FORECAST REPORT

GLOBAL MALARIA DIAGNOSTIC AND ARTEMISININ TREATMENT COMMODITIES DEMAND FORECAST

2016 – 2019

December 23, 2016

CLINTON HEALTH ACCESS INITIATIVE

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ABBREVIATIONS

ACT(s)	artemisinin-based combination therapy/therapies
AMFm	Affordable Medicines Facility for malaria
AL	artemether-lumefantrine
API	active pharmaceutical ingredient
ASAQ/AS+AQ	artesunate-amodiaquine
ASMQ	artesunate-mefloquine
ASPY	artesunate-pyronaridine
ASSP/AS+SP	artesunate-sulfadoxine pyrimethamine
B	Billion
BCG	Boston Consulting Group
CHAI	Clinton Health Access Initiative
CPM	Co-Payment Mechanism (Private Sector Co-Payment Mechanism)
DHA-PPQ	dihydroartemisinin piperaquine
EC	Economic Community
FY	fiscal year
The Global Fund	Global Fund to fight AIDS, Tuberculosis, and Malaria
IMF	International Monetary Fund
LLIN	long lasting insecticidal nets
M	Million
MTs	metric tons
MIT	Massachusetts Institute of Technology
MMV	Medicines for Malaria Venture
MOP(s)	(PMI's) Malaria Operational Plan(s)
NMCP(s)	National Malaria Control Program(s)
PMI	The President's Malaria Initiative
PSCM	Private Sector Co-payment Mechanism (see CPM)
QAACT(s)	quality-assured artemisinin-based combination therapy/therapies
QAINJAS	quality-assured injectable artesunate
QARDT(s)	quality-assured malaria rapid diagnostic test(s) [defined by the WHO procurement criteria for RDTs]
RDT(s)	(malaria) rapid diagnostic test/tests
UCSF	University of California, San Francisco
US	The United States of America
USAID	United States Agency for International Development
WHO	World Health Organization
WHO-GMP	World Health Organization – Global Malaria Program
WHO-PQ	World Health Organization – Pre-Qualified

EXECUTIVE SUMMARY

Recent years have witnessed a dramatic decline in the burden of malaria in endemic countries. The scale-up of effective tools to diagnose and treat malaria has played a significant role in this public health achievement, and continued availability of proven products for malaria case management is essential to sustaining and extending the gains. However, markets for malaria treatments and diagnostics face a number of challenging market dynamics that have in the past generated inconsistent product supply, volatile demand, significant price swings, and suboptimal allocation of resources. Given the size of the market for malaria case management commodities and its importance to public health, finding ways to ensure greater stability in this market is critical for a broad array of stakeholders including policymakers, market participants – and most importantly – malaria patients.

The Malaria Diagnostics and Artemisinin Treatment Commodities Forecasting Consortium ("the Forecasting Consortium") was established by UNITAID to provide better information to policymakers, market participants, and other stakeholders about the size of and trends in the global markets for malaria case management commodities. The Forecasting Consortium comprises the Clinton Health Access Initiative, Inc. (CHAI), IMS Health, and University of California San Francisco (UCSF) Global Health Sciences, is funded by UNITAID, and reports to a Steering Committee made up of UNITAID, the Global Fund to fight AIDS, Tuberculosis, and Malaria (Global Fund), the World Health Organization's Global Malaria Program (WHO-GMP), the President's Malaria Initiative (PMI), and Medicines for Malaria Venture (MMV).

This forecast represents the second in a new series of projections that will be made over the next year. The forecast presented in this report provides an update to the baseline projection of the size of the malaria commodity market that was presented in the prior published report (www.unitaid.eu/en/actforecasting) and shifts the forecast period from 2015 – 2018 to 2016 – 2019. In addition, this report presents analyses around three events/scenarios that the project Steering Committee believe might significantly impact the market for malaria treatment and diagnostic commodities. Future reports will update and extend the baseline forecast, and also assess different scenarios and events that could impact the market. This forecasting consortium builds on previous models for estimating the size of the market for artemisinin-based

combination therapies (ACTs), including WHO-prequalified ACTs (quality-assured ACTs; QAACTs) and ACTs that are not WHO-prequalified (non-quality assured ACTs; non-QAACTs), introduces new information around other categories of antimalarial medicines, such as quality-assured injectable artesunate (QAINJAS) and oral artemisinin monotherapies, and estimates the size of the market for malaria rapid diagnostic tests (RDTs).

Two key points about nomenclature warrant emphasis. 1) This forecasting report distinguishes three terms that often are used interchangeably but mean very different things: “need”, “demand,” and “procurement”. For this report, “need” represents our projection of the total number of febrile cases where the patient carries malaria parasites currently detectable by microscopy or rapid diagnostic tests (including cases where the fever may be caused by a separate infection); “demand” represents the number of cases where a consumer would seek treatment for a suspected case of malaria-caused fever (including cases where the fever is not caused by malaria); and “procurement” represents the number of quality-assured products that we estimate will be ordered by public or private sector purchasers in the given timeframe. 2) For our demand forecasts, we have divided the private sector into formal and informal channels, with the formal private sector including private not-for-profit and for-profit hospitals and clinics, and pharmacies, and the informal private sector including private drug shops, vendors and general retailers that sell medicines. For our QAACT procurement forecasts, we’ve divided the private sector market by those settings where the Global Fund co-payment mechanism allows for marketing of subsidized ACTs in the private sector, and those settings where co-paid ACTs are not formally part of the private sector market landscape (the premium private sector). By differentiating these concepts in our terminology we hope to clarify how evolving market dynamics are impacting different decisions around malaria case management.

KEY FINDINGS

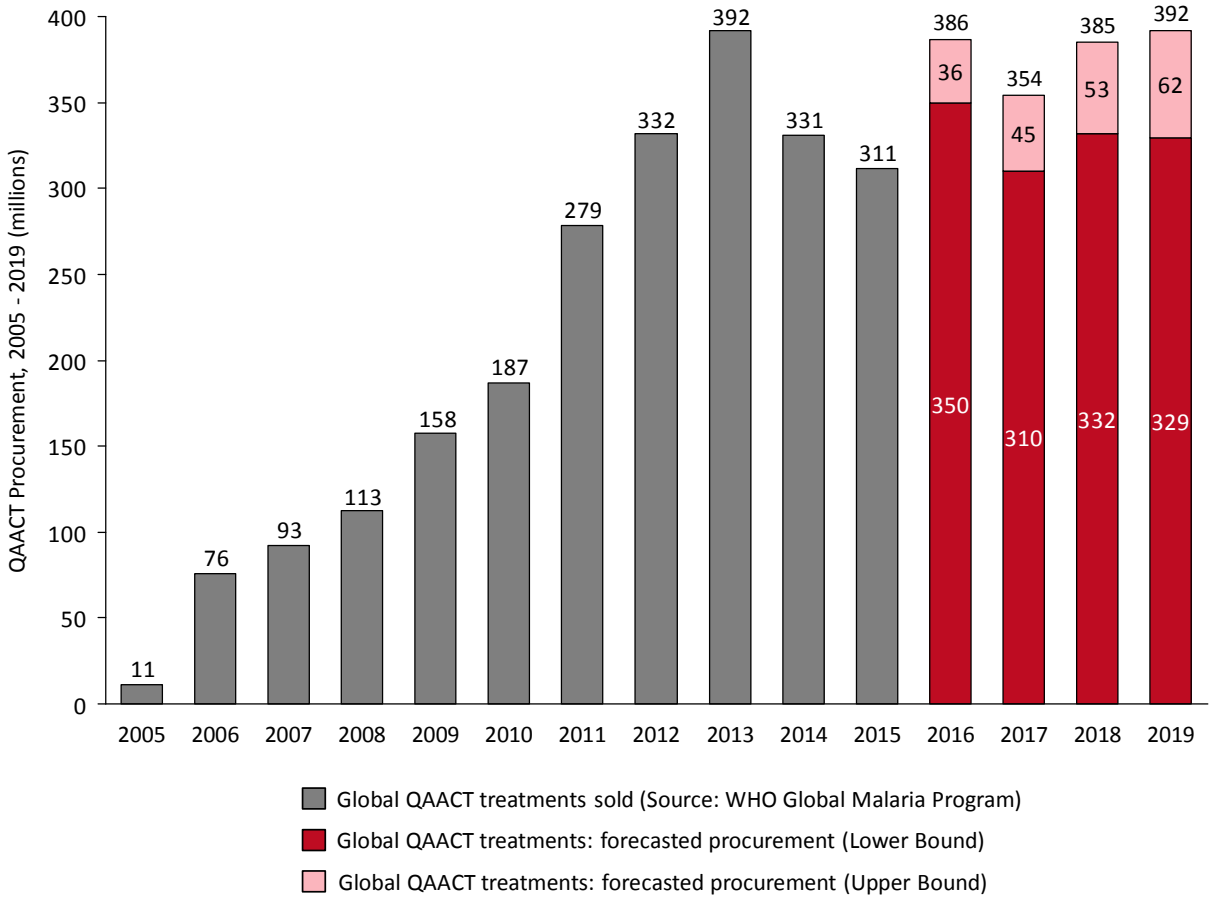
This report forecasts need, demand, and procurement of artemisinin-based malaria treatments and demand and procurement of malaria RDTs. Throughout the report, we define need as the number of treatments that are required to treat all febrile individuals who have a *Plasmodium falciparum* malaria infection at a parasite density that is detectable by diagnostic methods currently used in most settings (microscopy and RDTs), regardless of whether the febrile individual seeks treatment. We define demand as the number of treatments or point-of-care diagnostics that are required to meet consumer demand for malaria diagnosis and treatment of suspected *P. falciparum* malaria. Furthermore, we define procurement as the number of quality-assured diagnostics or *P. falciparum* malaria treatments that will be procured from manufacturers by public or private sector purchasers. Our procurement forecast is based on current procurement commitments by Global Fund grantees (principal recipients) and PMI, and projections of future funding for and spending on each commodity, both of which are affected by the availability of funding and changes in national strategic plans. For our demand and need forecasts, owing to a lack of timely source data across all settings, some assumptions are based on data from a limited set of countries, but applied to a much larger set of countries.

Procurement

The global market for quality-assured ACTs (QAACTs) is projected to decline from 350 million (M) treatments procured in 2016, to 329M treatments in 2019. This decline will occur due to decreases in procurement through the private sector Co-Payment Mechanism (CPM); under the Affordable Medicines Facility – malaria (AMFm) pilot program, market participants in eight countries were eligible to obtain subsidized QAACTs for private market resale at a significantly lower price. By 2016, six countries (Ghana, Kenya, Madagascar, Nigeria, Tanzania, and Uganda) had transitioned from dedicated donor funding to Global Fund grant funding to implement its successor program, the CPM. We project that annual QAACT procurement in this private subsidized channel will decline from 107M treatments in 2016 to 62M treatments in 2017 and beyond, owing to the effect of currently projected financial constraints on annual order volumes. Projections of public sector QAACT procurement, based on already committed donor funding, is expected to stay relatively flat during the 2016 – 2019 forecast period, around 200M

to 203M treatments, with a slight spike to 214M treatments in 2018 coinciding with a projected increase in PMI funding.

QAACT market: Historical and forecast growth, 2016 – 2019 (millions)



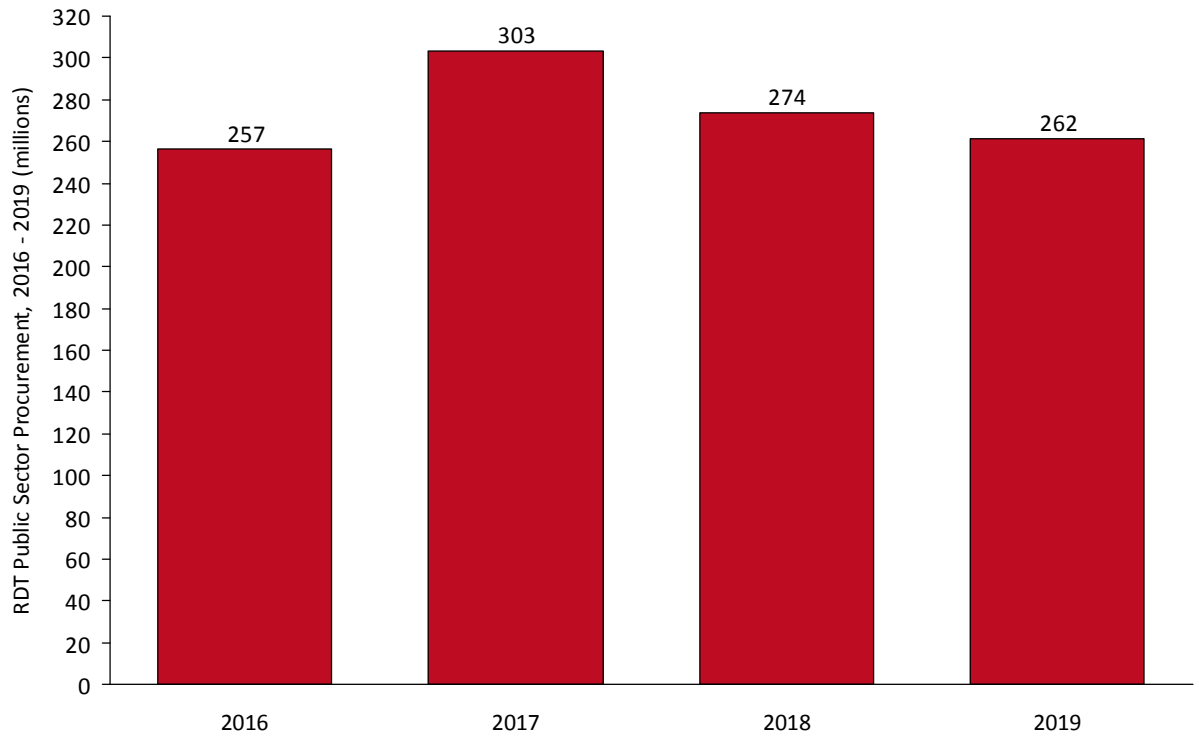
The share of orders among QAACT drug combinations is unlikely to change significantly during the next three years. There are currently five WHO-pre-qualified (WHO-PQ) suppliers for artesunate-amodiaquine fixed dose combinations (ASAQ), three WHO-PQ suppliers for artesunate-amodiaquine co-blisters (AS+AQ) seven WHO-PQ suppliers for artemether-lumefantrine (AL), two WHO-PQ suppliers for dispersible AL, and one WHO-PQ supplier for each of dihydroartemisinin-piperaquine (DHA-PPQ), artesunate-pyronaridine (ASPY),

artesunate-sulfadoxine-pyrimethamine (AS+SP), and artesunate-mefloquine (ASMQ). AL will continue to dominate the market for QAACTs through 2019.

In the non-subsidized private sector (the premium private market), QAACT procurement is projected to increase over the next few years from 39M treatments in 2016 to 64M treatments in 2019.

Public sector procurement for quality-assured injectable artesunate will reach 30M 60mg vials in 2016 and 2017, before declining slightly to 28M and 26M 60mg vials in 2018 and 2019, respectively. The decrease in projected quality-assured injectable artesunate procurement between 2018 and 2019 is driven by a slight decrease in projected funding of QAINJAS as severe malaria burden decreases.

RDT procurement, Public Sector, 2016 - 2019 (millions)

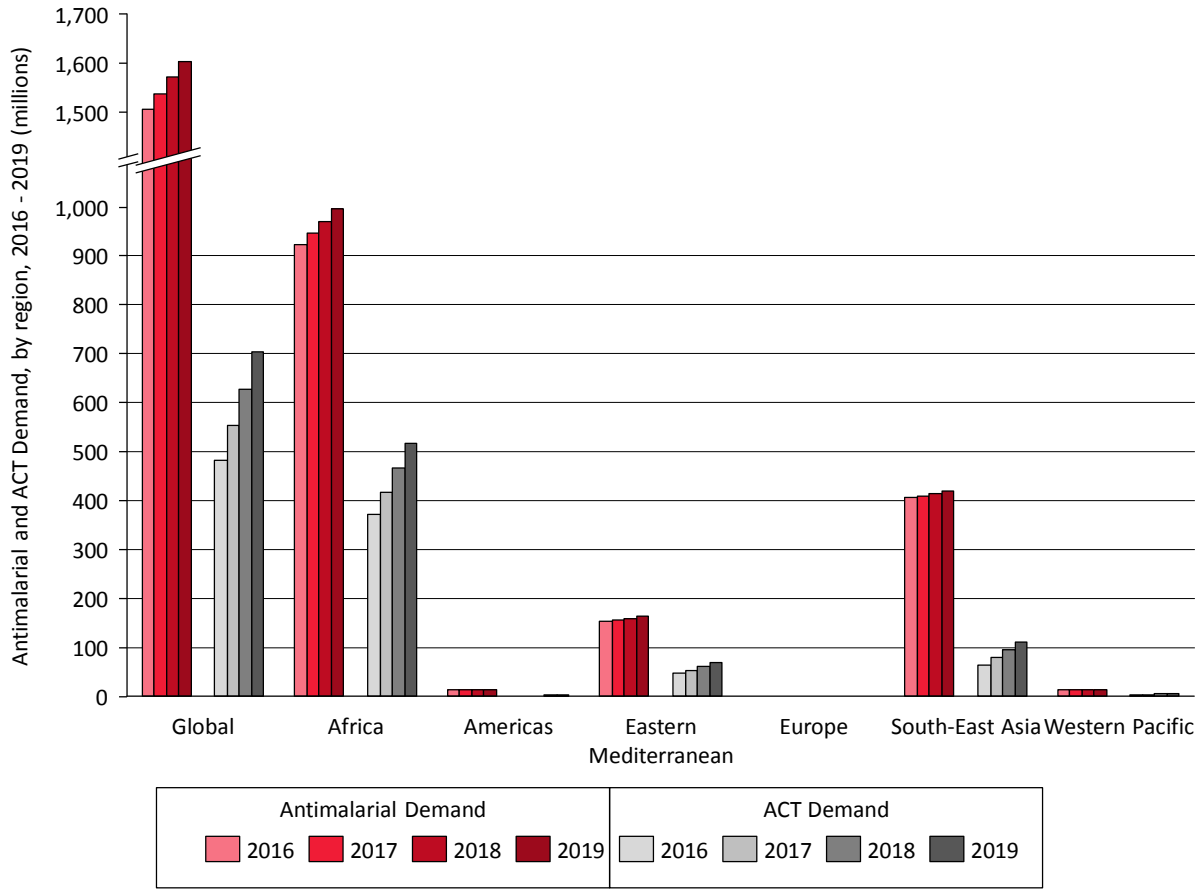


Procurement of RDTs has grown sharply in recent years, and our forecast projects this trend to continue. We estimate global public sector procurement of RDTs at 257M tests in 2016, rising to 303M in 2017. Modelled estimates of RDT procurement in the public sector, which is based on committed and projected future funding, are projected to decline slightly in 2018 (274M) and 2019 (262M).

Demand

The global demand for antimalarial medicines is estimated to be 1.5B antimalarial treatment courses in 2016, and is forecast to grow to 1.6B treatments by 2019. ACTs (QAACTs and non-QAACTs) currently comprise roughly a third of this demand in 2016, with their share expanding each year.

Antimalarial and ACT Demand, by region, 2016 - 2019 (millions)



Consumer demand for QAACTs, meaning the number of treatments consumers would seek to obtain and use if they were available, is projected to rise over the timeframe, reflecting population growth in endemic areas and a shift away from other non-ACT antimalarials. Consumer demand for QAACTs in 2016 is projected to be 361M treatments, rising (assuming continued product availability) to 504M treatments in 2019. The majority of this demand (>76%) will be generated through the public channel.

Over the next four years, private sector demand for ACTs (QAACTs and non-QAACTs) will grow faster than public sector ACT demand. In most countries, diagnosis coverage in the private sector is sparse, and thus, greater efforts are needed to address the growing need for appropriate malaria case management in the private sector.

Demand for non-QAACTs is estimated at 122M treatments in 2016, rising to 200M treatments in 2019. Most of this demand will be in the private channel, split relatively evenly between the formal and informal private sector channels.

Among QAACT product combinations, AL will continue to have the highest market share, with consumer demand rising from 259M treatments in 2016 to 362M treatments in 2019. ASAQ is projected to remain in second place, with demand growing from 80M treatments in 2016 to 111M in 2019. Demand for artesunate-sulfadoxine pyrimethamine (AS+SP) is expected to increase from 5.4M treatments in 2016 to 8M treatments in 2019, following the general trend in ACT demand growth.

Demand for RDTs is expected to grow over this timeframe as well, from 578M tests in 2016 to 623M in 2019. Most of this demand will be in the public sector, although the private formal and informal sectors combined account for over a quarter of global demand.

Demand for oral artemisinin monotherapies continues to decline; we forecast demand for oral artemisinin monotherapies will drop from 682,000 treatments in 2016 to 324,000 treatments in 2019.

Artemisinin demand is expected to slightly decrease from 197 metric tons (MT) in 2016 to 193MT in 2017, before increasing to 214MT in 2018, and to 226MT in 2019. The large decrease in CPM procurement in 2017 is counteracted by an increase of ACTs (both QAACTs and non QAACTs) in the non-subsidized private sector. The increase in artemisinin demand in 2018 is driven by a forecasted increase in QAACTs procured with the projected increased funds available from PMI for QAACT procurement, and a continued increase of ACTs (both QAACTs and non QAACTs) in the non-subsidized private sector. ACTs comprise the majority of global artemisinin API demand (96%), with QAACTs accounting for a large share (57-70%) of API demand.

Need

Our projections suggest that there were 15 billion (B) fevers in 2016 among-at-risk populations, and that 929M fevers occurred in people who were parasitemic. Not all of these fevers, however, were necessarily caused by malaria; some parasitemic individuals may have developed partial immunity to malaria parasites, and their fevers may simply be attributable to another infection.

We estimate that approximately 650M of the 929M total “need” is among African populations, due to the much higher level of parasitemia on that continent.

The estimate of this “need” is expected to rise between 2016 and 2019, largely with population growth. Fevers in parasitemic populations are projected to increase from 929M to 987M cases over this timeframe. Significant reductions in this measure of “need” will require additional large and sustained reductions in malaria prevalence in areas of risk and/or elimination of malaria from large areas (i.e., shrinking the malaria map) – both of which are longer-term objectives.

