemoprevention (SMC) model with regard to GNI per capita, life expectancy, discount rate, life value co-efficient, treatment costs and proportion of patients seeking treatment.	Evaluator analysis based on SMC model	The inputs have been aligned with Unitaaid's SMC impact model.

### K.2.1. Selection of the malaria incidence rate

The malaria incidence rate is calculated by dividing the estimated malaria cases with the population at risk in a country. The data has been used from the World Malaria Report (2019) which, despite its limitations, is a commonly used and reputable source on malaria burden which allows to use a standardised approach for inputs across countries.

The use of the upper-case estimates from the World Malaria Report (2019) was seen as more appropriate due to the fact that IRS is predominately used in high burden districts.<sup>100</sup> As such, the use of a national average malaria incidence rate would be likely to underestimate the impact. Additionally, the national case estimates of the World Malaria Report already include the effects of IRS and, thus, it was seen as more appropriate to use the upper bound case estimates to calculate the incidence rate to which the IRS effect size is applied.

The decision to use the higher case estimates was also supported when the results from the country studies in Ghana, Mali, Mozambique and Uganda were taken into consideration. The studies allowed to calculate a “case averted per person covered by 3GIRS per year” figure which we compared to the model intermediate outputs in Table K.2 below.

*Table K.2: “Cases averted per person covered by 3GIRS per year” compared by model calibrations and country studies*

Country	Study data provided by PATH/IVCC	Model estimates based on central WMR estimates	Model estimates based on upper WMR estimates
Ghana	0.14	0.07	0.14
Mali	0.20	0.12	0.22
Mozambique	0.07	0.09	0.16
Uganda	0.17	0.09	0.17

<sup>100</sup> In general, countries have followed former WHO guidance that 3GIRS be used in high burden areas but other criteria such as insecticide resistance, history of IRS and operational feasibility also play an important role in deciding on IRS target areas.

The data suggests that the best WMR estimates are more appropriate to capture the impact of the 3GIRS when compared with the study findings.<sup>101</sup> The study data includes only the reported malaria cases and as such still represents a conservative approach as the figures would be even higher when non-reported malaria cases are also considered.

### **K.3. MODEL INPUT ASSUMPTIONS**

Table K.3. sets out the key input assumptions across the conservative, central and best-case scenarios.

---

<sup>101</sup> The comparison across the malaria incidence rate reported by the studies is more difficult due to different methodological approaches, but overall the data also supports the conclusion that a malaria incidence rate based on upper WMR estimations is the more appropriate input choice for the model configuration.

Table K.3: Key input assumptions varied across scenarios

Area	Specific input	Conservative Scenario	Central Scenario	Best Scenario	Source	Rationale
Efficacy of IRS products	3GIRS	20%	30%	40%	Based on the evidence generated by NgenIRS project in Ghana, Uganda, Mali and Mozambique (forthcoming publication)	The forthcoming publication of the RCT and observational studies offer the most up-to-date account of the effect size of 3GIRS on the malaria incidence rate in countries.
	Non-pyrethroid IRS (i.e. Carbamates)	10%	15%	20%	Based on the evidence generated by NgenIRS project in Uganda	Assumption based on evidence from Uganda, where the impact of two rounds of non-pyrethroid IRS was shown to equal the impact the effect of one round of 3GIRS.
Malaria incidence rate	Malaria case estimates/ population at risk	Central case estimates	Upper case estimates	Upper case estimates	World Malaria Report (2019)	K.2.1 provides a full explanation of the selection of the upper-case estimates in the central scenario.
IRS coverage	Growth rate	-1%	0%	1%	Input assumption based on qualitative evidence	In the central case, we did not consider that there would be any substantial annual growth or decline in the overall IRS coverage in a country.
3GIRS market share forecast by 2023	Project countries	100%	100%	100%	Evaluator analysis based on past IVCC data as well as discussion with stakeholders	Based on the available qualitative evidence, it was deemed unlikely that project countries would switch back to non-3GIRS after the NgenIRS project.  In the central scenario, only a modest uptake in non-project countries has been assumed.
	Non-project countries in Africa with likely uptake	25%	50%	75%		
	Non-project countries in Africa unsure of uptake	0%	0%	50%		
	Non-project, non-African countries with chance of uptake	0%	0%	50%		