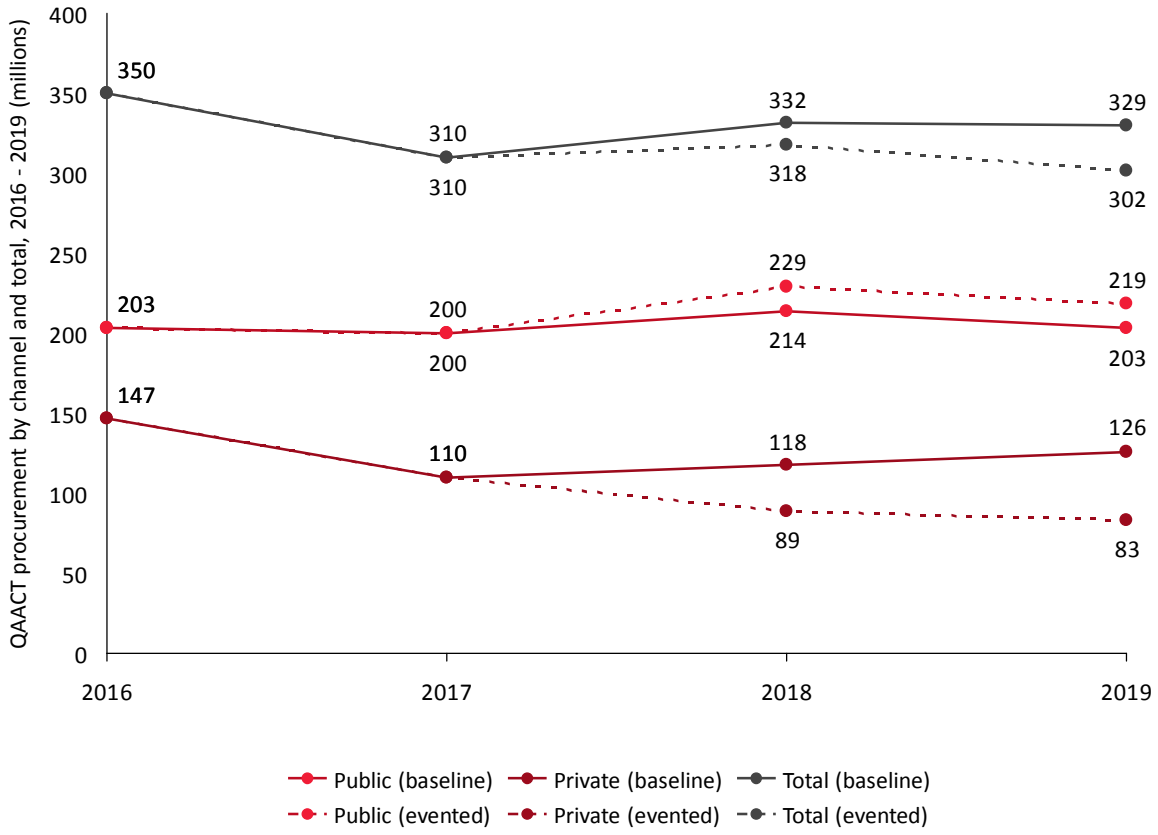
Implications

The markets for malaria diagnostics and treatment commodities are likely to remain very large and important over the near term. Despite shifts in funding models and programs, international funding for QAACT procurement remains very robust but is expected to plateau. The growth in RDT procurement and use suggests that effective treatments will be allocated in a more rational manner than historical patterns of presumptive treatment for malaria have allowed. Moreover, the sharp decline in demand for oral artemisinin monotherapy treatments suggests progress in one of the malaria community's key strategies to forestall the development and spread of artemisinin-resistant malaria parasites. Continued efforts to sustain support for effective case management commodities promise not only to reduce the burden of disease in the near term but to enable continued progress toward elimination of this disease.

FUTURE SCENARIOS AND PROJECTIONS

In this report, we present analysis around three events/scenarios that could have a significant effect on the markets for ACTs (QAACTs and non-QAACTs) and RDTs. These events are: changes to the funding landscape for (1) QAACT or (2) RDT procurement via funding from international donors, and (3) the impact that termination of the Private Sector Co-Payment mechanism (CPM) would have on ACT demand and QAACT procurement. The recent announcement that donors had pledged over $12.9B in response to the Global Fund's fifth replenishment request (thus meeting the Global Fund's funding target), the approval of a $674M FY2016 budget, and a $200M supplementary funding request for the President's Malaria Initiative (PMI), funneled through the US Agency for International Development, have dispelled uncertainties in the funding pictures for the first two scenarios.

QAACT procurement by channel and total, 2016 - 2019 (millions)



While the baseline forecast assumes that countries participating in the current CPM (Ghana, Kenya, Madagascar, Nigeria, Tanzania and Uganda) will continue to invest in private sector treatment subsidies, the event models the effect of a termination of all CPM funding beyond 2017. In comparison to the projected baseline growth in QAACT procurement in 2018 and 2019, this hypothetical scenario projects a slight decline in QAACT procurement in 2018 and 2019, as the QAACT market would decrease to global annual procurement volumes not seen since 2012. Most of this decline would be the result of rapid erosion of QAACT sales in the private informal sector once QAACTs no longer held a retail price advantage over non-QAACTs.

Future editions of this forecast report will continue to project the impact of various market events and scenarios on treatment and diagnostic commodity need, demand, and procurement. These

"events" will include both supply-side and demand side events with significant potential for market impact. The hope is that the inclusion of such scenarios will provide policymakers and market participants with a sense of how sensitive our forecasts are to external shocks.

In addition, the Forecasting Consortium will update prevalence trends to incorporate de-novo shifts in the malaria landscape and epidemiology based on ongoing interventions. The Forecasting Consortium will also leverage new studies or data, as applicable, to refine estimates.

METHODS AND DATA UPDATES SINCE THE PREVIOUS REPORT

Since the publication of the previous report, a number of significant updates have been made to the source data and the forecasting methods. Chief among the data updates have been:

- Revisions to data on Global Fund historical procurement volumes and planned procurement in 2016 and beyond. Previous data had indicated the potential for fairly large procurement volumes in 2016 and 2017 (for some key countries e.g., Democratic Republic of the Congo), but the latest data does not support this potential.

- Revised assumptions for PMI funding, following U.S. President Obama's statements during the January, 2016 State of the Union speech, and subsequent request for increased funding for PMI programs.

- Assumed an annual budget increase of at least $71M per year, starting in the 4th quarter of 2017.

- Incorporation of more recent estimates of malaria prevalence in sub-Saharan Africa, based on data from the Malaria Atlas Project (MAP) leading to a decline in weighted average prevalence from 30% to 17% in the Africa region.

- Revised data inputs for the private sector co-payment mechanism.

- Funding continues to tighten for this program, with 2017 funding likely to be significantly less than funding in 2016. We assume the 2017 funding floor will continue through 2018 and 2019.

The updates to the methodology have been:

- Revisions to the procurement forecast methods for Global Fund funded commodities to more accurately project annual procurement of QAACTs, QAINJAS, and RDTs. Whereas previous methods relied primarily on country-level procurement plan data, with the grant-recipient's historical spending rate for ACTs as a secondary approach, the revised method estimates future procurement primarily based on historical procurement trends (i.e. order data for all artemisinin-derivative therapies and malaria rapid diagnostic tests between 2013 and 2015), with country-level procurement plan data (i.e. order actuals or planning for 2016-2017) used only for select high volume countries.

- The country-level planned procurement information is gathered from a combination of sources – national malaria programs, Global Fund principal recipients, and Global Fund health product managers – to account for country specific nuances that shape procurement plans. The use of either source (historical procurement trends or procurement plans) varies by the country, the forecast year, and the commodity. The methods document outlines the algorithm for the use of each data source. The proportion of the total forecasted volumes attributed to a source varies by the forecast year and by the commodity. Table 1 lists the proportional contributions of each source for the forecasted Global Fund public sector procurement of QAACTs, RDTs, and QAINJAS. Planned procurement data accounts for 69%, 57% and 35% of the 2016 forecasted volume for QAACTs, RDTs and QAINJAS respectively. This share drops to 42%, 40%, and 31% for QAACTs, RDTs and QAINJAS respectively in 2017, and then declines to <10% for all commodities in the 2018 and 2019 forecast (Table 1). The share of planned procurement data declines since procurement plans are not drawn out more than 1 – 2 years in advance and because there is very limited or no data available on planned procurement in 2018 and 2019 due to a new cycle of The Global Fund funding commencing in 2018. The share of planned procurement data vs. historical procurement trends used for the forecast also varies by the

commodity. This is due to a difference in the number of countries where planned procurement data is available for each commodity and the cumulative share of those countries in the public sector Global Fund procurement forecast for that commodity. In 2016, planned procurement data is available for 10 countries for QAACTs, 9 for RDTs and 7 for QAINJAS.

- The definition of the historical procurement trend data source varies by the forecast year. In 2016, historical procurement data refers to the order data for all artemisinin-derivative therapies and malaria rapid diagnostic tests between 2013 and 2015. In 2017, the historical procurement trends also incorporate planned procurement data for 2016 where available. Similarly, for 2018, historical procurement trends incorporate available planned procurement data for 2016 and 2017, and the 2019 historical procurement trends incorporate available planned procurement data for 2016 through 2018.

Table 1 The Global Fund Financed Public Sector QAACT, RDT and QAINJAS Procurement Forecast: Proportion of Projected Procurement Volume, by Data Source, by Commodity, 2016 – 2019

Commodity	Data Source Used	Proportion of Projected Procurement Volume,			
		2016	2017	2018	2019
QAACT	Based on planned procurement	69%	42%	<5%	<5%
	Based on historical procurement trends	31%	58%	>95%	>95%
RDT	Based on planned procurement	57%	40%	6%	7%
	Based on historical procurement trends	43%	60%	94%	93%
QAINJAS	Based on planned procurement	35%	31%	-	-
	Based on historical procurement trends	65%	69%	100%	100%

This change in the methodology, and the review and subsequent update of data sources, has resulted in significant changes in the procurement and need outputs of the current forecast, when compared to those published in the prior report.

Forecasted procurement of QAACTs has decreased significantly in the current forecast, as compared to the prior one (Figure 1).

These methodological and data sourcing changes had a different effect on the RDT procurement forecast; revised projections point to a rise in RDT procurement in 2017 and 2018, based on trends in increasing use and access to these products (Figure 2).

Forecasted need of ACTs has significantly decreased with the incorporation of more recent estimates of malaria prevalence in sub-Saharan Africa, which show a weighted average prevalence decrease from 30% in the previous forecast to 17% in the current forecast for the Africa region (Figure 3).

Figure 1 Change in QAACT Procurement Forecast between Reports

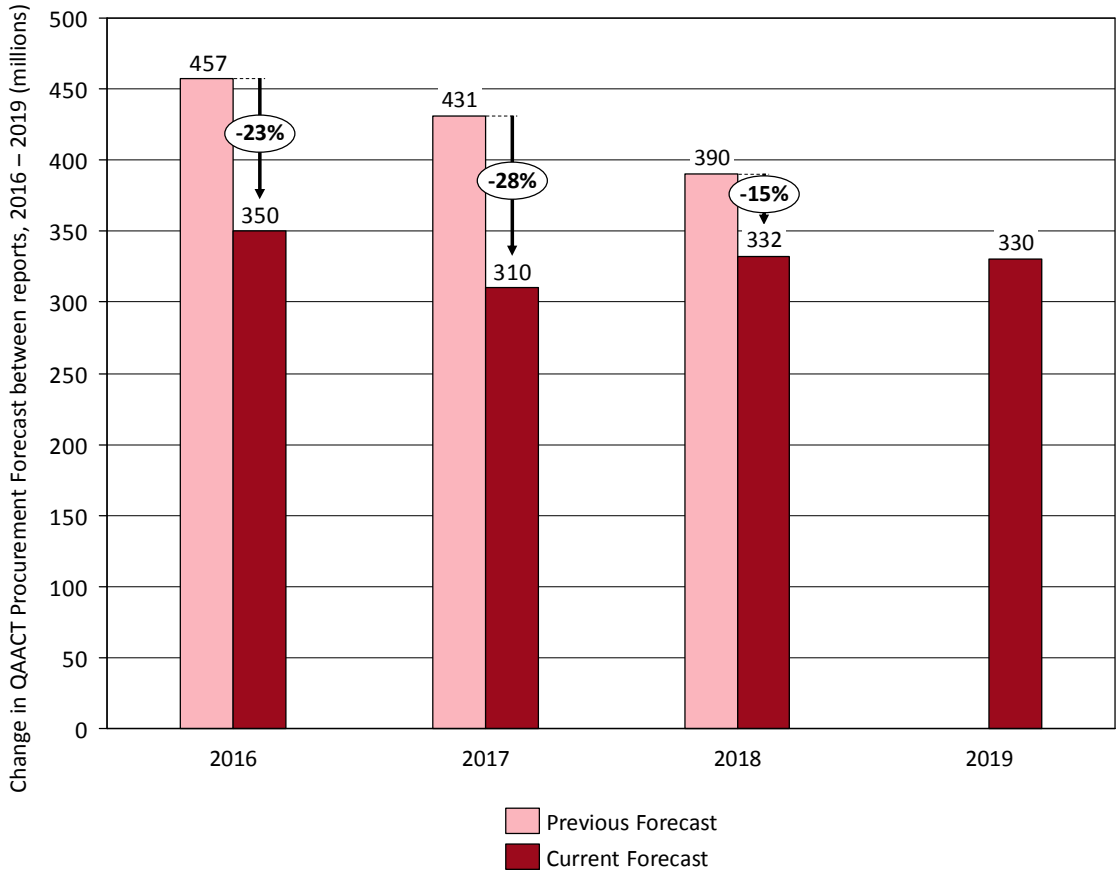


Figure 2 Change in Public Sector RDT Procurement Forecast between Reports

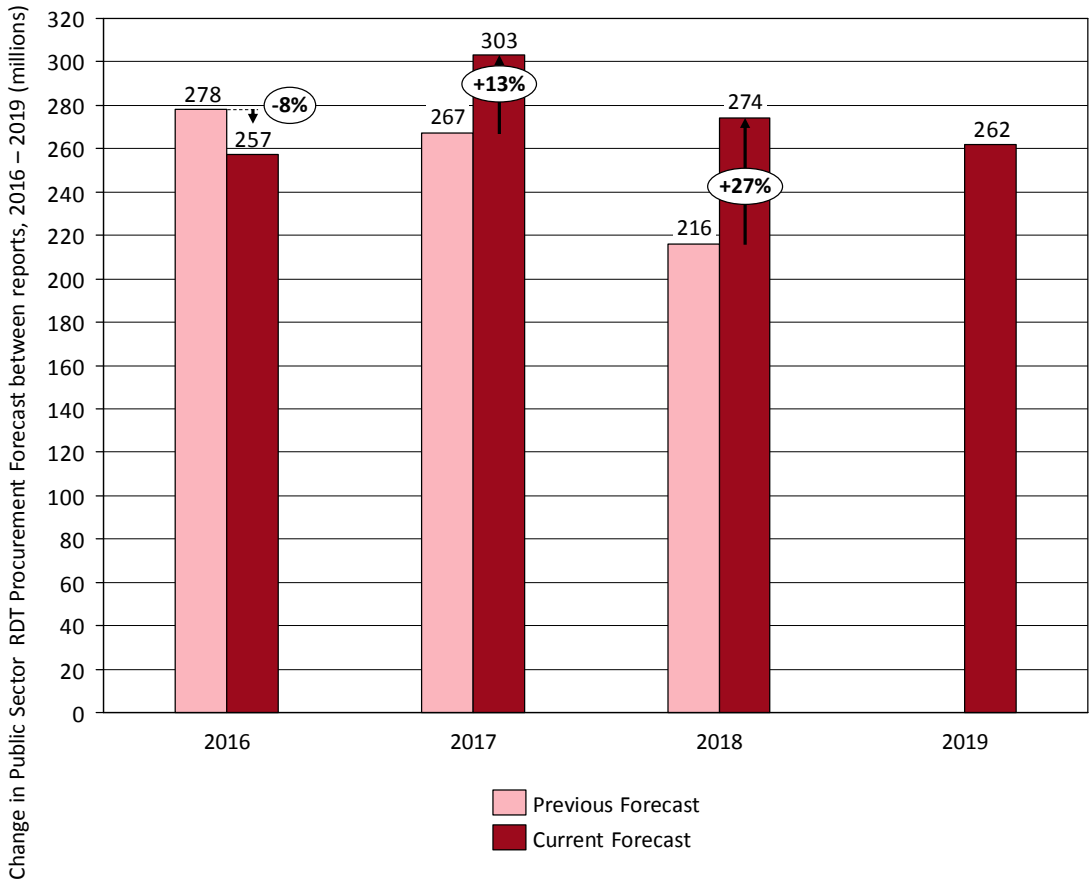
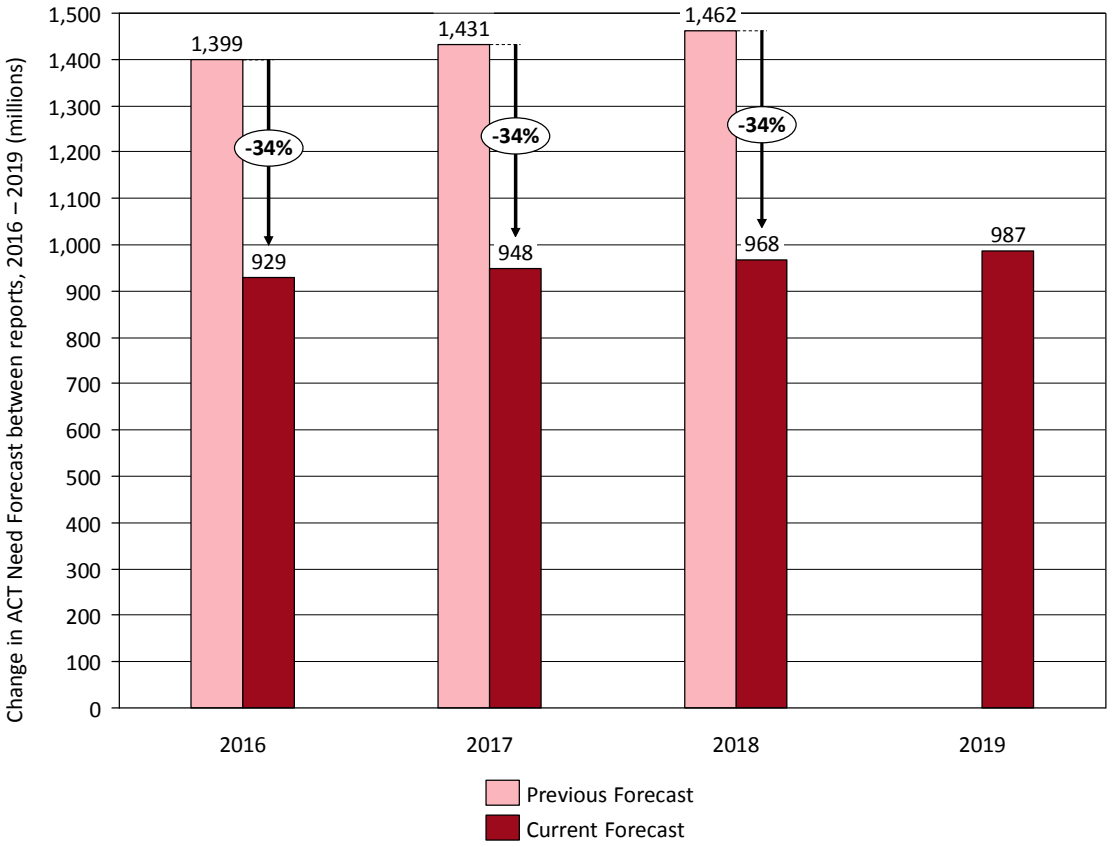


Figure 3 Change in ACT Need Forecast between Reports



1. INTRODUCTION

Since their launch and adoption as the WHO-recommended treatment for uncomplicated malaria over a decade ago, the global market for quality-assured artemisinin-based combination therapies (QAACTs) has expanded dramatically. Artemisinin, the key component of artemisinin-based combination therapies (ACTs), can be readily extracted from the leaves of the sweet wormwood plant (*Artemisia annua*), and cultivated *A. annua* remains the major source of artemisinin for these life-saving antimalarial medicines. The market's reliance on a vegetal artemisinin source, with all that that confers (e.g., long production cycles dictated by growing seasons, varying crop yields, competition for cultivation acreage from other in-demand cash crops, small volume growers, an inflexible supply chain that cannot easily adjust to changes in market demand), has at times resulted in supply constraints, and at other times, an abundance of supply. These supply swings, resulting from uncertain or unforeseen demand, have led to dramatic oscillations in artemisinin prices. In 2010, the Affordable Medicines Facility for malaria (AMFm), a private-sector subsidy mechanism was launched with the goal to increase access to appropriate, low priced antimalarial medicines in the retail/private sector. The introduction of this QAACT scale-up mechanism increased the uncertainty around QAACT demand and whether artemisinin supply would be sufficient to meet it.

Given past uncertainties in the artemisinin market, ongoing and future shifts in the funding landscape for malaria diagnostics and treatments, changes in disease epidemiology, and the impact of key interventions and tools, demand forecasting for QAACTs and rapid diagnostic tests (RDTs) continues to be important for many stakeholders invested in malaria diagnostic and treatment access. After a sustained period of growth, QAACT demand has reached a volume that has stabilized artemisinin prices. However, the relatively-low current prices of artemisinin may drive farmers toward planting alternative cash crops, leading to a potential decline in the planted *A. annua* acreage, and another period of artemisinin price fluctuations. Meanwhile, several large-volume countries plan to continue subsidizing QAACTs through the Private Sector Co-Payment mechanism (CPM) until 2017, but the picture of support for private-sector QAACT co-payment subsidies beyond 2017 remains unclear. At the same time, countries are scaling up confirmatory diagnostic testing in the public sector, particularly with RDTs, meaning that many public sector entities are facing the challenge of funding large RDT

procurement volumes while also continuing to pay for the high costs of treatment. Improved market intelligence can help countries and donors develop new strategies to prevent supply shortages and stabilize prices. Such market intelligence would have broad utility for stakeholders throughout the supply chain, including the *A. annua* farmers, semi-synthetic artemisinin producers, the artemisinin extractors, the manufacturers of RDTs, artemisinin based active pharmaceutical ingredients (APIs), and finished products containing these APIs, the National Malaria Control Programs (NMCPs) and donors.

This project is the second phase of the UNITAID ACT forecasting project, expanding the scope of the previous work to forecast the ACT and artemisinin monotherapy for uncomplicated and severe malaria need, demand, and procurement, as well as RDT demand, and procurement, and artemisinin API demand. We have defined these outputs as follows:

Definition of Outputs

ACT Need – The number of treatments that are required to treat all febrile individuals who have a *Plasmodium falciparum* malaria infection at a parasite density that is detectable by diagnostic methods currently used in most settings (microscopy and RDTs), regardless of whether the febrile individual seeks treatment.

ACT Demand – The number of treatments that are required to meet consumer demand for treatment of suspected *P. falciparum* malaria with an ACT.

QAACT Procurement – The number of quality-assured artemisinin combination therapy treatments that will be procured from manufacturers by public or private sector purchasers.

Artemisinin Monotherapy Demand – The number of artemisinin monotherapy treatments (including Injectable and rectal artesunate) that are required to meet consumer demand for treatment of suspected *P. falciparum* malaria, or severe malaria.

Injectable Artesunate Procurement – The number of injectable artesunate treatments that will be procured from manufacturers by public sector purchasers.

RDT Demand – The number of RDTs that are required to meet the consumer demand for rapid test diagnosis of suspected malaria (e.g., a proxy: the number of patients who sought treatment and received an antimalarial treatment could be equated to the catchment population for rapid diagnostic testing).

RDT procurement – The number of RDTs that will be procured by public or private sector purchasers.

Artemisinin Demand – Metric tons of artemisinin required to meet public sector procurement volumes and private sector demand for all artemisinin-based antimalarial medicines.

Demand has been projected across three access channels: public sector, formal private sector, and informal private sector, where the formal private sector includes private not-for-profit and for-profit hospitals, clinics, and pharmacies, and the informal private sector includes private drug shops, vendors and general retailers that sell medicines. QAACT procurement has been projected across three market categories as well: public sector, subsidized private sector market, and the non-subsidized (premium) private sector market.

These forecast reports will generally cover a four to five year forecast period, with this report forecasting the outputs listed above, at a global level, covering 2016 – 2019. For a detailed description of the methods used to generate the forecasts presented in this report, please refer to the separately published report, where these methods are outlined in detail: www.unitaid.eu/en/actforecasting.

2. FORECAST OUTPUTS 2016 – 2019

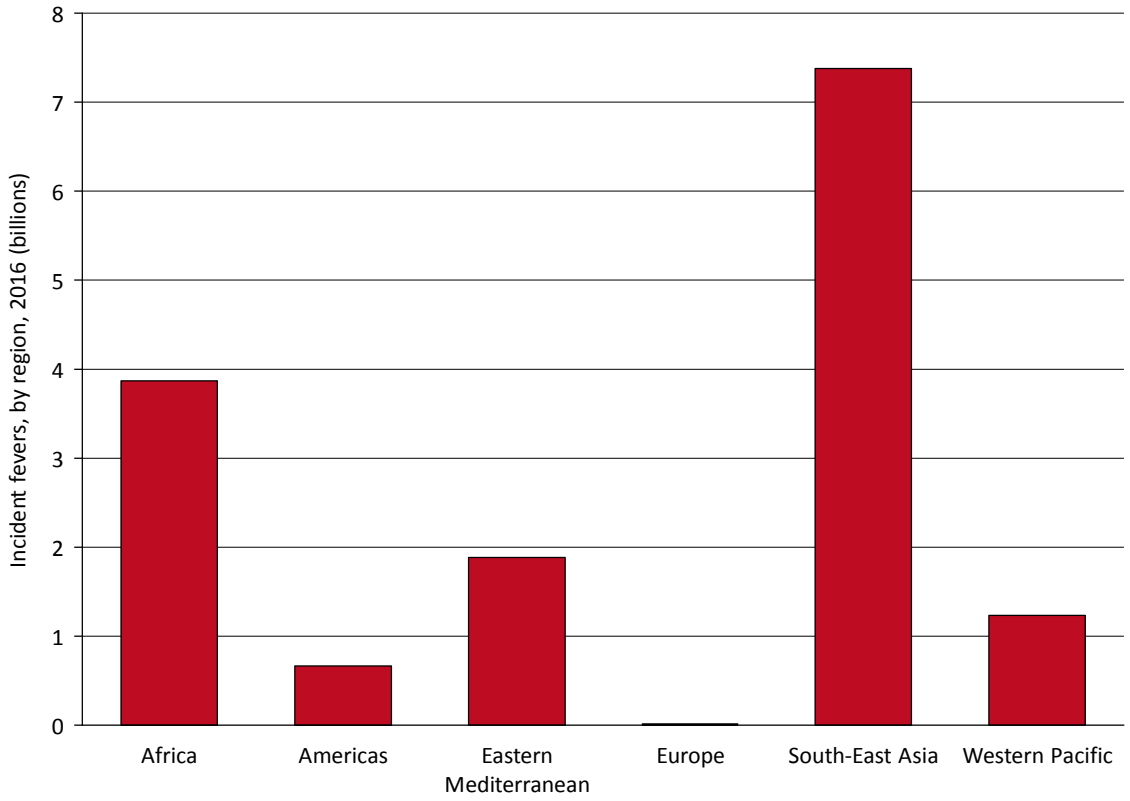
ACT Need

Using a decision-tree algorithm, based on febrile incidence extracted from national population-representative household surveys (see separately published methods for further details), we have estimated the number of malaria infections among febrile patients across the malaria-endemic world. Our method aims to project the number of febrile individuals who have a malaria infection at a parasite level detectable by diagnostic methods currently used in most settings (microscopy and RDTs), regardless of their treatment-seeking status or whether they fit the case definition. In some settings, without the insight that diagnostic testing can provide, many of these individuals would not necessarily be identified as incident malaria cases as their febrile illness might be primarily caused by concomitant infection (e.g., typhoid).

To provide further context for the analysis of our ACT need outputs, it is first worth viewing our global estimates for annual incident febrile illness. It is important to note that our estimates, derived from the same decision-tree algorithm described in the methods, are not a tabulation of the number of individuals who experience a febrile episode per year, but rather, an estimate of the number of fevers that occur per year within malaria-at-risk populations, and thus these figures are typically much larger than the size of the general population in a given country. Unlike methods used in some of the previously published literature (1), we have not based our assumptions on a basic framework with which we tabulate the number of fevers by age group in a given malaria-transmission setting. Instead, we have produced estimates based on extrapolation of data from household surveys reporting fevers across all age cohorts, by fitting the data to account for potential seasonality of febrile illness during survey data collection periods conducted at different times across numerous years.

Our model estimates that in 2016, there were around 15 billion (B) incident fevers among the malaria-at-risk populations within the 89 countries included in our model (Figure 4).

Figure 4 Incident fevers among malaria-at-risk populations, by region, 2016 (billions)

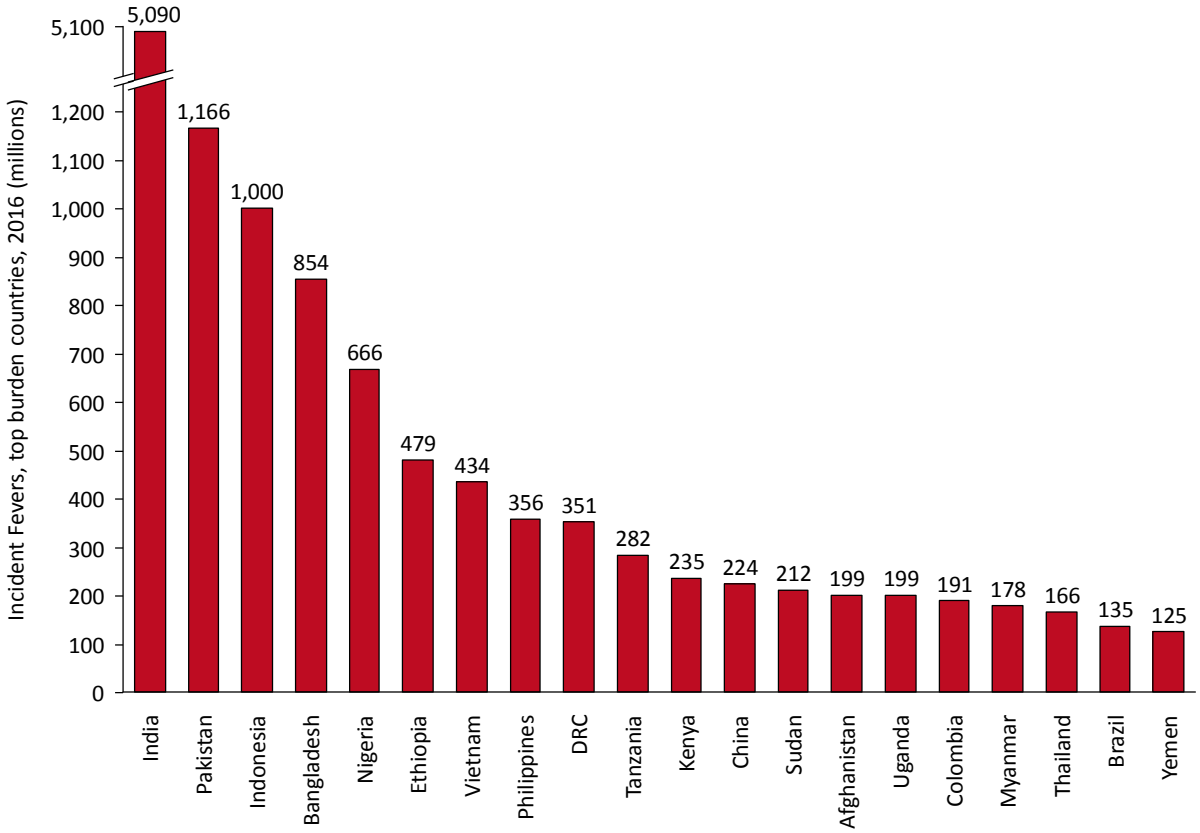


Adopting population-weighted 2010 global *P. falciparum* prevalence estimates obtained from the Malaria Atlas Project (MAP; we used population-weighted 2015 *P. falciparum* prevalence estimates from MAP for all countries in sub-Saharan Africa), we estimate that nearly half of all incident fevers in *P. falciparum* malaria at-risk populations occur in South-East Asia, a region comprising 8 countries – Bangladesh, Bhutan, India, Indonesia, Myanmar, Nepal, Thailand, and Timor-Leste – with a weighted average fever-adjusted malaria prevalence of 3% (using the WHO's regional classification scheme, see Table 5, Appendix; Cambodia, Viet Nam, Lao PDR, and Malaysia are included in the "Western Pacific" region). Africa represents the second largest regional burden for incident fevers, with nearly 3.7B fevers estimated in 2016, but also

represents the highest average burden for fever-adjusted malaria prevalence: nearly 30%. All other regions comprise fewer annual incident fevers than South-East Asia and Africa, with fever-adjusted prevalence of approximately 2% or less.

At the national level, our estimates for the burden of incident febrile illness track closely with rankings by overall population census among countries with *P. falciparum* malaria at-risk populations (Figure 5).

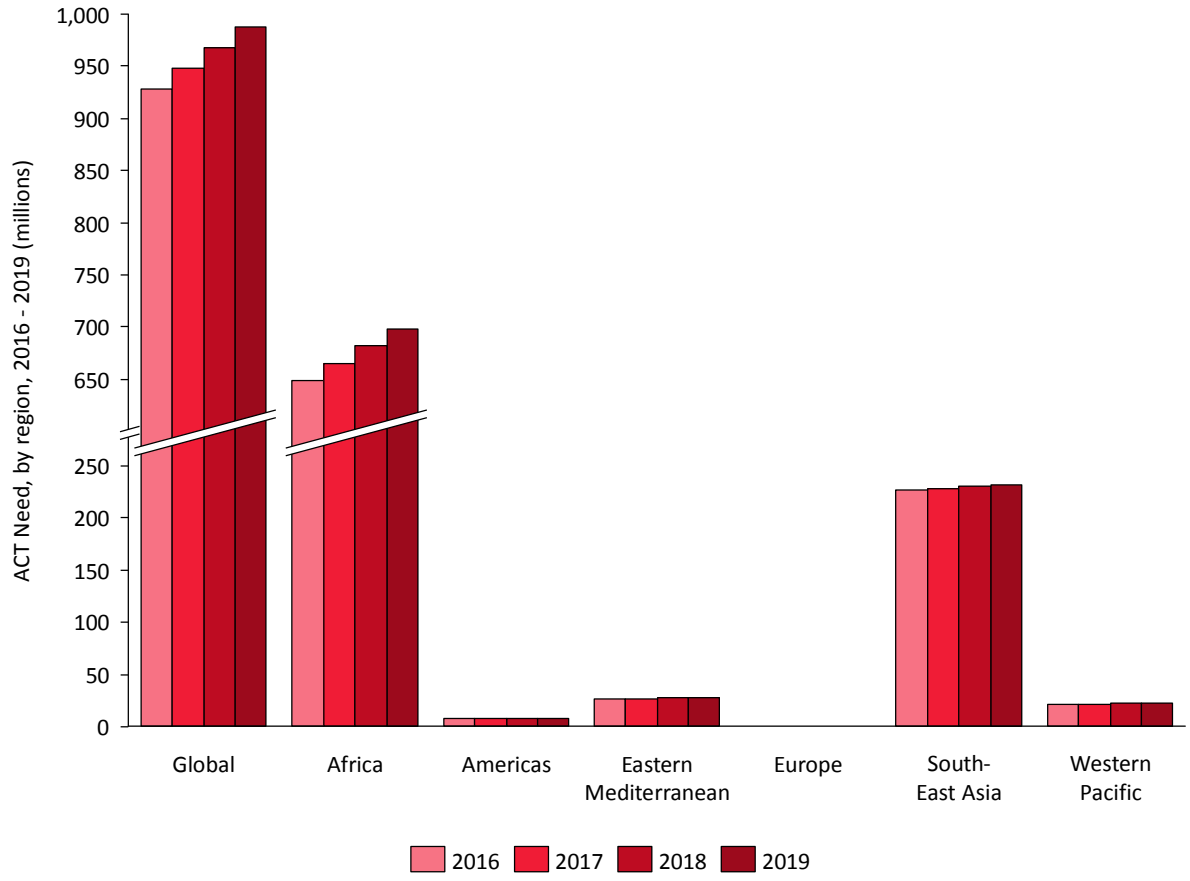
Figure 5 Incident fevers among *P. falciparum* malaria at-risk populations, top burden countries, 2016 (millions)



Note: China includes only Hainan and Yunnan provinces

Applying adjusted malaria prevalence to the 2016 fever estimates results in an estimate of 929 million (M) incident fevers with microscopy/RDT-detectable malaria infection. If, in 2016, all such febrile cases were treated with an ACT (assuming all such events could be identified and treated appropriately), then a total of 929M ACTs would be required to meet this need (Figure 6). Our current model does not account for the de-novo combined impact of multiple malaria control interventions on prevalence as the data to support such a model is currently unavailable. The model does iterate the effect of increased ACT usage on malaria prevalence (and thus incident fevers), but this effect results in only a slight decline in malaria prevalence throughout the African, American, and South-East Asian regions during the five-year forecast period. Thus, with the projected growth in populations-at-risk over this period, our estimates for incident fevers with concomitant microscopy/RDT-detectable malaria infection result in an increasing trend for ACT need. Future iterations of this forecast will incorporate de-novo trends in malaria prevalence as comprehensive data supporting such analysis becomes available.

Figure 6 ACT need, by region, 2016 - 2019 (millions)

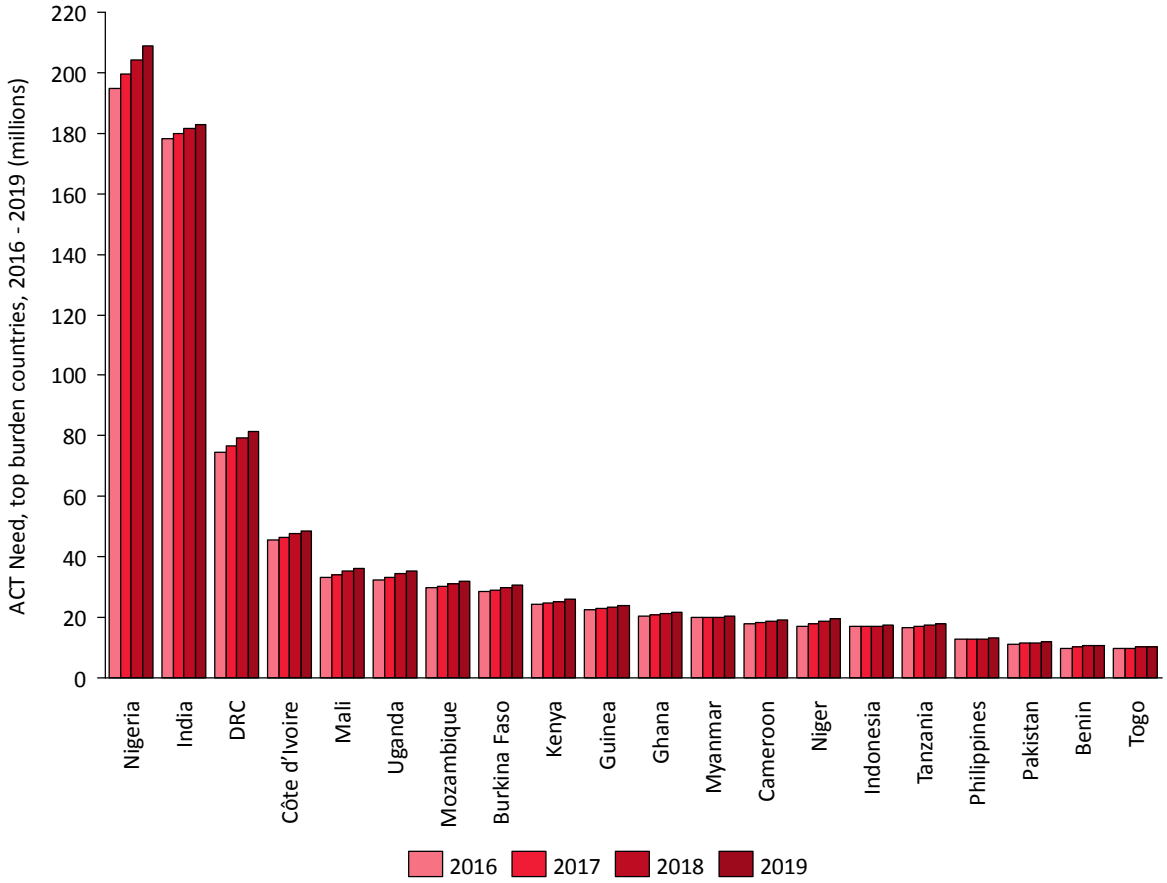


Although we estimate that South-East Asia has nearly twice as many annual incident fevers than Africa, Africa's malaria burden (and thus ACT need) is significantly higher than that in South-East Asia, owing to the African region's fever-adjusted prevalence being nearly tenfold higher than that in the South-East Asian region.

At the national level, we estimate that Nigeria has the largest overall number of incident fevers that have concomitant microscopy/RDT-detectable malaria infection (and thus, the largest national ACT need) (Figure 7). While malaria prevalence in India is relatively low and is mixed between *P. falciparum* and *P. vivax* infections (n.b. – all of the data sources and analyses in this report are focused on *P. falciparum* malaria), sheer volume of febrile illnesses and non-trivial falciparum-malaria prevalence leads to substantial figures for ACT need in this nation. The other

high burden ACT need nations follow suit on the interaction between the annual volume of incident febrile illnesses and malaria prevalence.

Figure 7 ACT need, top burden countries, 2016 - 2019 (millions)



Discussion: ACT need

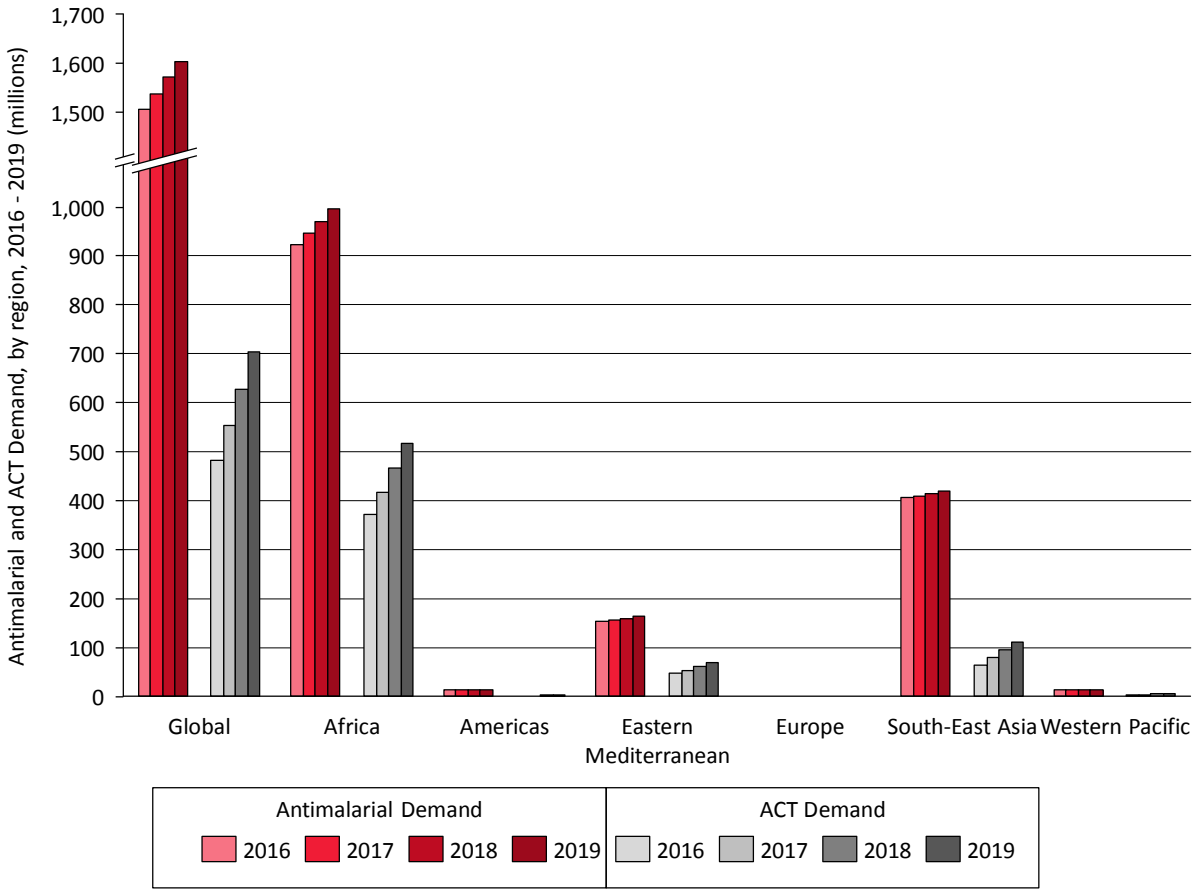
We defined ACT need as the number of antimalarial medicines required to treat all febrile illness concurrent with a detectable (by microscopy or RDT) *P. falciparum* malaria infection, regardless of whether (a) the individual with the febrile illness sought treatment for that illness, (b) whether a febrile individual, having sought treatment, received any sort of diagnostic test to determine the cause of that illness, and (c) whether the tested individual actually received a course of antimalarial treatment (or, more specifically, an ACT). It is important to note that these ACT need estimates are based on extrapolation from limited historical fever and prevalence data and are not an estimate for likely reported cases. In some settings, our methods, using overall

population at risk, febrile incidence and finally falciparum malaria prevalence, may result in an estimate for ACT need that far exceeds estimates of cases, owing to a number of potential factors including but perhaps not limited to: changing dynamics in malaria prevalence, or imprecision in extrapolating malaria prevalence among febrile illness from total population malaria prevalence, or inherent imprecision in our incident fever estimates. We would suggest that the ACT need figure of 929 in 2016 should be interpreted as a high ceiling to the overall need for antimalarial medicines, rather than as a guide to a necessary volume of ACTs that must be achieved by manufacturers and whose procurement must be funded by governments and donor agencies. The point of presenting this figure is to demonstrate that a fairly large reservoir for potential malaria treatment need exists, and that while annual QAACT production currently exceeds case estimates, it comprises approximately a third of the potential need for QAACTs if every febrile illness was tested and every malaria positive test were to be treated with an QAACT.

ACT Demand

The Forecasting Consortium's antimalarial/ACT need and demand model, based on extrapolation of data from national population-representative household surveys, produces estimates for a number of outputs, including annual incident fevers, the portion of those incident fevers that are likely to have a concomitant microscopy/RDT-detectable malaria infection, and the demand for diagnostic testing. The model uses household survey data on antimalarial treatment in febrile children and an extrapolation to similar treatment in adults to arrive at global demand estimates for antimalarial treatments (including ACTs). Using the model's forecast for global antimalarial demand (1.5B in 2016, growing to 1.6B in 2019) and ACT (QAACTs and non-QAACTs) demand (483M in 2016, growing to 704M in 2019) as a baseline (Figure 8), the baseline forecast has been segmented to provide more detail into the dynamics of global artemisinin and RDT demand. In terms of the geographical distribution of ACT demand, Africa represents the largest source of ACT demand with 370M treatments in 2016, growing to 517M treatments in 2019, and accounting for approximately 73% to 77% of global demand for ACTs. Furthermore, twenty countries comprise over 80% of global ACT demand (Angola, Burkina Faso, Burundi, Cameroon, Chad, Côte d'Ivoire, DRC, Ethiopia, Ghana, India, Kenya, Malawi, Mali, Mozambique, Niger, Nigeria, Sudan, Tanzania, Uganda, and Zambia).