Distribution of 3GIRS in counterfactual 2016-19	% of people covered by 3GIRS in factual also receiving 3GIRS	50%	40%	30%	Evaluator analysis based on in-country and global stakeholder consultations and documentation review.	Based on gathered evidence from stakeholder consultations, some countries would have continued to use or introduce 3GIRS, albeit at a lower scale (e.g. Ghana, Zambia and, to a lesser extent, Tanzania). Other countries would have more likely continued to rely predominately on non-pyrethroid IRS (e.g. Ethiopia and Uganda) whilst others may have stopped using IRS altogether (e.g. Kenya). Based on the market size of these countries sensible input ranges across the scenarios were developed.
	% of people covered by 3GIRS in factual receiving non-pyrethroid IRS	40%	30%	20%		
	% of people covered by 3GIRS in factual receiving no IRS	10%	30%	50%		
Distribution of 3GIRS in counterfactual 2020-24	% of people covered by 3GIRS in factual also receiving 3GIRS	35%	25%	10%	Based on the IVCC input assumption used.	Due to restricted IRS product options and the resulting insecticide resistance issues, it has been assumed that the market for 3GIRS would have declined over time in the absence of the project. In order to reflect this trend, the input ranges have been adjusted for the future project impact (2020-24).
	% of people covered by 3GIRS in factual receiving non-pyrethroid IRS	30%	20%	5%		
	% of people covered by 3GIRS in factual receiving no IRS	35%	55%	85%		
Case fatality rate	-	0.3%	0.3%	0.3%	Based on the IVCC input assumption used.	IVCC (in conjunction with Imperial) consider this CFR to be appropriate for countries in sub-Saharan Africa.
Costing	Discount rate	7%	3%	3%	Jamison et al., Global health 2035: a world converging within a generation, The Lancet, Dec 2013. p.16	Based on commonly cited figures in the health economics literature and used in other Unitaid impact models.
	Prices of 3GIRS in factual (in counterfactual)	US\$15 <i>(US\$18)</i>	US\$15 <i>(US\$20)</i>	US\$15 <i>(US\$23.50)</i>	Based on NGenIRS project data.	Without the project, it was assumed that any potential price reductions that occurred due to competition would

						have been smaller than the reduction achieved under the project.
	Operational costs per person sprayed	US\$ 4.04	US\$ 4.04	US\$ 4.04	Based on the 2017 PMI IRS costing reporting.	
	Number of people covered by IRS product	9.9	9.9	9.9	Based on the 2017 PMI IRS costing reporting.	
Treatment costs	Severe malaria	US\$28	US\$28	US\$28	Gilmartin, C., Nonvignon, J., Collins, D., and Boucoum, F.I. K.Y. Cost- effectiveness and cost savings analysis of seasonal malaria chemoprevention in the Sahel. 2018. Prepared by Management Sciences for Health for the ACCESS-SMC project, p.25	Used in Unitaids SMC model
	Mild malaria	US\$8.9	US\$8.9	US\$8.9		
Value of life year gained	Life value coefficient	1.0	2.3	2.3	Jamison et al., Global health 2035: a world converging within a generation, The Lancet, Dec 2013. p.16	Used in Unitaids SMC model
	Population weighed average GNI per capita	US\$1,865.28	US\$1,865.28	US\$1,865.28	Estimates from Unitaids based on internal analysis.	Used in Unitaids SMC model

## K.4. IMPACT ASSESSMENT AND EVIDENCE GENERATED BY IVCC

This section contains information on the impact assessments and market growth scenarios conducted by IVCC.