Figure 8 ACT demand, by region, 2016 - 2019 (millions)

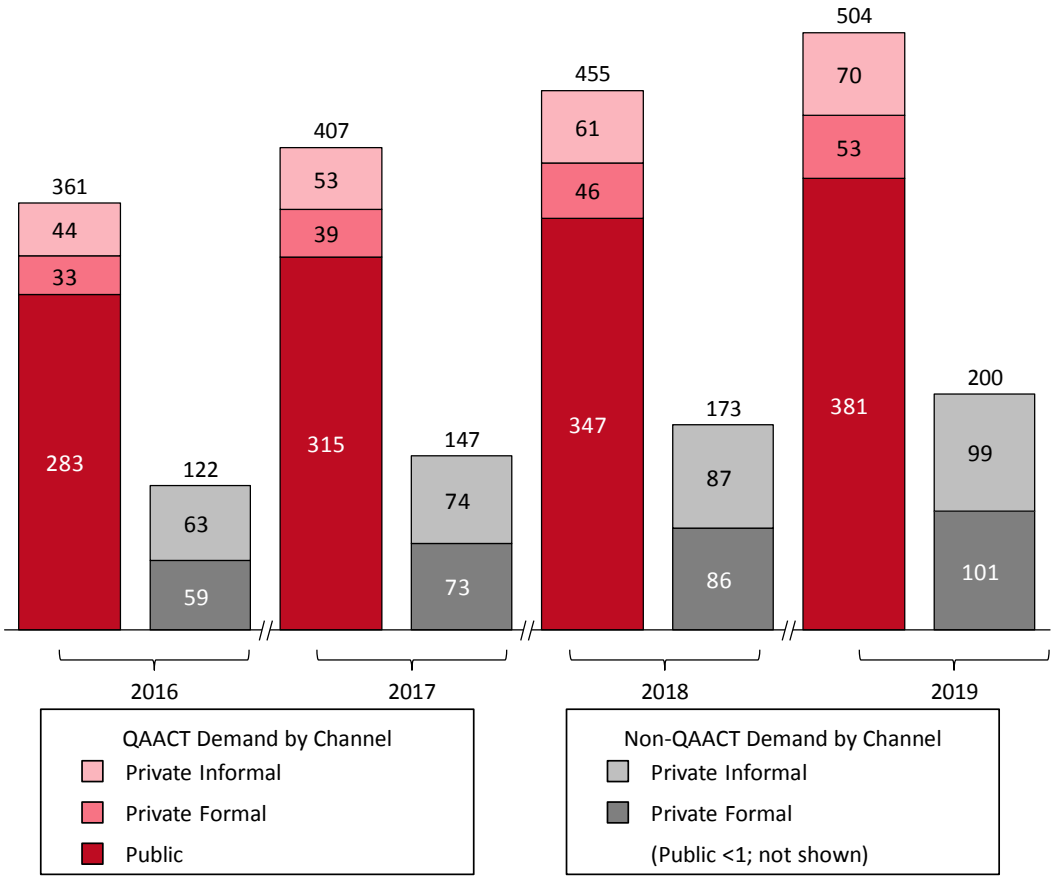


The public sector remains the main source of global ACT demand, accounting for approximately 60% of total ACT demand in 2016 (Figure 9). However, we expect that over the next four years, private sector ACT demand will grow faster than public sector demand, which will reduce the public sector's share of global ACT demand to 55% in 2019. Segmenting the two private channels, the informal private channel contributed the larger share of global ACT demand in 2016 (22%) while the formal private channel accounted for 19% of global ACT demand in 2016.

By applying estimates of QAACT use in the private sector, based on available IMShealth data and ACTwatch country-level data, we have further segmented ACT demand estimates into QAACT and non-QAACT demand across each of these three channels (Figure 9). While in some settings (e.g., Viet Nam), the majority or all of the public sector ACTs are non-QAACTs (volumes are relatively small), the majority of demand in the public sector is assumed to be for

QAACTs. We used IMS sales data and ACTwatch data (from 2013/2014) to segment demand in the formal private and informal private channels by quality-assured drug classification. Based on these data, we project that in 2016, non-QAACTs make up approximately 30% of total ACT demand in ex-AMFm countries (Ghana, Kenya, Madagascar, Niger, Nigeria, Tanzania and Zanzibar, Uganda) and 76% of total ACT demand in non-AMFm countries.

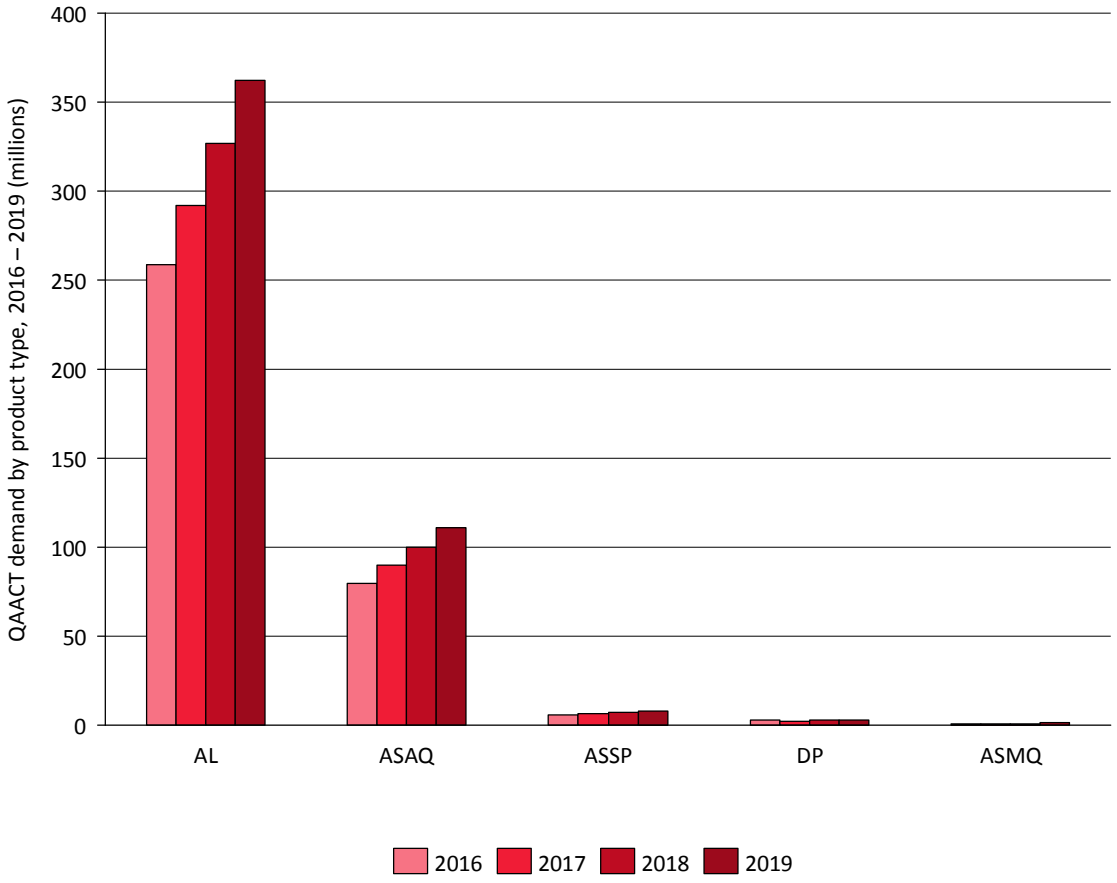
Figure 9 ACT global demand, by quality-assured drug classification and distribution channel, 2016 - 2019 (millions)



Further segmenting our global QAACT demand forecast by specific product types (Figure 10), AL will continue to comprise the majority of QAACT demand across all sectors, with demand forecast to grow to 362M treatments in 2019, while demand for quality-assured ASAQ will expand from 80M treatments in 2016 to 111M in 2019. We forecast quality-assured AS+SP

demand to grow from 5.4M in 2016 to 8M treatments in 2019, following general growth trends in QAACT demand in countries where AS+SP is included in treatment guidelines.

Figure 10 QAACT global demand, by product type, 2016 - 2019 (millions)



Discussion: ACT demand

Using IMS's extensive private sector sales data, our analysis presents the first comprehensive, data-driven estimates around the portion of global ACT demand that is fulfilled by non-QAACTs. While the data supporting this analysis has limitations, the combination of IMS and ACTwatch data has allowed us to apply some basic assumptions around the use of QAACTs vs. non-QAACTs in the private and public sector, as well as the

market share trends for various oral, parenteral, and rectal artemisinin monotherapies. We estimate that non-QAACTs comprise 25% to 28% of global ACT demand.

Although population growth may be the main driver of the growth for our current model's ACT demand output, another significant driver is the use of ACTs by febrile patients who have no microscopy/RDT-detectable malaria. ACT over-treatment contributes significantly to ACT demand volume in the absence of effective strategies to reduce ACT use among febrile patients who are not diagnosed or those that receive a negative diagnosis.

Our underlying model for antimalarial and ACT demand applies treatment data collected from household surveys to an algorithm, also based on household survey data, that projects incident fevers and subsequent treatment seeking behaviour and treatment algorithms. The model is not currently able to incorporate underlying changes in malaria prevalence, other than the gradual changes to malaria prevalence conferred by increasing ACT access and use in malaria-positive patients. Given the limitations of the model, the main driver to ACT demand is thus population growth, which is positive, and hence, the model outputs positive growth trends for ACT demand over time.

QAACT Procurement

The model that we use to estimate global QAACT procurement is based on the following data inputs:

- Estimates of the available financing from the Global Fund to fight AIDS, Tuberculosis, and Malaria (the Global Fund) or administered by the Global Fund, and USAID's President's Malaria Initiative (PMI) for public sector procurement of QAACTs, which account for ~98% of the donor-funded QAACT market;

- Public sector procurement plan data for select high volume countries that procure QAACTs through the use of funds from the Global Fund;

- Historical QAACT spending on Global Fund grants;

- Historical QAACT orders placed through Global Fund funding;

- Historical QAACT procurement through USAID's PMI;

- Weighted average of currently reported QAACT prices;

For the private sector in countries taking part in the Global Fund's Private Sector Co-Payment Mechanism (CPM), which supports a subsidized, private sector market for QAACTs, estimates of CPM funding, procurement based on historical funding / procurement, and co-payment plans where known;

For the premium private sector in countries not taking part in CPM (we have assumed that countries taking part in the CPM have majority of the private sector QAACT procurement through the CPM, and have not quantified the premium private sector in those countries), the QAACT portion of ACT demand in the private sector, based on the QAACT portion of ACT volumes calculated from private sector sales volumes tabulated by IMS, and applied to outputs from the ACT demand model (described above).

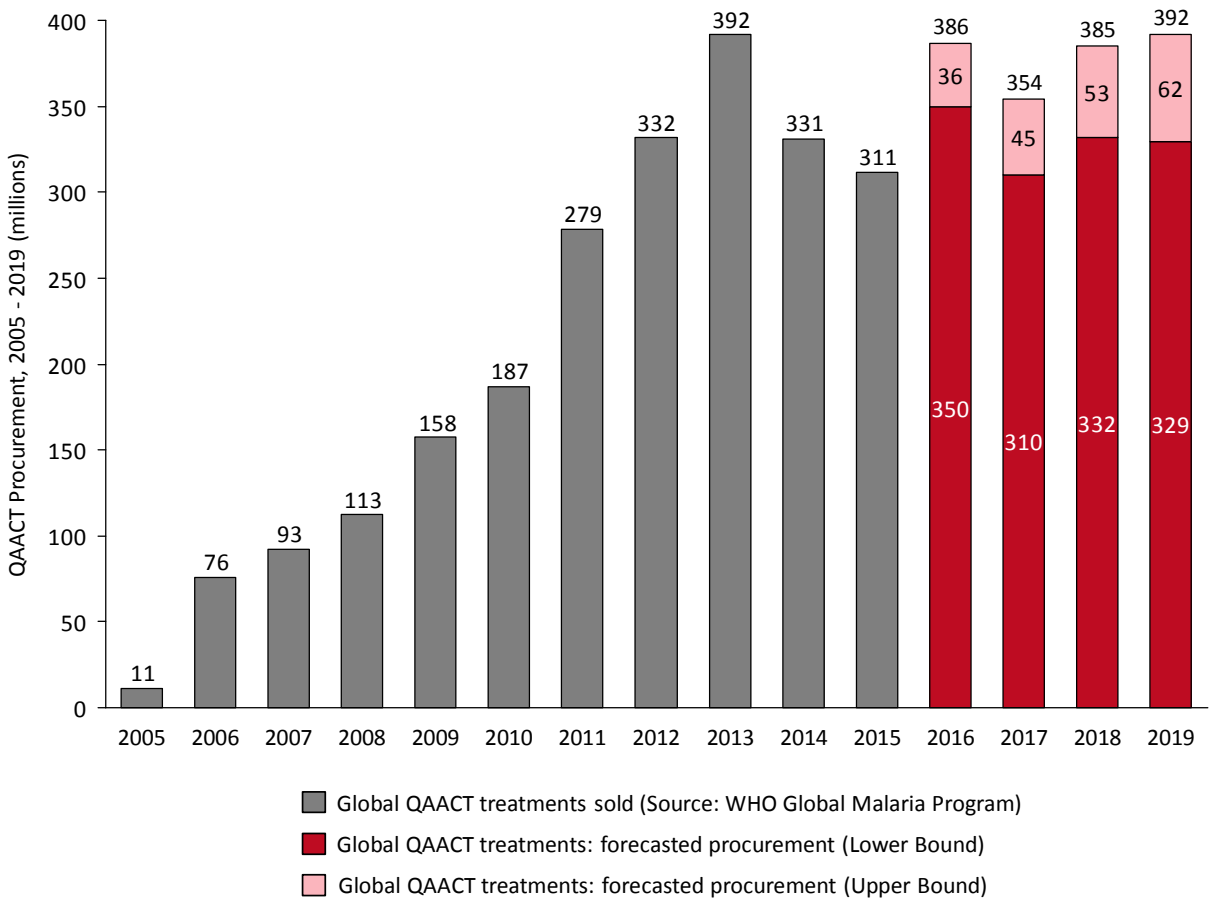
Our approach, detailed in the forecast methodology, uses Global Fund data on historical trends in grant disbursements to estimate the average pace and value of future malaria grant disbursements at the national level. We then use national procurement plans or historical orders' data from Global Fund's PQR database (in countries where we do not have planned procurement data) to extrapolate historical spending (or use planned spending) on ACTs as a percentage of total malaria programmatic funding, to arrive at annual estimates for funds available for QAACT procurement. Applying these estimates on QAACT funding and incorporating price assumptions and associated procurement costs (based on publicly available Global Fund data, historical PMI procurement and funding data, and data from NMCPs), we arrive at projections for QAACT volumes at a national level.

Historically, the US Government's President's Malaria Initiative (PMI) helped coordinate country-level efforts in the provision and rapid scale-up of QAACTs. Given programmatic flexibilities in the treatment commodity procurement space, PMI has also been successful in filling developing gaps in treatment coverage. We therefore apply trends in national QAACT procurement over the past few years to the forecast years to forecast procurement via PMI funds.

With regard to the Global Fund-mediated CPM mechanism, while financial commitments for the continuation of CPM QAACT procurement are unclear beyond 2017, we have assumed that in CPM-participating countries, subsidized private sector QAACT treatment volumes in 2018 and 2019 will be equivalent to 2017 estimations. On QAACT procurement volumes in the premium private sector, there is very little available data; we have developed lower-bound and upper-bound assumptions to address this uncertainty and to frame our QAACT procurement forecast for the premium private market.

Our lower bound QAACT procurement forecast (which we also consider the base case) projects 350M QAACTs to be procured across all channels in 2016, with this figure declining to 310M in 2017 before climbing to 332M, and 329M QAACTs in 2018, and 2019, respectively (Figure 11). Our upper bound case forecasts 386M QAACTs to be procured in 2016, with this number declining to 354M in 2017, and bouncing back to 385M in 2018 and 392M in 2019. The underlying driver for the difference in the lower and upper bound projections is a varying assumption on the QAACT procurement in the premium private sector (based on varying assumptions on the QAACT share of the total ACTs in the premium private sector).

Figure 11 QAACT market: Historical and forecast growth, 2005 – 2019 (millions)



In 2016, QAACT procurement is highest in the public sector followed by the private subsidized sector (CPM) and the premium private sector (Figure 12). Although the prices of QAACTs have come down substantially, they cost much more than other sub-optimal antimalarials, which explains the relatively low procurement volumes in the private non-subsidized sector (premium private sector). The decline in QAACT procurement from 2016 to 2017 is largely driven by a reduction in procurement under the CPM due to financial constraints. While the total malaria funding available for the public sector increases from 2016 to 2017 owing to an increase in projected Global Fund disbursements, spending on QAACTs will remain relatively fixed (thus, the average spend on QAACTs is projected to decrease), leading to little change in public sector procurement volumes. The subsequent increase in 2018 will be due to an increase in public sector procurement following the additional PMI funding that will become available

starting in 2018, and a projected increase, based on analysis of market trends in non-CPM private sector markets, in use of QAACTs in the premium private sector. While we project total malaria funding from The Global Fund to decrease in 2018, the estimated increase in the average percentage of each Global Fund grant that is spent on QAACTs will balance out the overall funding decrease. The projected decrease in Global Fund funding in 2018 follows a year of peak malaria funding in 2017, during which time most grants from the current funding cycle are projected to end. The total QAACT procurement in 2019 will remain in line with 2018 with the decrease in public sector procurement being counteracted by the increase in the premium private sector QAACT procurement.

The decrease in public sector QAACT procurement in 2019 (Figure 12) is driven by a projected decrease in total malaria funding available in 2019 through the Global Fund. Our QAACT procurement model for the Global Fund funded volumes assumes that the total disbursement rates (or malaria funding through the Global Fund) going forward will be equal to disbursement rates during the current 'New Funding Model' period, and uses projections on the starting dates of next round's funding (based on modelling closing dates for the previous grant round) to forecast annual disbursement amounts. These disbursement rates are then multiplied with spending rates on QAACTs based on historical trends and know procurement plans, providing a time-sensitive estimate for the top-line funds available for procurement of QAACTs through the Global Fund. The African region will continue to constitute the majority of QAACT treatments procured in the public sector as nineteen of the twenty countries comprising over 80% of global ACT demand are located in this region (Figure 13).

Figure 12 QAACT procurement, by channel, 2016 - 2019 (millions)

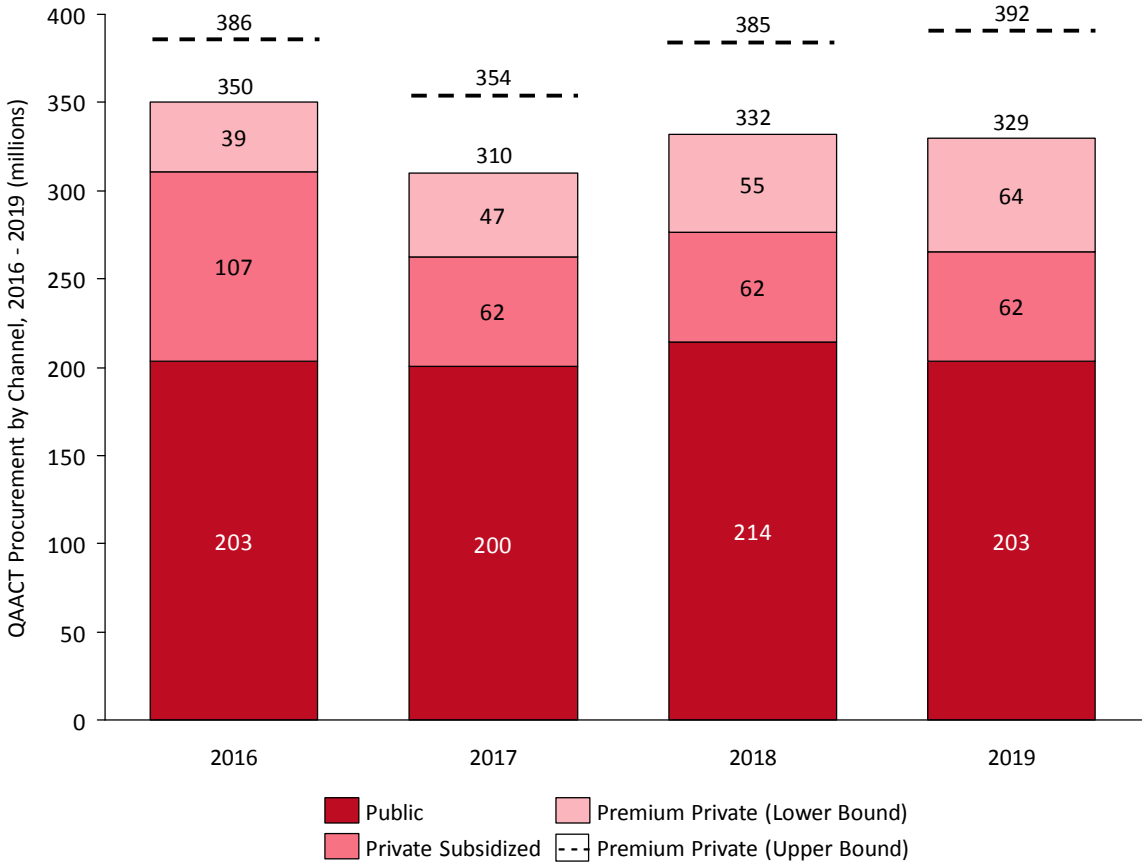


Figure 13 QAACT public sector procurement, by region (Africa and others), 2016 – 2019 (millions)

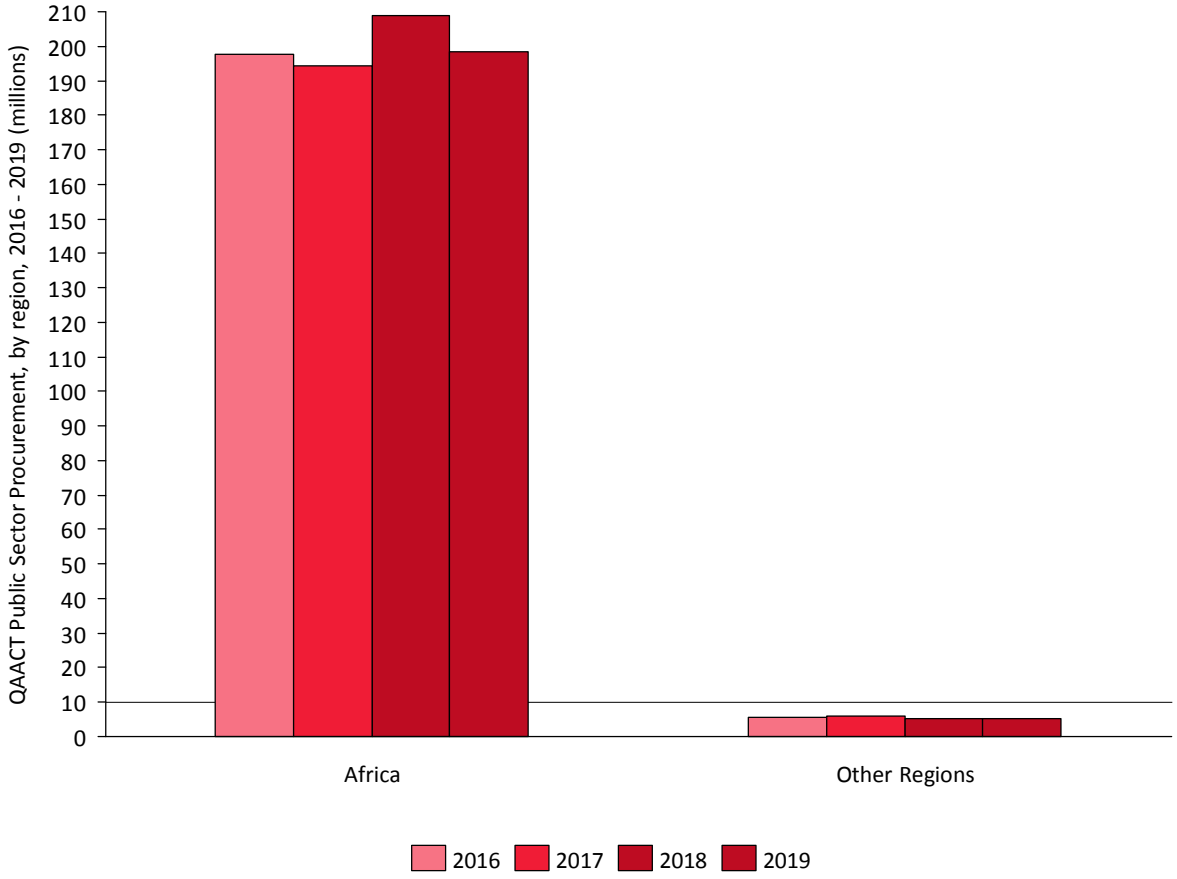
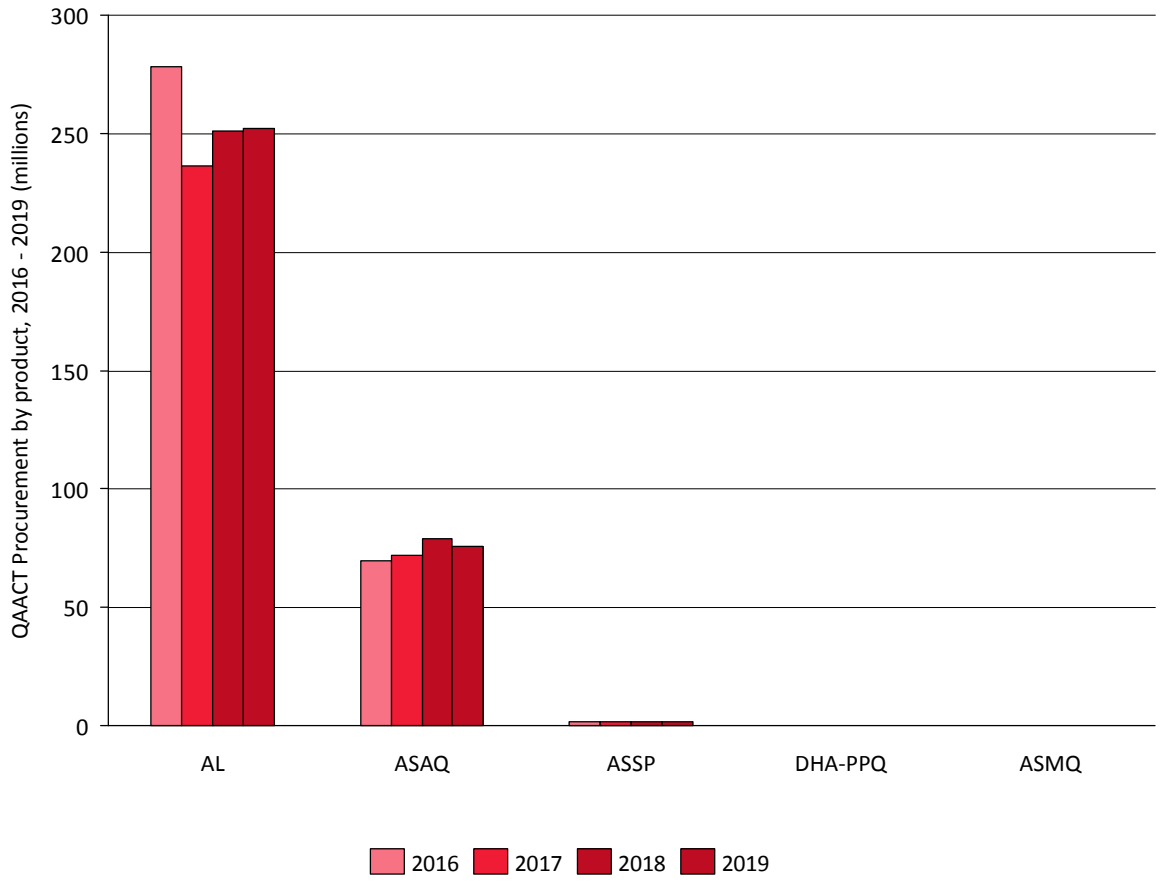


Figure 14 QAACT procurement, by product type, 2016 – 2019 (millions)



While our model has incorporated as many data as were available to us, it still relies upon extrapolation and assumptions that are based on historical data that might not be predictive of future trends; financial information from grant applications and procurement plans from past Global Fund grants does not necessarily reflect actual procurement volumes using those funds. We have tried to reconcile this by using actual procurement data, where available, and have erred on reliance on actual procurement trends rather than trends outlined in commodity procurement plans.

Global Fund grants have a three-year lifespan, and grant start and end dates are staggered according to when countries/principal recipients applied for the grant. We have adopted the non-synchronized Global Fund grant timelines and incorporated estimates for the timing of the next round of concept note submissions, at the national level. While future Global Fund funding replenishments may bring significant changes to the overall availability of Global Fund funds for malaria programs, national funding envelopes, and country allocations for commodity procurement, we have adhered to a conservative approach: we expect future funding envelopes will be similar to today's existing funding envelopes, and we expect that commodity funding allocations and the pace and product mix for procurement will be similar to that of today.

Discussion: QAACT procurement

Most QAACTs are procured using funds from donor organizations such as the Global Fund or PMI, and therefore our procurement forecasts are based on projections for available funding. With the transition to the Global Fund's New Funding Model in 2014, countries now have more stable expectations around funding envelopes, and the annual disbursement mechanism supports more regular procurement of essential medicines. However, with the launch of the New Funding Model, historical funding allocations for treatment and diagnostics procurement may no longer reflect contemporary priorities and challenges, and while departures from historical trends may lead to forecast imprecision in a forecast based in part on analysis of historical trends, until new data is obtained, application of historical trends provides the most straightforward analytical approach. In addition, some countries entered this funding cycle with prior existing funds while others were facing funding gaps that required acute attention. Thus, some countries have planned procurement to cover their needs for two years of a three-year funding cycle, with the aim of renewing funding for continuous procurement prior to the third year in the cycle. 2016 will be a peak year for QAACT procurement before annual CPM procurement drops from over 100M QAACTs to approximately 60M QAACTs. Our current procurement estimates are based on analysis of current funding streams and procurement commitments, and as such, may shift in the future if high-volume countries submit new proposals that change their procurement strategy.

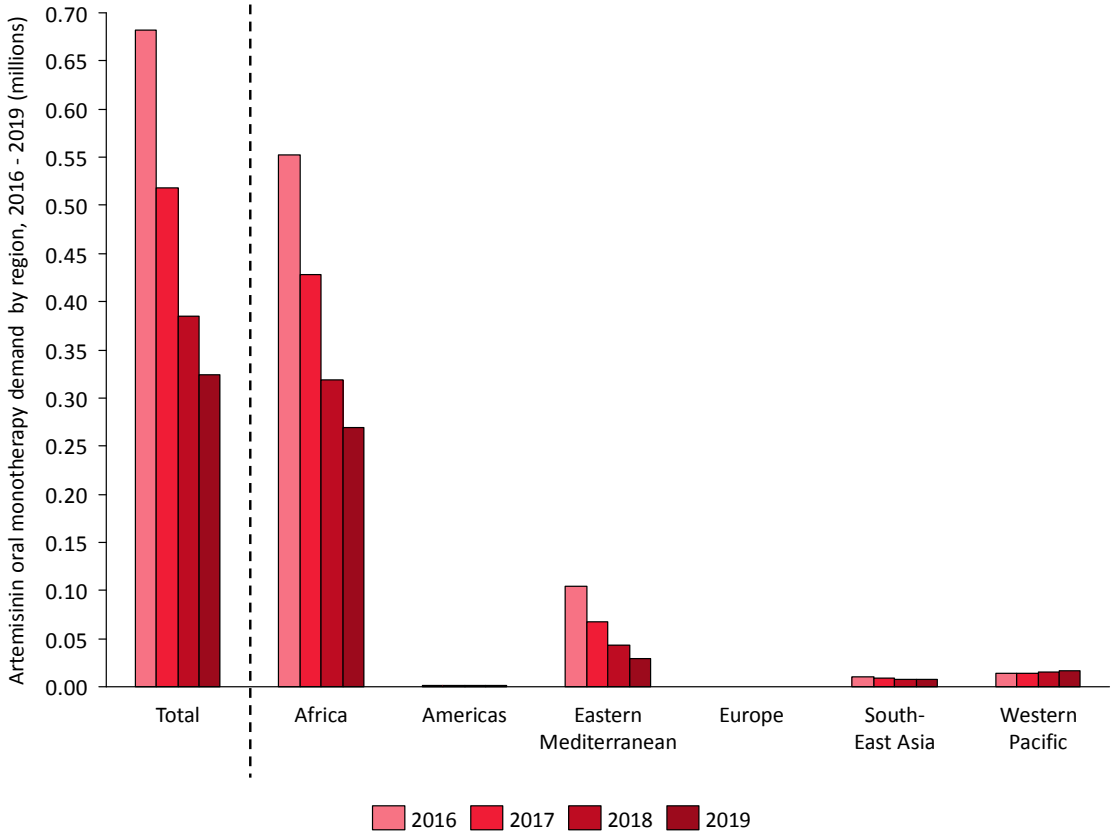
One of the interesting effects of the Global Fund's New Funding Model is that it has perhaps shifted the financial-geographical-product balance in the QAACT market. In 2010 – 2013, when the AMFm was ongoing, approximately 80% of Global Fund funding for QAACTs was targeted at a handful of countries, most of them using AL as their recommended first-line therapy for uncomplicated malaria. With the transition of the AMFm to the CPM program, QAACT procurement funding for this handful of countries has declined and the introduction of the funding envelopes has made procurement plans from other high-burden countries more prominent, some of them adopting ASAQ as their recommended first-line therapy. Thus, while AL will continue to dominate the QAACT market, we expect that as the CPM volumes decline, ASAQ market share may increase in 2017 and 2018.

Our demand model and procurement models produce different estimates for QAACT demand (361M in 2016, growing to 504M in 2019) and QAACT procurement (350M to 386M in 2016, and 329M to 392M in 2019) over the forecast period. This is the result of fundamental differences in what each model estimates and the source data they use. The demand model outputs estimates for ACTs (both QAACTs and non-QAACTs), and is based on analysis of historical trends using data derived from household surveys. Therefore, the demand model projects growth in ACT and QAACT demand. The procurement model makes projections based on historical procurement (i.e. order data) trends of QAACTs, with country-level procurement plan data used only for select high volume countries. There are obvious uncertainties inherent in this method, and the impact of these uncertainties will be explored in a follow-on forecast report where we model sensitivities of QAACT procurement to changes in funding cycles. Given the continuing expansion in ACT use in recent years, these projections demonstrate that QAACT procurement is unlikely to keep pace with demand, leaving a demand gap that will likely be filled by non-QAACTs.

Artemisinin Monotherapy Demand

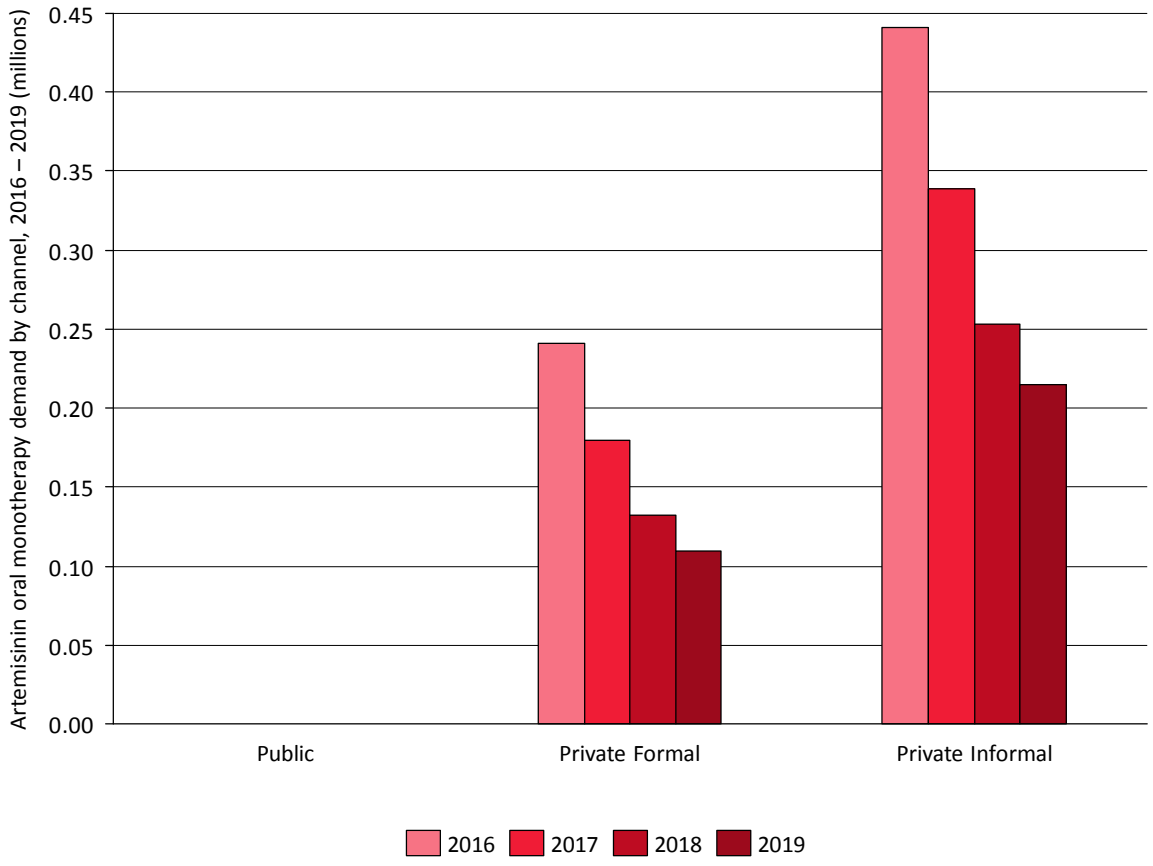
Despite guidance from the WHO for the market withdrawal of oral artemisinin-based therapies to halt the spread of artemisinin resistance, there is still evidence, observed through sales data collected by IMS, of continued, albeit declining, sales of oral artemisinin monotherapies (Figure 15). Oral artemisinin monotherapy use is forecasted to decrease in all regions as a result of efforts to phase out these medicines. We forecast demand for oral artemisinin monotherapy, which is highest in Africa, will decline in this region from 552,000 treatments in 2016, to 270,000 in 2019.

Figure 15 Oral artemisinin monotherapy global demand, by region, 2016 – 2019 (millions)



We have assumed that there is little to no use of oral artemisinin monotherapies in the public sector (Figure 16). We used IMS data to calculate the proportion of oral artemisinin monotherapy out of the total oral artemisinin demand in the private sector; this proportion has been applied to both the formal private and informal private channels. This results in a forecast demand of approximately 324,000 oral artemisinin monotherapies across both private sector channels in 2019

Figure 16 Oral artemisinin monotherapy global demand by channel, 2016 – 2019 (millions)



The lack of available data to support estimation of public sector demand for injectable or rectal artemisinin-derivative products precludes us from making any robust projections on their demand in the public sector at this time. However, we have forecasted public sector injectable artemisinin procurement later in this report. We forecast private sector demand for injectable artemisinin-derivative products is 33M in 2016 and will increase to 56M in 2019 (Figure 17). We forecast that private sector demand for rectal artemisinin-derivative products will increase, from 4M total suppositories (units: 80mg. artemether; 100mg. artesunate) in 2016 to 6M suppositories in 2019 (Figure 18). To estimate the demand for parenteral and rectal formulations of artemisinin in the private sector, we have used IMS private sector sales data to calculate the share of these forms as a proportion of total ACTs, based on average historic sales across a range of countries (historical sales data is from 2010 through 2015, and for countries where historical data is unavailable, we have applied a fixed ratio between injectable or rectal formulation volumes and oral ACT volumes based on aggregate 2015 data). We have applied this additional proportion to total oral ACT demand and then projected the shares forward to estimate future demand. Since the projections for injectable and rectal ACTs are linked to the growing demand for oral ACTs, the growth in demand of these forms may be overestimated in the forecast.

Figure 17 Injectable artemisinin demand, Private Sector, 2016 - 2019 (Standard Units, millions)

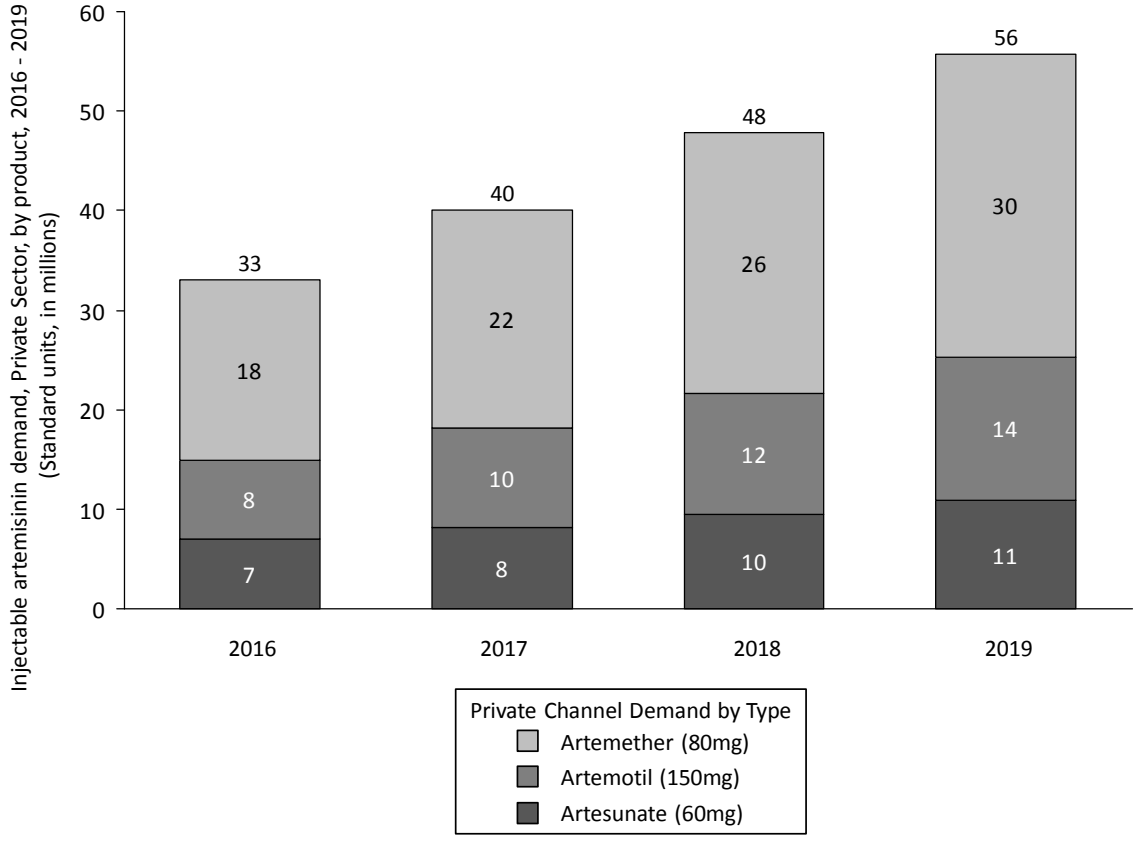
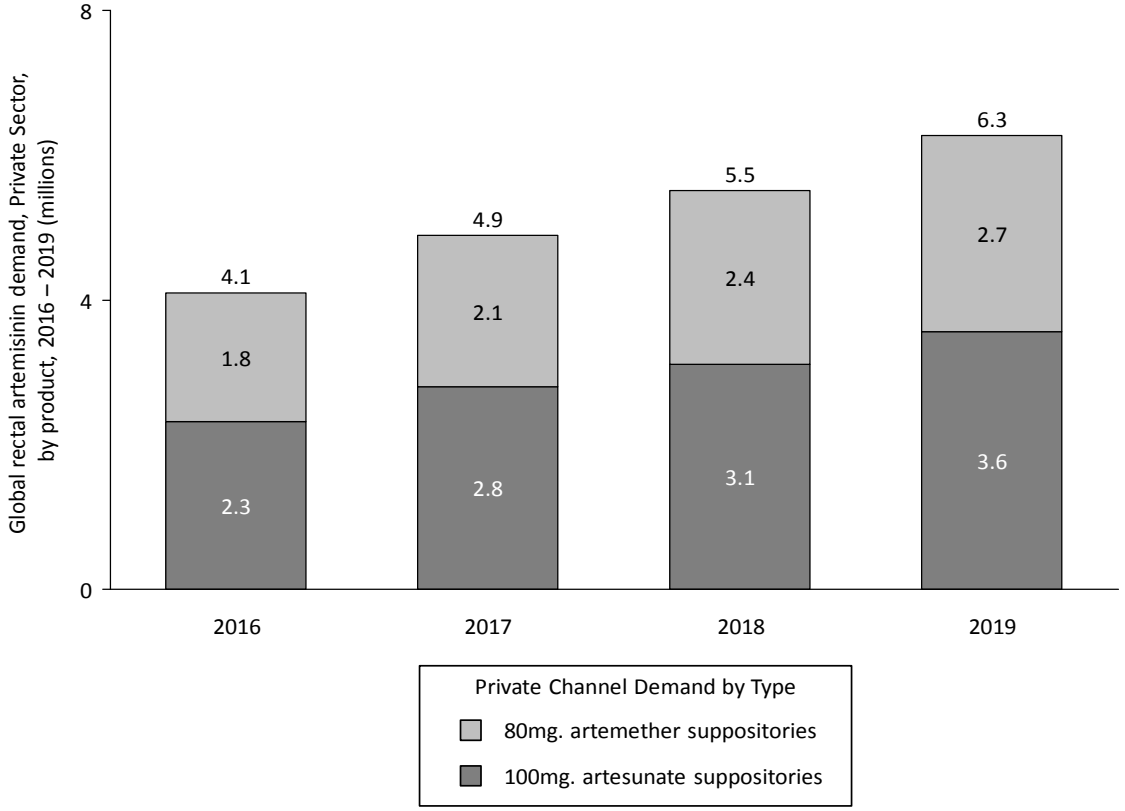


Figure 18 Global rectal artemisinin demand, Private Sector, by product, 2016 – 2019 (millions)



Discussion: Artemisinin monotherapy demand

Despite guidance from the WHO for the withdrawal of oral artemisinin-based therapy to halt the spread of artemisinin resistance (2), oral artemisinin monotherapies are still manufactured, sold, and administered across the globe. However, there is good news on this front: we expect that demand for these unfavourable medicines will continue to decline. With on-going efforts to reduce their usage, we forecast demand for oral artemisinin monotherapies will drop from 682,000 treatments in 2016 to 324,000 treatments in 2019. Since historical trends have been used to forecast future monotherapy demand, this figure is likely to be heavily impacted by regulatory initiatives that aim to reduce the usage of oral artemisinin monotherapies. The estimated demand volumes for injectable/rectal artesunate may exceed severe malaria caseloads, as it is likely that there is off-label use for these products.