### K.4.1. Public health impact assessment

Table K.4 below provides an overview of the conducted public health impacts generated by IVCC. Most of the generated evidence will also be provided through peer-reviewed papers in 2020.

*Table K.4: Available evidence on the public health impact of 3GIRS from IVCC*

Source	Time-frame	Geography	People covered by IRS	Reduction in malaria incidences	Malaria cases averted	Lives saved	ICER (per case averted)
NgenIRS Policy Recommendation to WHO	2016-18	All NgenIRS project countries	Not stated	20-40%	2.7m – 5.4m	8,120 - 16,240	Not stated
IVCC summary impact estimates	2016-19	NgenIRS countries (discounted and project countries)	122.1m	20-40%	5.0m – 10.1m	14,431- 28,862	Not stated
IVCC evidence summary	2012-14	Mali	Not stated	32%	350,000	Not stated	US\$ 6.76
	2015-17	Ghana	Not stated	40%	260,000	Not stated	US\$ 3.20
	2016-18	Mozambique	Not stated	22%	20,000	Not stated	US\$ 34.44
	2015	Uganda	Not stated	47%	245,00	Not stated	US\$ 41.25

### K.4.2. 3GIRS market scenarios

Figure K.2 below outlines the assumptions behind the 3GIRS market growth scenarios that IVCC developed as part of their application for a project extension. The key variables that have been varied between the scenarios included:

- Further funding for an extension of the NgenIRS project (NgenIRS plus);
- Variation in the median 3GIRS price;
- Uptake in Ethiopia;
- Market growth in existing project countries;
- Donor shifting resources towards or away from 3GIRS.

Figure K.2 Assumptions behind the developed market scenarios by IVCC

<b>Scenario 1</b>	1. No funding for NgenIRS Plus
<b>Low</b>	2. Median price remains at \$15 - successful transition of forecasting to GF, PMI in partnership with RBM (CRSPC)
	3. Ethiopia gradually adopts 3GIRS (20% in 2020 and 10% more in subsequent years)
	4. GF and PMI procurements remain flat or potentially drop as funding shifts to cover increased cost of new nets (PBO and dual-AI)
<b>Scenario 2</b>	1. Modest funding for NgenIRS Plus to support new phase of co-payment through 2023, continued evidence work around integration of multiple tools tailored to local conditions
<b>Med</b>	2. Median price reduced to \$12 - successful transition of forecasting to GF and PMI in partnership with RBM (CRSPC)
	3. Ethiopia adopts 3GIRS at 50% in 2020 and 15% more in following 2 years
	4. Market growth rate of 50% by 2024
	5. GF and PMI procurements increase as reduced pricing allows for addition of IRS in several new countries despite higher LLIN costs
<b>Scenario 3</b>	1. Full funding for NgenIRS Plus to cover all elements in concept (reduction in forecasting work based on transitioning from stand-alone process to integration within existing mechanisms)
<b>High</b>	2. Median price reduced to \$10 - successful transition of forecasting to GF and PMI in partnership with RBM (CRSPC)
	3. Ethiopia aggressively adopts 3GIRS (75% in 2020 to 100% in 2022, expansion into Nigeria, DRC, Sudan, E8, etc., piloting of new private sector models)
	4. Market growth of 100% by 2024
	5. GF and PMI procurements increase as reduced prices more than offset increased cost of new nets (PBO and dual-AI), modeling facilitates more cost-effective integration of multiple tools.
<b>Scenario</b>	1. No funding for NgenIRS Plus
<b>Worst Case risk</b>	2. No uptake of 3GIRS by Ethiopia
	3. Donors begin to shift limited resources from IRS to cover increased cost of new nets
	4. Prices of 3GIRS remain stable in 2020 based on firm forecast/capped prices but increase in subsequent years and market stability erodes with donor shift to higher priced LLINs (PBO and dual-AI)

Source: IVCC presented at the NgenIRS Semi-annual Review (October 2019)