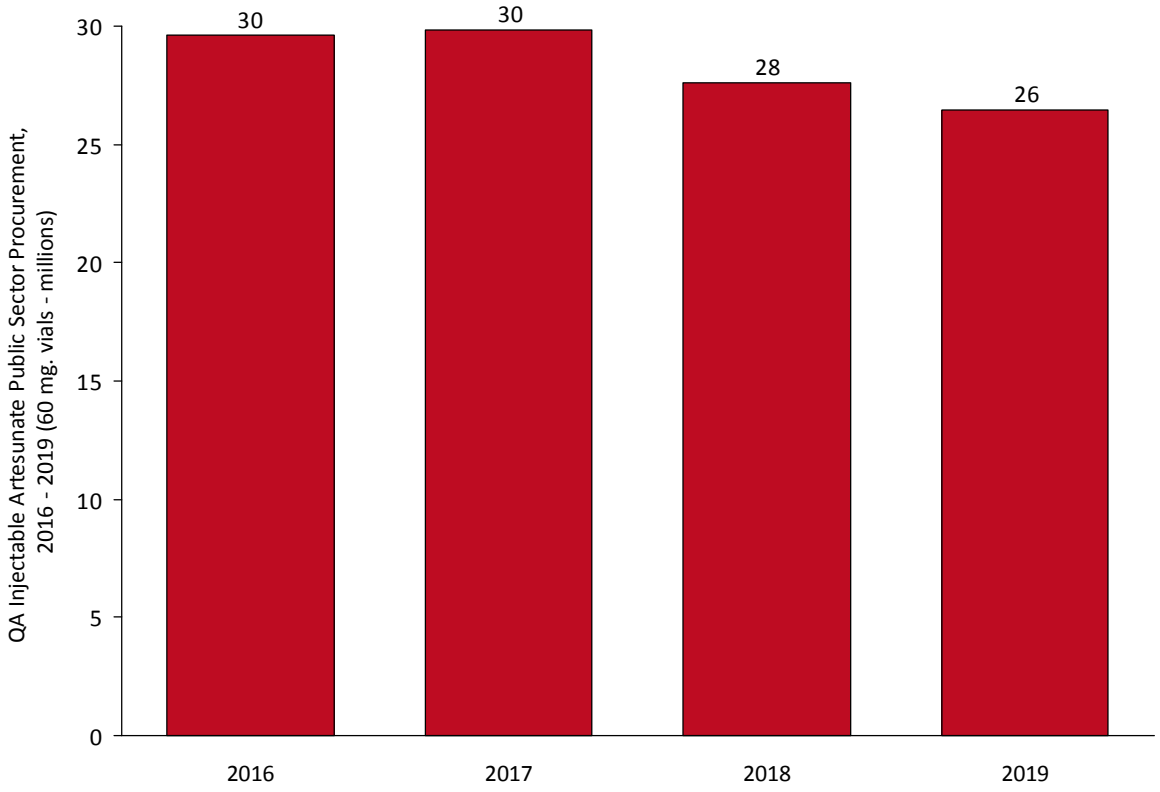
QA-Injectable Artesunate Procurement

Since the publication of the seminal SEAQUAMAT and AQUAMAT clinical trials, which demonstrated that replacing administration of quinine with injectable artesunate, in treatment of patients with severe malaria, resulted in 34.7% and 22.5% reductions in in-hospital adult and child mortality respectively (3,4), there has been a concerted effort to engage National Malaria Control Programs and advocate for the revision of treatment guidelines toward recommending injectable artesunate as the preferred treatment for severe malaria.

Because the market for quality assured injectable artesunate (QAINJAS) remains fairly young, there are few data on which to base assumptions around product uptake. Therefore, we have used current Global Fund procurement plans from high burden countries, as well as data from PMI and UNITAID, to build our forecast projections. We do not currently estimate the private sector procurement of QAINJAS but expect that it will be a small fraction of that in the public sector.

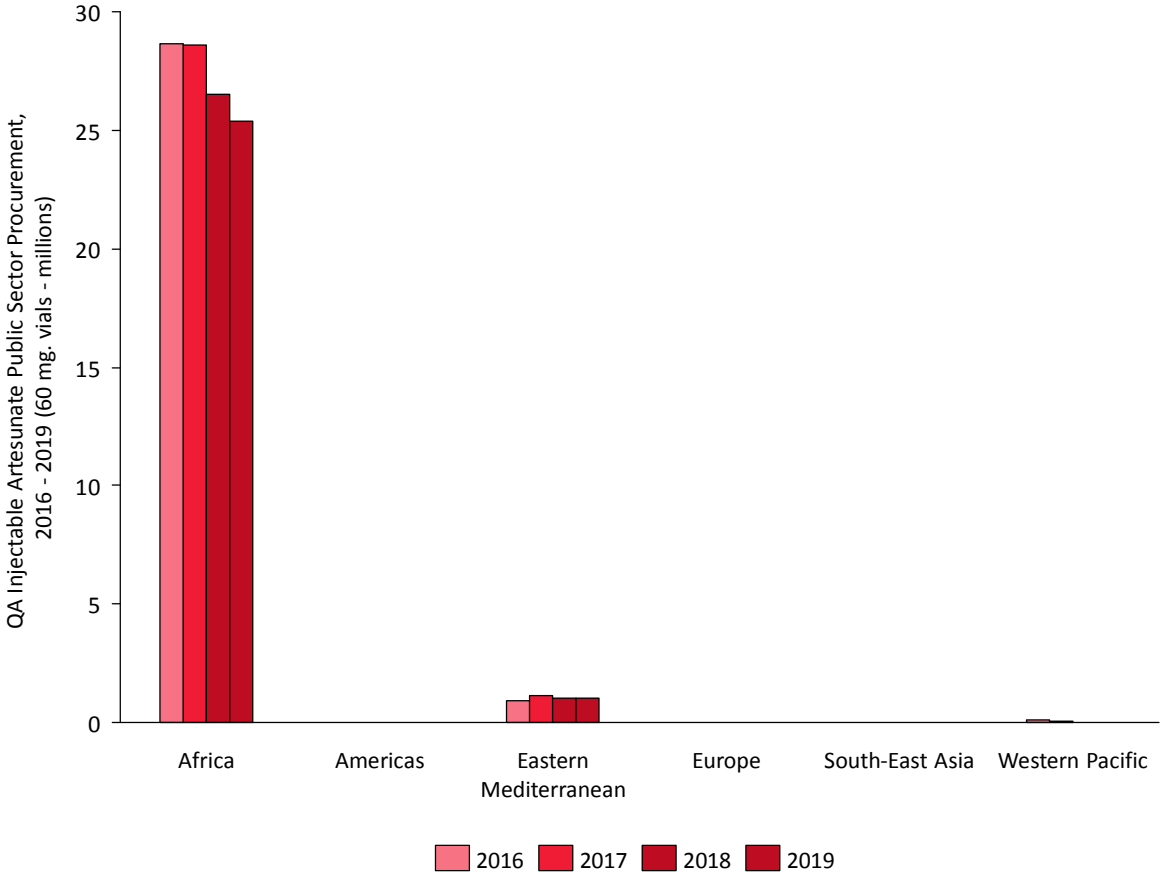
We forecast public sector QAINJAS procurement to be 30M 60 mg. vials in 2016 and 2017, with this figure slightly declining to 28M and 26M 60 mg. vials of QAINJAS in 2018 and 2019, respectively (Figure 19). The projected decrease in QAINJAS procurement between 2017 and 2019 is driven by a decrease in total malaria funding available through the Global Fund, following a peak funding year in 2017, since we have assumed the percentage spend on QAINJAS to remain consistent. This is leading to a decrease in funding available for, and consequently procurement of QAINJAS. The procurement through other donors is expected to remain flat.

Figure 19 QAINJAS public sector procurement, 2016 - 2019 (60 mg. vials - millions)



The African region will procure the majority of QAINJAS in the public sector (Figure 20). The Eastern Mediterranean region will also procure a significant volume of QAINJAS; however, this is procurement that will come largely from countries on the African continent – Sudan and South Sudan.

Figure 20 QAINJAS public sector procurement, by region, 2016 - 2019 (60 mg. vials - millions)



Discussion: QAINJAS procurement

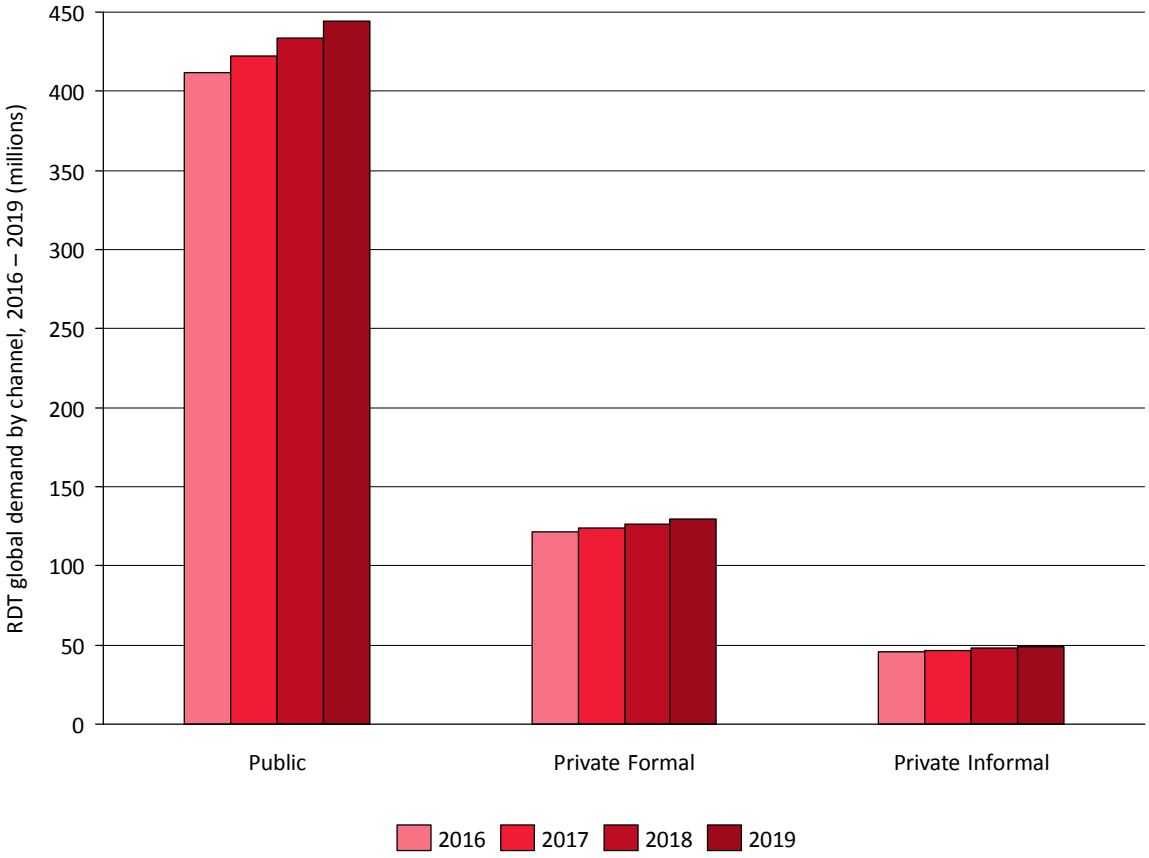
Over the past few years, there has been a significant push to switch the first-line therapy for severe malaria from injectable quinine to injectable artesunate. These efforts included a UNITAID-funded project led by the Medicines for Malaria Venture. In addition to these efforts, a number of countries have revised treatment guidelines, leading to an increase in procurement of QAINJAS. We currently forecast a two-year plateau in QAINJAS procurement, owing to flattened growth in the countries that have adopted this product, and our focus on forecasting this product only for countries that have adopted it to date, and a lack of information on which countries will adopt this product in the coming years. It is important to note that the model projecting QAINJAS demand is a different from the model supporting our procurement

forecasts, and therefore outputs between the two may not align. Owing to the recent Global Fund expert review panel approval of a quality assured rectal artesunate (QARAS) product, we will project public sector procurement for QARAS in subsequent reports.

RDT Demand

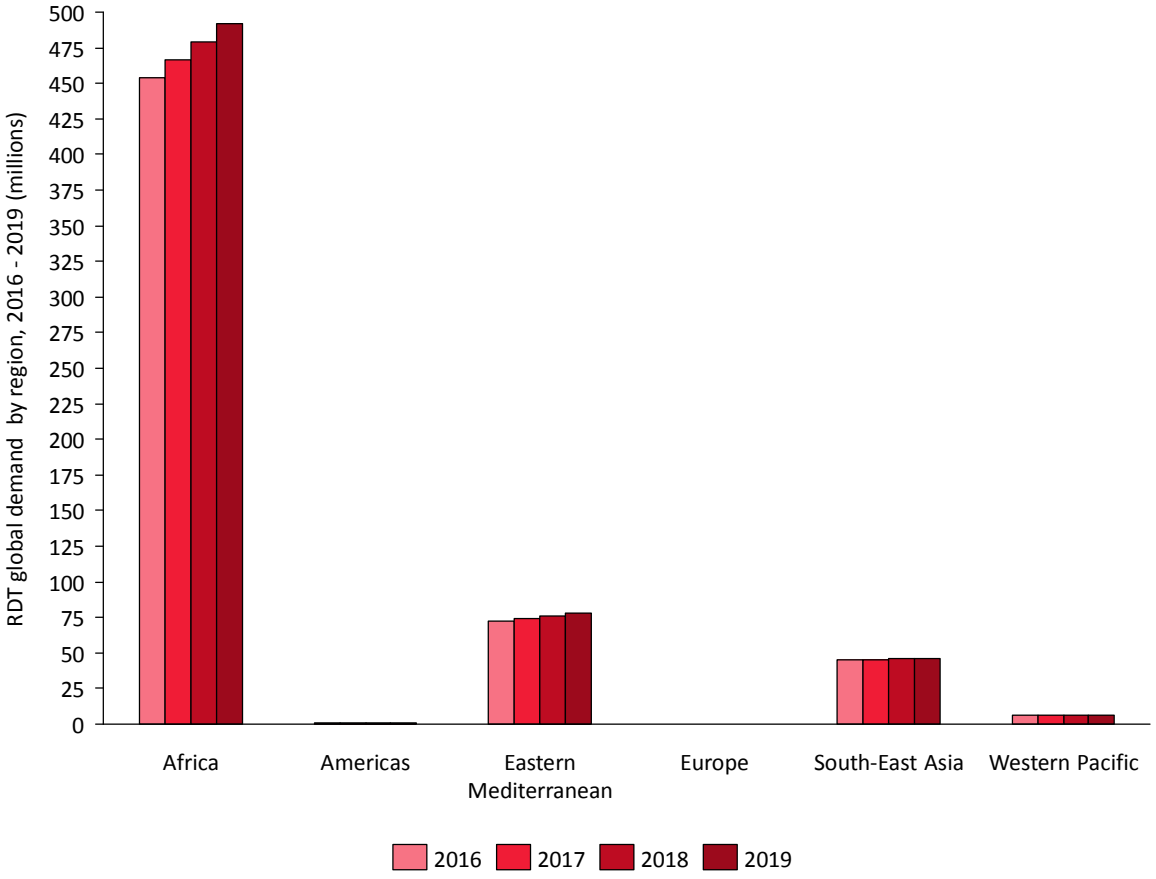
The antimalarial/ACT need and demand model includes fever testing by channel as an output. We have combined this with information from the 2015 World Malaria Report on the proportion of diagnosed cases that are examined using RDTs to estimate the number of tests carried out with RDTs. Due to the lack of information on RDT usage across the different channels we have applied the same calculated proportion across all three channels. Global demand for RDTs is estimated to be 578M tests in 2016, and will increase to 623M tests in 2019 with the continued growth of RDT usage in the public sector and increasing efforts to expand RDT access in the private sector. Overall, the majority of RDT testing is forecast to take place in the public sector, reaching 445M tests in 2019, and accounting for approximately 71% of all RDT testing (Figure 21). Without the addition of new interventions focused on RDT uptake in the private sector, RDT use in this channel is likely to remain flat.

Figure 21 RDT global demand, by channel, 2016 - 2019 (millions)



RDT demand is highest in Africa, where we forecast it will reach 492M tests, across all treatment channels, in 2019 (Figure 22). This reflects the high number of tests carried out in this region as well as the relatively higher share of RDT testing in the Africa region compared to other regions: 57% RDT share in Africa vs. 43% average across all regions.

Figure 22 RDT global demand by region, 2016 – 2019 (millions)



Discussion: RDT demand

Global demand for RDTs will grow from 578M tests in 2016 to 623M tests in 2019, owing to continued efforts to increase RDT uptake in the public sector and expand RDT use in the private sector. We estimate that 71% of all RDTs are currently used in the public sector. We forecast demand for RDTs in the public sector will expand from 411M RDTs in 2016 to nearly 445M in 2019. Expansion of RDT availability and use in the informal private sector remains a challenge, though some countries, like Tanzania and Kenya, are beginning to make inroads in this sector. Comparing our RDT demand forecast to our RDT procurement forecast exposes different outcomes based on two differing approaches. The RDT demand forecast is based on historical data on diagnostic testing as well as historical share of RDT use among diagnostic testing methods. Assumptions based on these data are projected forward in our patient-based decision

tree model to estimate the number of incident febrile treatment-seeking episodes that are tested with an RDT per year. The forecast demand is significantly higher than our procurement forecast as the demand estimates rely on test data from household surveys, and extend data on the portion of diagnostic tests conducted using an RDT across all sectors, while the procurement estimates focus on historical orders and procurement plans for the public sector, and do not include estimates of private sector RDT use.

RDT Public Sector Procurement

As is the case with QAINJAS procurement, the past few years have witnessed rapid growth in the malaria RDT market. Our forecast model uses a similar approach as that used for QAACTs with the key data inputs being available funding for the procurement of RDTs and RDT procurement plans or historical procurement data (from the Global Fund and PMI). For the private sector, we have applied the RDT share of testing (calculated from the 2015 World Malaria Report) to the private sector test forecast outputs from the demand model (described above).

We forecast global public sector RDT procurement to be 257M in 2016, peaking at 303M in 2017, before declining to 274M and 262M RDTs in 2018 and 2019, respectively (Figure 23). Growth in RDT procurement from 2016 to 2017 is largely driven by increased planned procurement in Africa (Figure 24). This increased procurement in 2017 results from a projected increase in Global Fund grant disbursements during the end of the current funding cycle combined with an increase in the average percentage of the disbursements spent on RDTs. Conversely, during the coming funding cycle, the decrease in RDT procurement from 2018 to 2019 is driven by a decrease in projected funding available through the Global Fund for malaria, with the percentage of funding earmarked for RDT procurement remaining stable. PMI funded RDT procurement is projected to remain stable aside of an increase starting in 2018 when the additional PMI funding becomes available.

Figure 23 RDT public sector procurement, 2016 - 2019 (millions)

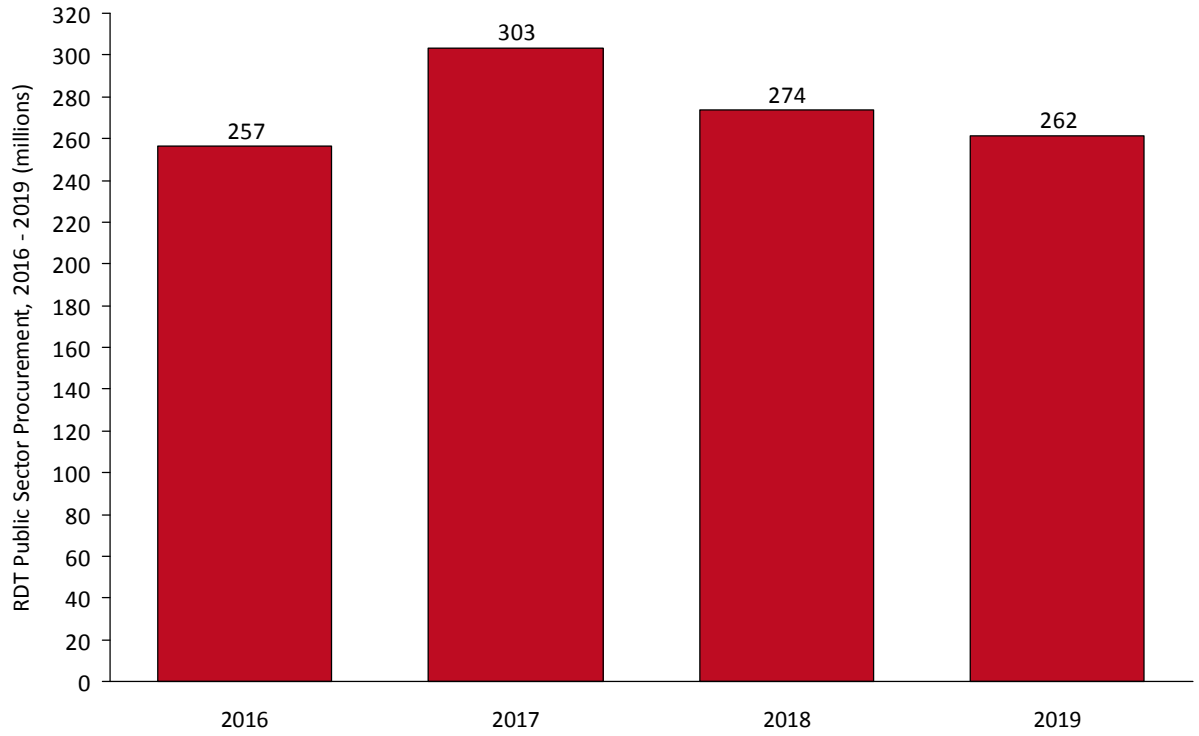
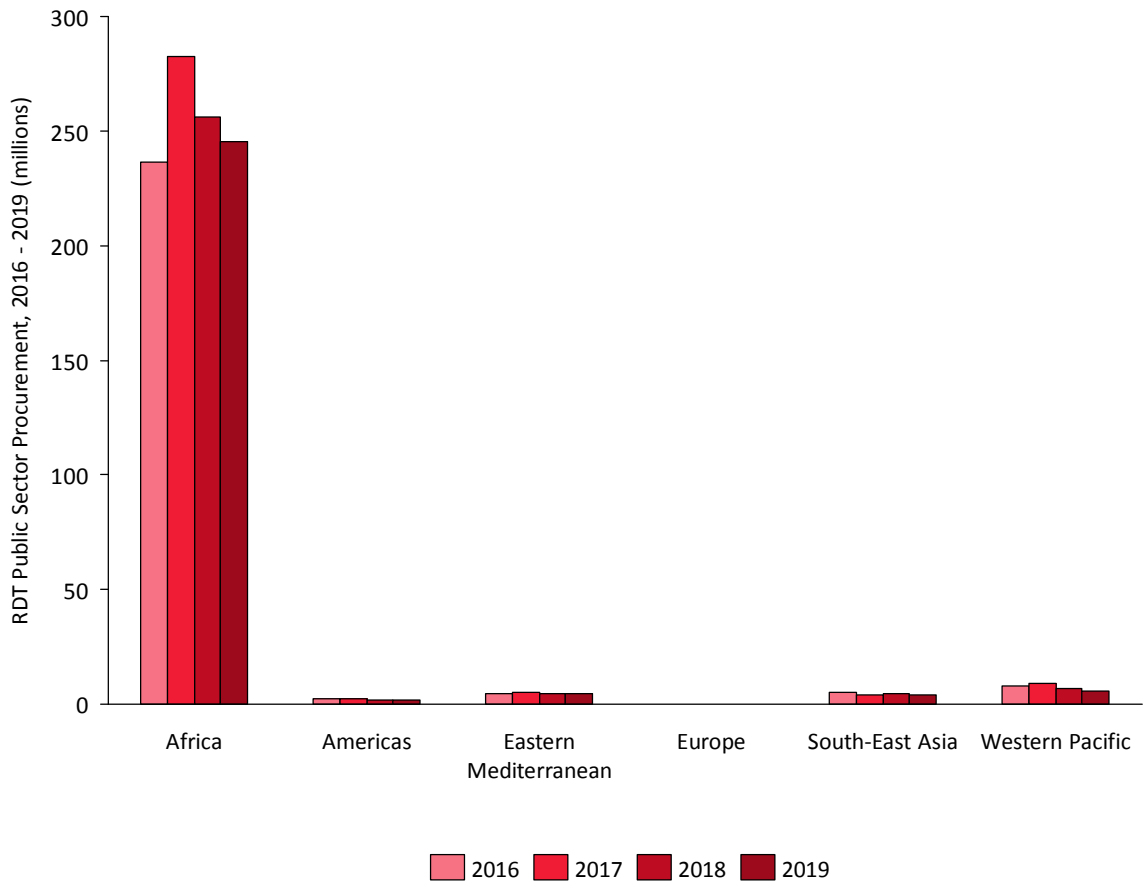


Figure 24 RDT public sector procurement by region, 2016 - 2019 (millions)



Discussion: RDT procurement

Public Sector RDT procurement will peak in 2017, driven by an anticipated increase in Global Fund grant disbursements as the current funding cycle comes to a close, and increasing funding allocations toward RDT procurement. Because we have little information on funding allocations and country procurement plans supporting RDT procurement and expansion in the private sector, the uncertainty in our private sector RDT procurement estimates precludes their inclusion in this report at this time, and we will revisit their inclusion in future reports given access to data that can reduce the uncertainty in those forecasts. Our forecast relies on recent historical procurement and funding allocations to estimate future procurement. Therefore, while it does incorporate ongoing initiatives that have been driving uptake of RDTs in some settings for the past few years, it does not generalize trends in recent RDT uptake across all countries in

the model, and therefore, may underestimate procurement if additional high-volume countries shift their procurement and case management strategies toward expanding RDT use more broadly.

Artemisinin Demand for API

Global demand for artemisinin can be calculated by tabulating the number of QAACT treatments that will be procured (taking into account the dosage/strength of each commodity) in a given year, summing this figure with projections of demand for non-QAACTs, injectable artesunate, and artemisinin monotherapies, and converting these estimates to API demand using the process yields commonly associated with industrial conversion of raw artemisinin to its various derivative products (process yields obtained in communication with industry experts):

Efficiency of conversion from Artemisinin to Artemisinin Derivative	
Artemether	80%
Artesunate	106%
Dihydroartemisinin	80%

In addition to the efficiency of conversion from artemisinin to artemisinin derivative, our artemisinin demand calculation also accounts for a 5% material loss that occurs during conversion of artemisinin derivative APIs to oral, parenteral, or rectal formulations, and during packaging of such treatments.

Among artemisinin derivatives, artemether has the highest demand, driven by AL being the most widely used ACT (Figure 25). We forecast global demand for artemisinin will slightly decline from 197 metric tons (MTs) in 2016 to 193MTs in 2017, before increasing to 214MTs in 2018, and 226MTs in 2019, respectively (Figure 27). We have assumed that the efficiencies in converting artemisinin to its derivative products will remain constant throughout the forecast period, and as such, the change in global demand for artemisinin is a function of change in

procurement of QAACTs and demand for non-QAACTs, injectable artesunate and other artemisinin monotherapies (Figure 9, Figure 11, Figure 15, Figure 17, and Figure 18).

Figure 25 Artemisinin derivatives' demand by derivative, 2016 – 2019 (MTs)

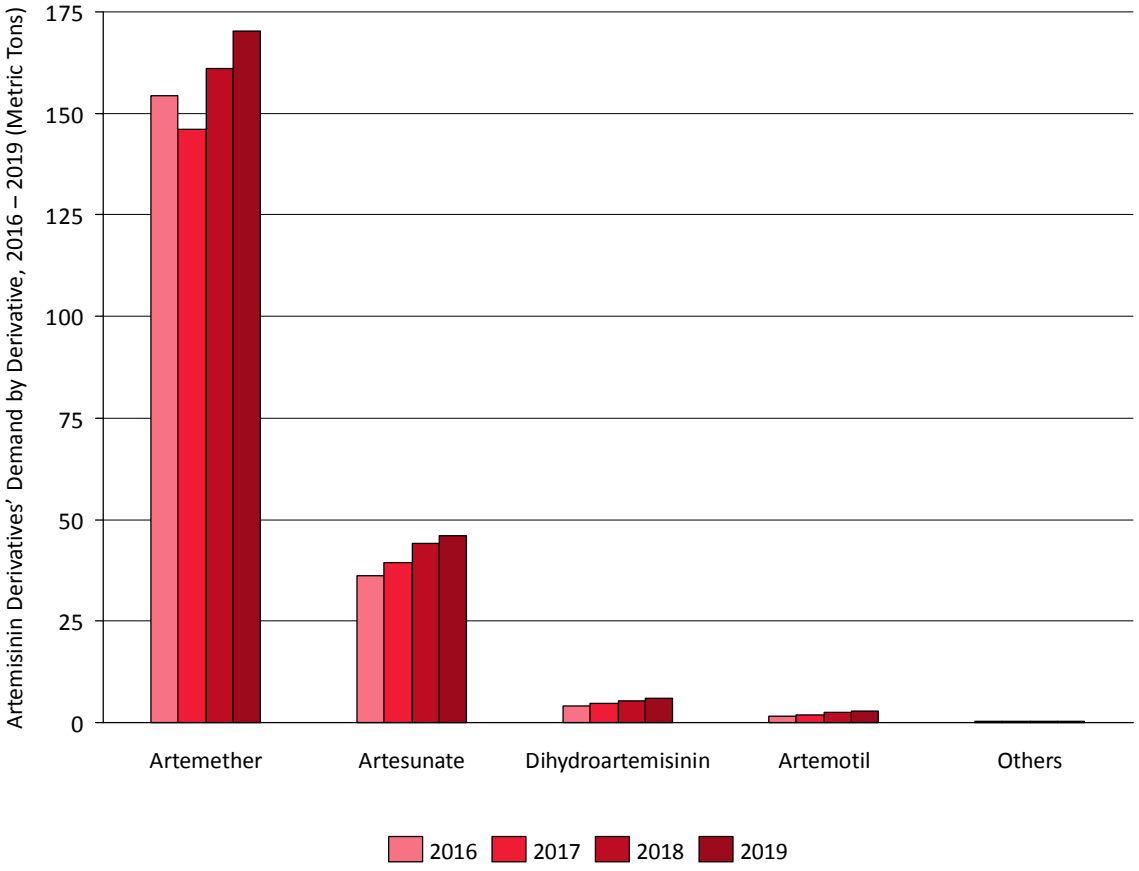
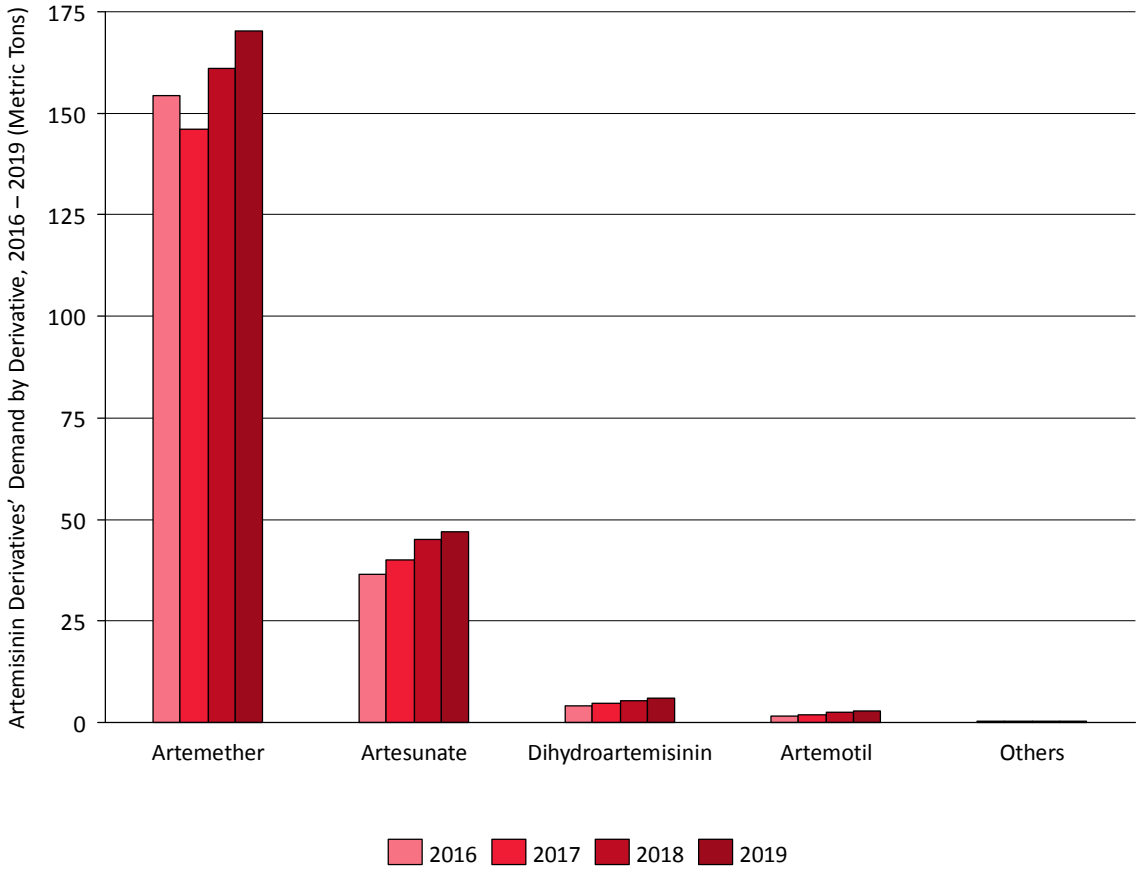


Figure 26 Artemisinin derivatives' demand by derivative, 2016 – 2019 (MTs)



Discussion: Artemisinin demand

We have leveraged our ACT, oral artemisinin monotherapies, and injectable/rectal artesunate forecasts to estimate the global demand for artemisinin, and forecast 197MTs of artemisinin was required to meet global demand for artemisinin-containing medicines in 2016. We forecast demand for artemisinin to dip down slightly to 193MTs in 2017 despite the large forecasted decrease in procurement of QAACTs in 2017, which is counteracted by an increase of ACTs (both QAACTs and non QAACTs) in the non-subsidized private sector. It is expected to increase to 214MTs in 2018 and 226MTs in 2019 owing to the rebound in QAACT procurement in 2018 with the influx of PMI's additional funding for malaria programs, and sustained growth in demand for all other artemisinin containing

medicines, including non-QAACTs. ACTs comprise approximately 97% of global artemisinin demand, with QAACTs commanding approximately 57% to 70% of global artemisinin demand. The ACT share of artemisinin demand is only bound to increase as oral artemisinin monotherapies are phased out of use.

The demand for artemisinin can be influenced by numerous potential events (e.g., reduction in ACT demand with the introduction of ubiquitous, effective case management; increased demand resulting from increased frequency of delayed parasite clearance in ACT-treated patients that leads to an extension in the duration of therapy). We may explore such scenarios and their impact on RDT, ACT, and artemisinin demand in a future forecast report.

Figure 27 Artemisinin demand for API, 2016 – 2019 (metric tons)

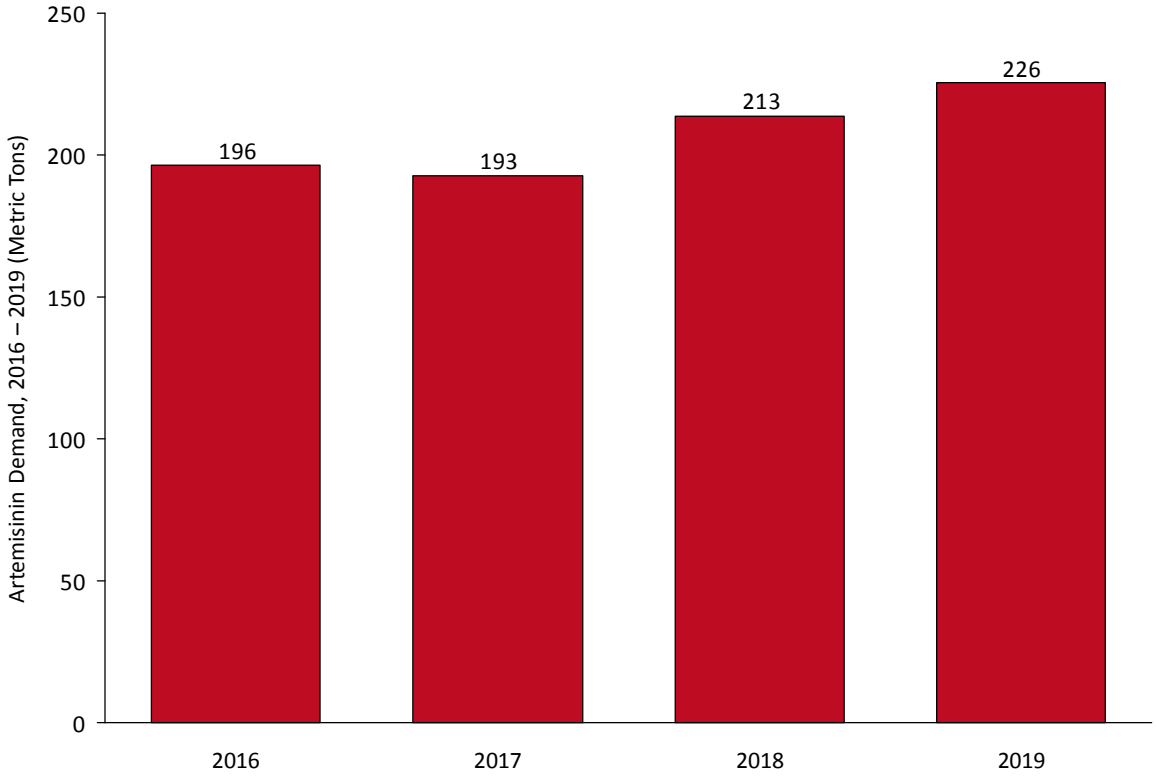
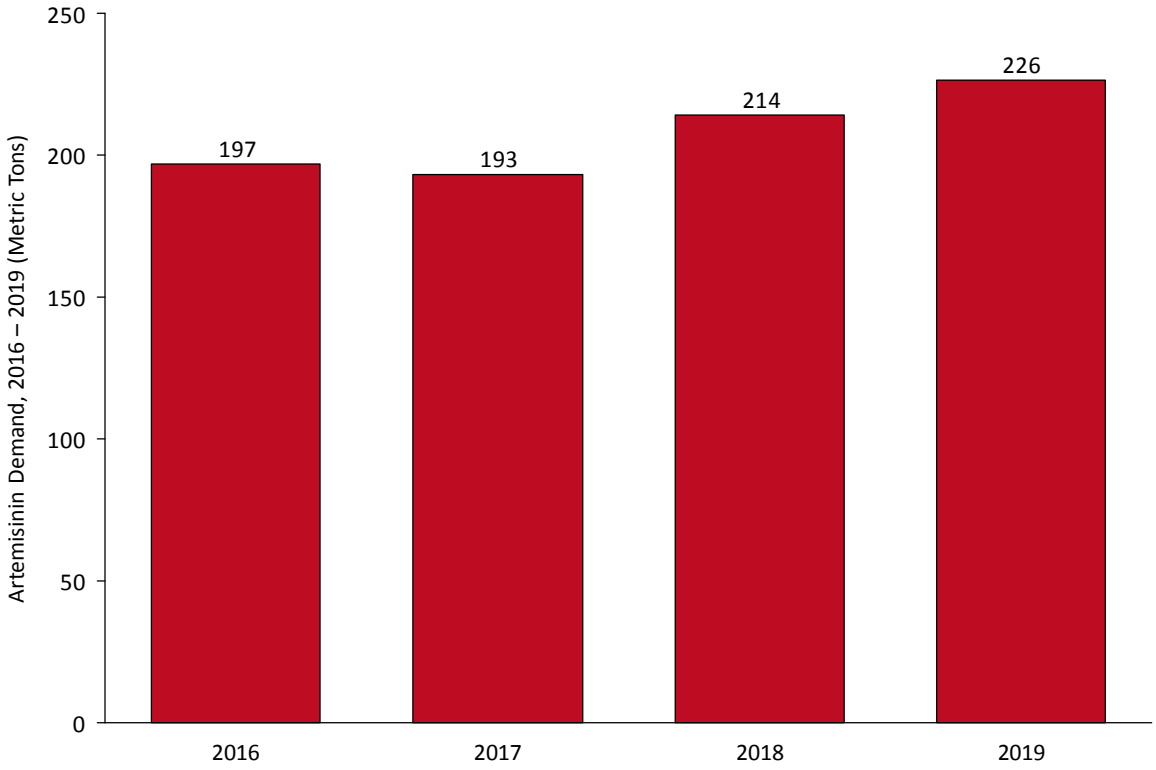


Figure 28 Artemisinin demand for API, 2016 – 2019 (metric tons)



3. EVENTS

In this report, we have used our forecasting models to estimate how specific events/scenarios might affect the ACT/RDT markets. We present analysis around three potentially key events that may occur during the forecast period. An "event" is a future occurrence which will change the expected evolution of given behaviors and acts as a disruption to the baseline forecast. For example, events may include: changes in funding, changes in treatment guidelines, new product launches, new formulation launches or specific disease awareness or education programs. On-going trends, such as improvements to case management in some countries, or decrease in usage of oral artemisinin monotherapies, are not considered as events and are included in the baseline projections.

Predicting the impact of an event is complex and the outputs of this analysis should be used with caution. There is limited historical data to benchmark future shifts in the market, so event impacts have been quantified using best estimates based on available information and judgment. This project's Steering Committee members have provided input on which events are most critical to model at this point in time, and have provided some guidance on expectations for the impact of the selected events. We have used the Steering Committee's guidance, along with other available data and qualitative information sources, to provide a consensus view of the impact of each event which has been applied in the model.

The eventing process is iterative by nature and is described previously. With guidance from the project's Steering Committee, we have profiled and provided a number of potential events that could impact artemisinin or RDT demand in the future. Only events affecting demand and procurement have been considered. The Steering Committee has reviewed these events and has selected three events that they believe may have the greatest impact over the current forecast period:

Events 1 & 2: Change in total donor funding available for QAACTs and the total donor funding available for RDTs.

Event 3: Termination of the Private Sector Co-Payment Mechanism (CPM) in countries currently participating in the CPM.

The first two events have been analyzed together in view of their interdependence. The third event will be analyzed separately.

Events 1 & 2: Market impact from a change in total donor funding available for QAACTs and total donor funding for RDTs

Event Summary Sheet	
Event Title	Change in total donor funding available for QAACTs and total donor funding for RDTs
Event Description	This combined event describes the potential impact of a change in total donor-sponsored funding available for procurement of QAACT treatments and RDTs in the public sector.
Baseline	Total donor funding available for QAACTs & RDTs follows historical trends
Anticipated Impact	No impact anticipated on global RDT or QAACT demand. The Global Fund has met its targets for its next replenishment cycle and it is not expected that the funding envelope will decrease to such an extent that demand is impacted. New funding commitments from PMI have been incorporated into the baseline forecast and no further additional funding commitments are anticipated from this donor during the forecast period. In addition, maintaining investment in RDTs and QAACTs is a strong priority in most countries so even if there is a slight decrease in the funding envelope it is assumed that demand will remain stable and budgets supporting procurement of these diagnostic and treatment commodities will be protected.

This analysis assumes that the event may be influenced in a number of ways, including changes to the global economic environment and Global Fund resources, changes in the Global Fund priorities or allocations, and impact of national counterpart financing.

Impact of changes in the wider economic environment on the demand and procurement forecasts

The Global Fund funding comes from a number of sources, with 39 major donors contributing to the 2014 – 2016 fourth replenishment. However, 82% of this budget comes from just six donors: the United States of America (US), the United Kingdom, France, Germany, Japan, Canada, and the European Community (EC). Therefore, the economic health of these countries may affect future Global Fund resources significantly.

The demand forecast should consider the implications of other drivers on national growth in the key countries identified above, given the weight of their contributions to the Global Fund budget overall. Several of these countries, notably some in the EC, are currently facing sluggish economic growth. The US economy is growing at a relatively faster rate than most economies in the EC, but the US has just undergone a Presidential election cycle with the next US President due to be inaugurated in January 2017. Reflecting uncertainties and weaknesses in the state of the global economy, the International Monetary Fund (IMF) forecast 3.1% global economic growth in 2016 (5). Given the prominent roles of the Global Fund and PMI in financing malaria treatment and diagnostic commodities, changes to the political or economic status quo may affect the overall funding for procurement of RDTs and QAACTs, and have an add-on effect on demand.

While the current global economic outlook, coupled with extended need for limited funds committed to international development, peace, and health programs, could result in a reduction in funding for malaria programs, we do not anticipate that the global economic climate will adversely affect Global Fund or PMI financing the 2017-2019 period.

Impact of changes on the Global Fund's priorities and allocations on the demand forecast

National and other donor contributions have already been committed for the period 2014 – 2016, for slightly over $12B. These funds will be made available to cover the costs of existing grants (covering the requirements for the QAACT and RDT demand forecast until end 2016).

Thus, the funds required for the initial period of the forecast are already theoretically guaranteed by the Global Fund.

The Global Fund is currently engaging in its fifth replenishment process, to guarantee funding for the period 2017 – 2019. This process commenced at the December 16-17, 2015 preparatory meeting for the Global Fund's fifth replenishment, which was held in Tokyo, Japan, where the Global Fund announced that it will seek $13B in funding commitments to finance programs for 2017 – 2019. In September, 2016, the Global Fund announced that this replenishment goal was met with commitments from several donors.

Other changes to The Global Fund funding such as re-focusing of grant allocations between the diseases have also been considered. This has been discussed with the Steering Committee and it is anticipated that malaria funding is likely to remain at 32% of the total allocation. It is less clear how this allocation will be further divided among countries. The Global Fund's strategy is shifting to focus increasingly on under-served populations and high risk groups, as well as recognizing the likelihood of several countries (none in Africa at present) transitioning from Global Fund funding. This is not expected to have an impact on demand unless funding in the public sector is reduced to such an extent that a given country is unable to procure medicines. We expect that countries will prioritize procurement of WHO-recommended malaria medicines and diagnostics and if faced with funding constraints, would likely reduce non-commodity budgetary spending.

The $13B Global Fund fifth replenishment is similar to previous replenishment funding levels. The assumption made in this forecast is that funding will remain at approximately the same levels for the period 2017 – 2019. Therefore no decrease in demand is expected as a result of changes to absolute levels in Global Fund funding.

Impact of USAID-PMI funding on the demand forecast

In its 2015 – 2020 strategy document, USAID's PMI has committed to accomplish a 40% reduction in malaria morbidity and a 33% reduction in malaria mortality, from 2015 levels, in

PMI-supported countries by 2020 (6). USAID's Fiscal Year (FY) 2016 budget includes $674M for PMI (7), representing a 9% increase in overall funding from the $618M FY2014 budget (8). While it is difficult to predict whether the increase in PMI funding will translate to an increase in RDT/QAACT demand or procurement, if there is going to be a reduction in donor funding for RDTs or QAACTs, it will not likely be driven by changes to PMI's strategic investment priorities for malaria.

Impact of changes on the National Counterpart financing to the demand forecast

While none of the high burden countries are expected to transition away from Global Fund funding for malaria in the forecast timeframe, the influence of national counterpart financing may be important. As part of the Global Fund's New Funding Model, countries commit to providing national counterpart financing for tackling the burden of the three main diseases including malaria.

If domestic funds are used for non-commodity costs, this would have no direct implication on QAACT/RDT/artemisinin procurement over the period of the grant. Thus there is likely to be no impact on QAACT and RDT demand over the forecast period. Should a government fail to meet its contribution requirement, this could have an impact on the grant disbursement overall, thus impacting the funding available for commodity procurement. Given the importance of the Global Fund grants for many of the 88 countries in our forecast model, and the increased support provided by the Global Fund in continual dialogue with the country principal recipients, this is thought to be low risk.

Conclusion for Events 1 and 2: Market impact from a change in total donor funding available for QAACTs and total donor funding for RDTs

Based on the dynamics discussed, no changes to the diagnosis and treatment cascade are expected as a result of this event. The Global Fund has met the goal of raising $13B in funding commitments for its next replenishment cycle, which is comparable to the funds raised in the

fourth replenishment, but which represents a slight decrease from the total $15.8B funding allotment (including surplus funds) from that replenishment. The Global Fund may adjust the replenishment figure as more pledges come in. The key question is whether there will be decreases to country funding envelopes that are significant enough to have a sufficient impact on global QAACT and RDT demand. We assume that such changes to country funding envelopes will not have an impact at the global level as the overall change in funding is small and countries will prioritize maintenance of their investments in RDTs and QAACTs. It is likely that budgets for procurement of QAACTs and RDTs will be protected even if there is a decrease in the funding envelope, and thus neither demand for QAACTs and RDTs will diminish, nor will procurement.

Event 3: Termination of the Private Sector Co-Payment Mechanism (CPM) in countries currently participating in the CPM

Event Summary Sheet	
Event Title	Termination of the Private Sector Co-Payment Mechanism (CPM) in countries currently participating in the CPM.
Event Description	Cessation of funding allocation, initiated at the country level in the Global Fund concept notes, for continued investment in a Private Sector Co-payment Mechanism (CPM), with programs eliminated after the current funding cycle.
Baseline	Countries continue to fund the CPM as outlined in current or imminent Global grants
Anticipated Impact	Decrease in overall ACT (QAACTs and non-QAACTs) demand in the private sector Increase in proportion of non-QAACTs demand in the private sector Decreased QAACT procurement in the private sector Number of cases of severe malaria may increase, increase in fever cases and malaria prevalence

The CPM follows on directly from the AMFm and continues to focus on providing a subsidy, provided directly to manufacturers, for recommended QAACT products purchased by importers qualified as part of the CPM.

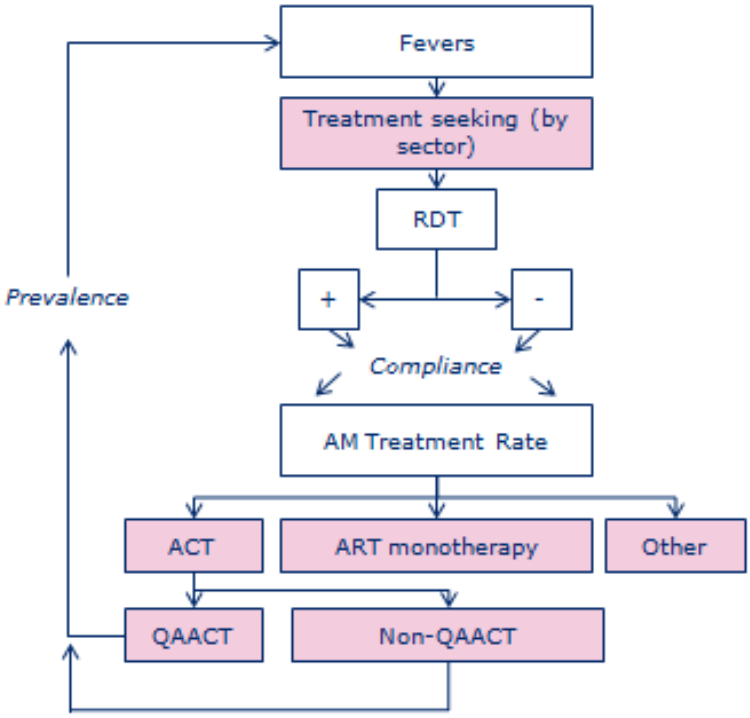
The analysis of this event will focus on the five nations that participated in the Phase I AMFm pilots and that have continued the CPM through 2016, phased into their current Global Fund grants (Ghana, Kenya, Tanzania, Nigeria, and Uganda). Three of the original AMFm pilot countries (Cambodia, Niger, Zanzibar) no longer participate in the program and thus are not included in this event modeling, and a fourth (Madagascar) is not among the top 20 burden countries, and thus will likewise not be included in the modeling for this event.

If the CPM is terminated in Ghana, Kenya, Tanzania, Nigeria, and Uganda, then the subsequent change in affordability and availability of QAACTs is likely to affect treatment demand. Although available retail pricing data is based on the available antimalarial products at the time of the surveys, which were conducted in a limited sampling of retail outlets, price differentials between antimalarial products can be significant: for example, the median retail price for CPM QAACTs was $1.75 in Kenya, $0.94 in Tanzania, and $1.30 in Nigeria while the median price for sulfadoxine-pyrimethamine was $0.56 in Kenya, $0.89 in Tanzania, and $0.62 in Nigeria (9–11). In Nigeria, median QAACT prices ranged from $1.87 in drug stores and pharmacies, to $2.50 in general retailers and private for-profit health facilities (9). As countries move beyond their current commitments (2016 or 2017) to support the CPM, price differentials between antimalarial products and those for identical products sold across different channels may have a critical impact on the ability of future CPMs, potentially financed through domestically-sourced funding, to achieve their targets for the affordability, availability, and appropriate use of QAACTs.

As historical ACT sales data have shown, the AMFm resulted in a significant increase in QAACT volumes in the initial pilot countries. While the market has stabilized, in part due to volume controls resulting from funding limitations, there is still a large volume of product passing through this mechanism and thus affecting overall demand.

Parts of diagnosis & treatment cascade impacted

The key points likely to be affected by a change in this event are:



- Treatment seeking by sector should QAACTs become significantly more / less available in one sector than another;
- The choice of product (ACT, monotherapy, other) based on what is available or preferred; and
- The use of a QAACT versus a non-QAACT based on availability and price.

As the private sector is not currently systematically using RDT or microscopy to diagnose malaria, we assume that treatment is often provided presumptively even if there are measures to increase the frequency of diagnosis before treatment. Thus, we assume that the consumption of RDTs is unlikely to be affected significantly in 2016 – 2017, but may change from 2018 if countries focus on achieving broad compliance with the diagnostics guidelines across all distribution channels.

Similarly, many national malaria control strategic plans consider prevalence rates to be significantly influenced by (1) better diagnosis, (2) improved reporting on malaria cases and (3) scale up in preventive measures (long lasting insecticidal nets; LLINs) or, inversely, decreases in prevention (e.g. due to decreased LLIN coverage rates and/or insecticide resistance). We therefore believe that a change in the CPM is unlikely to be the most significant driver in national prevalence data.

We have modeled the event's impact as starting in 2018 for all five countries (Table 2). The peak impact is reached after two years and we have modeled a linear relationship between the impact and time; if the time to impact is 2 years, then 50% of the impact is reached at the end of year 1 and 100% of the impact is reached after two years. These assumptions are in-line with a typical model of market share erosion with the introduction of generic (off-patent) products, in which peak impact is reached after two years.

Table 2 Summary of countries affected by event, event start date and time to impact

Country	Event start date	Time to impact
Ghana	2018	2 years
Kenya	2018	2 years
Nigeria	2018	2 years
Tanzania	2018	2 years
Uganda	2018	2 years

Table 3, below, highlights how the event will affect the demand forecast baseline. For each event impact, the key point in the baseline forecast that is affected, and the quantification of the impact, is provided.

Table 3 Summary of event effects by level impacted and quantified impact

Event impact	Key impact point	Quantification of impact
1.Treatment seeking by sector (should ACTs become significantly more / less available in one sector than another)	Treatment seeking private formal	We have assumed that there will be a reduction in treatment seekers in the private sector and an increase in treatment seekers in the public sector as subsidized QAACTs become less available or less affordable in the private sector. We have assumed that this corresponds to a **10% decrease** in treatment seekers in the private formal and informal sectors with a **corresponding increase** in treatment seekers in the public sector. This is an estimate, as there is no reliable data available to predict how treatment seeking behaviour might change with regard to which sector treatment is sought.
	Treatment seeking private informal	
	Treatment seeking public	
2.The choice of product (ACT, monotherapy, other) based on what is available	Treatment with artemisinin in the private informal channel	We have assumed that a proportion of treatment seekers in the private informal sector would shift to lower cost antimalarials (not ACTs) as the CPM is removed. We used IMS data to compare the usage of ACTs to other antimalarial products in the private sector in CPM and non-CPM countries. As expected, usage of ACTs is higher in CPM countries vs. non-CPM countries. On withdrawal of the CPM, we have assumed a **12.5% decrease** in ACT usage in the private informal sector. This decrease brings the percentage of ACT usage in line with the higher range for non-AMFm countries.

3.The use of a QAACT versus a non-QAACT based on availability and price	Treatment with QAACT in private informal sector	We have assumed that there will be a **decrease in usage of QAACTs** in the private channels as CPM is withdrawn.
	Treatment with non-QAACT in private informal sector	For the private informal sector, we have assumed that usage of QAACTs decreases to match levels observed in non-CPM countries. In non-CPM countries, QAACT demand typically makes up approximately 23% of total ACT demand in the private sector. A corresponding increase in demand for non-QAACTs is assumed.
	Treatment with QAACT in private formal sector	We expect there to be less switching from QAACTs to non-QAACTS in the private formal sector and demand for QAACTs is expected to remain higher than the average level observed for non-CPM countries. Therefore we have assumed that QAACTs will contribute to 33% of total ACT demand in the private formal sector. This is an estimate as there is no reliable data available to predict how consumer behaviour might change with regard to treatment seeking and treatment in the two private sectors.
	Treatment with non-QAACT in private formal sector	A corresponding increase in demand for non-QAACT is also assumed in the private formal channel.

Impact on QAACT Demand

As previously discussed, termination of the CPM is forecast to affect ACT demand in Ghana, Kenya, Nigeria, Tanzania and Uganda. All other countries maintain the same ACT demand as specified in the baseline. Out of the five countries that are impacted by this event, Nigeria has the largest baseline ACT demand and correspondingly is forecast to have the largest net change in QAACT demand after event three is applied (Table 4).

Table 4 Event #3: Termination of CPM post 2017: Absolute QAACT demand 2018-2019 in Ghana, Kenya, Nigeria, Tanzania and Uganda

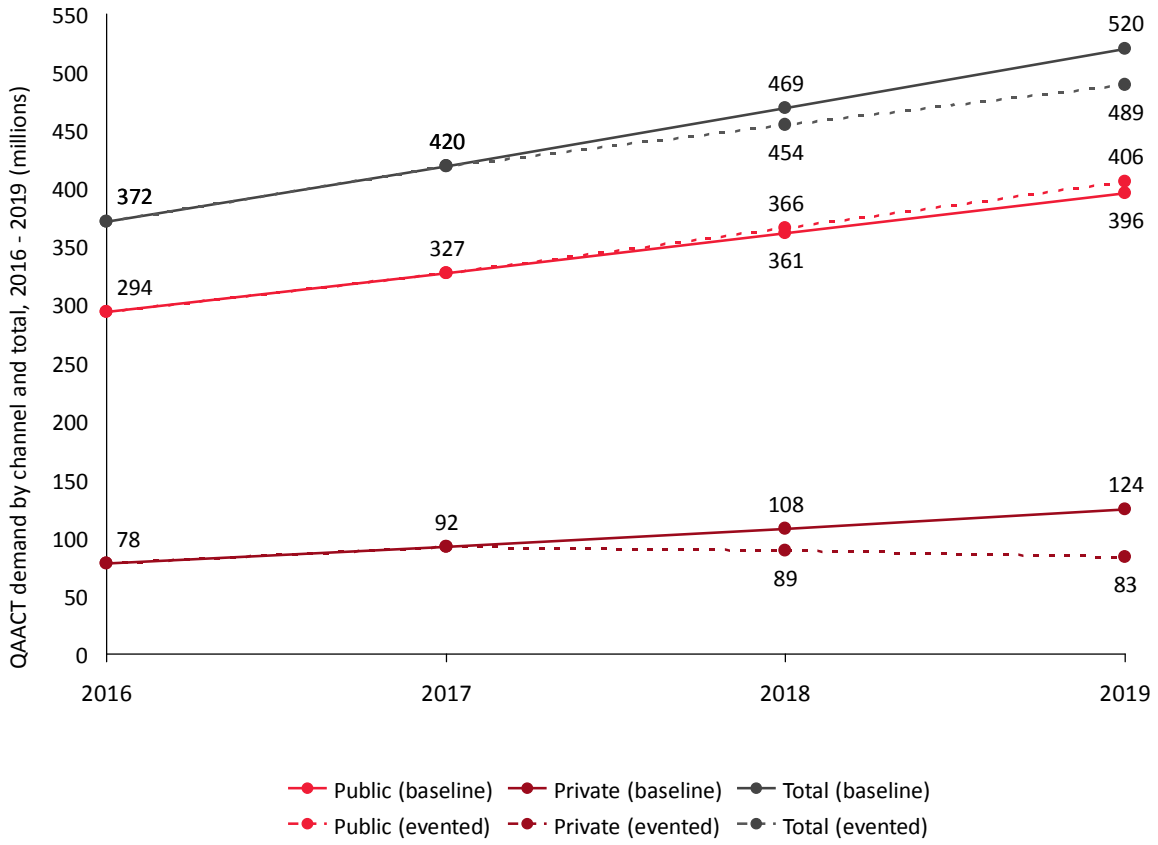
	Absolute demand for QAACTs with event 3 applied				Net change in QAACT demand from baseline	
	2018		2019		2018	2019
Country	Public	Private	Public	Private	All channels	
Ghana	12,895,250	3,322,382	14,156,648	1,813,094	-1,475,032	-2,877,135
Kenya	16,226,673	3,851,605	18,394,633	2,151,228	-1,592,553	-3,208,803
Nigeria	21,329,711	13,087,728	27,555,863	7,794,511	-6,359,898	-13,946,052
Tanzania	24,485,142	4,241,465	27,452,086	2,372,360	-1,853,955	-3,710,28
Uganda	25,671,970	7,644,426	28,224,566	4,165,154	-3,517,421	-6,850,228

Comparing the evented global ACT demand forecast to the baseline (Figure 29) shows that termination of CPM leads to a <1% decrease in total ACT demand in 2019. This slight decrease is due to a greater number of treatment seekers switching to cheaper, non-artemisinin, antimalarial medicines, as compared to treatment seekers who switch to get treatment from the public sector.

Figure 29 Event #3: Cessation of CPM post 2017: Baseline and Evented ACT demand, by channel, 2016 – 2019 (millions)

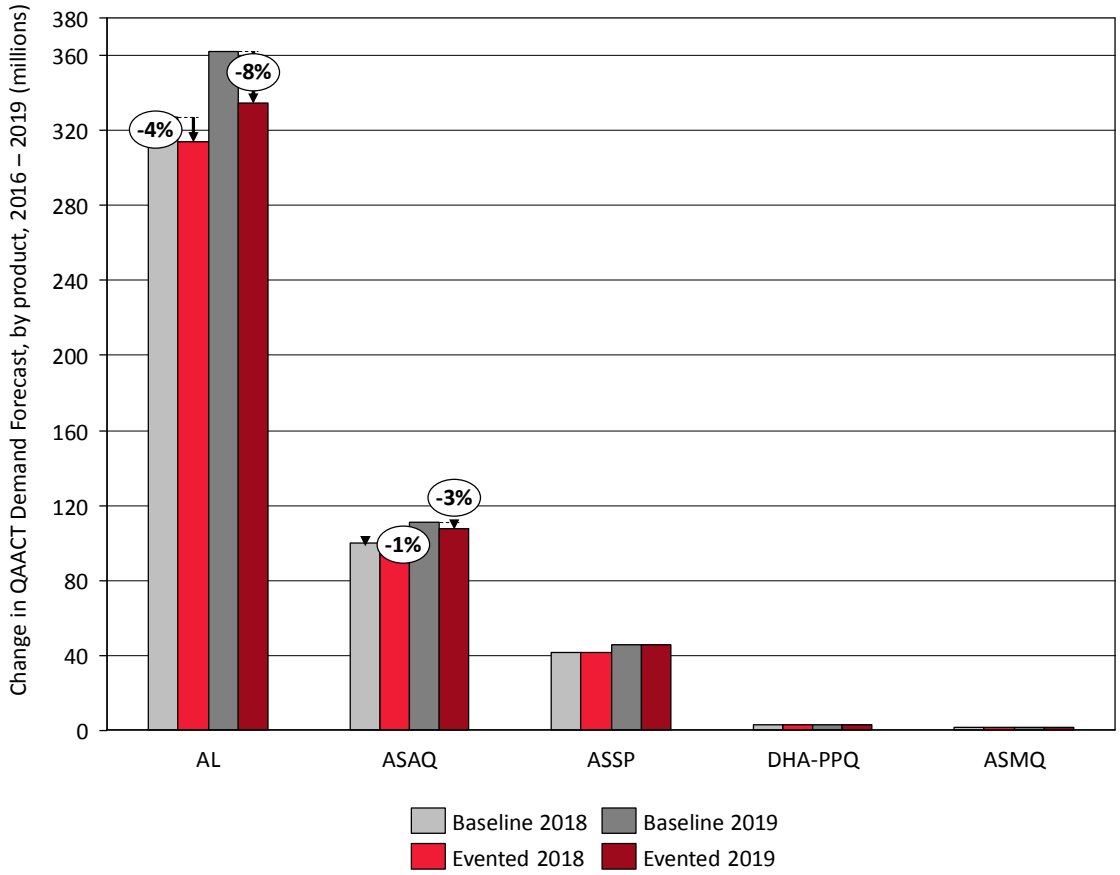
The impact of the CPM cessation is more pronounced if the evented global QAACT demand forecast is compared to the baseline forecast (Figure 30). From 2018 onwards, due to changes in the availability and affordability of QAACTs in the private sector, the model projects a decrease in QAACT demand in the private sector and an increase in QAACT demand in the public sector, resulting in a 6% decrease in total QAACT demand relative to the baseline forecast in 2019.

Figure 30 Event #3: Cessation of CPM post 2017: Baseline and Evented QAACT demand, by channel, 2016 – 2019 (millions)



This decrease in QAACT demand compared to the baseline would lead to a drop in demand for AL, which is forecast to decrease from 362M treatments in the baseline to 334M treatments in 2019 (Figure 31). A smaller decrease in ASAQ demand of approximately 3M treatments vs. the baseline is also projected.

Figure 31 Event #3: Cessation of CPM post 2017: Comparison between Baseline and Evented QAACT global demand, by product type, 2018 - 2019 (millions)

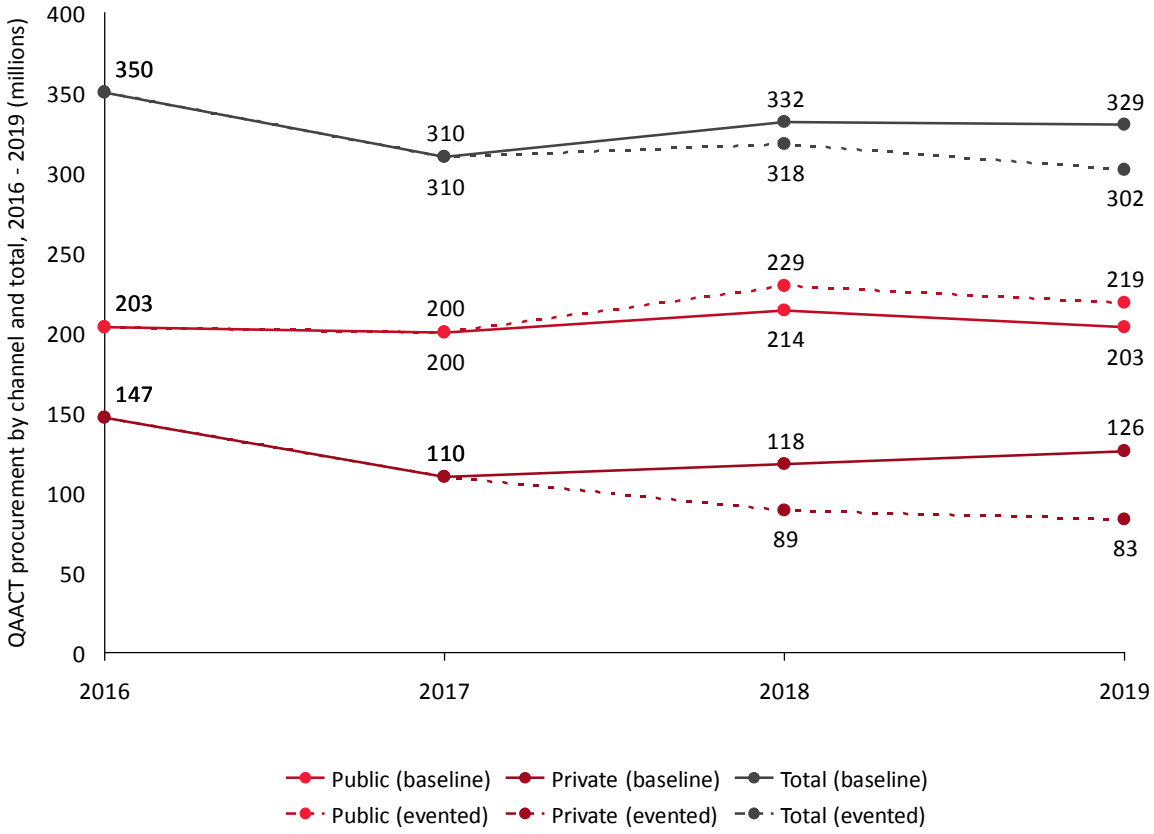


Impact on QAACT Procurement

Given that the CPM is expected to command 28 – 30%, and 18% – 20% of all QAACT procurement in 2016 and 2017, respectively, termination of the CPM, as modeled in this event, is likely to have a dramatic effect on QAACT procurement. Similar to the approach outlined above, we assumed that some 10% of treatment seekers would shift from the private sector to the public sector. We expect that this will result in a small increase in QAACT procurement by the public sector. However, this small increase pales in comparison to the rapid erosion of the QAACTs in the private sector. While the forecast estimates an overall peak in QAACT procurement in 2016 followed by a shallow decline in 2017 and a moderate recovery in 2018 and 2019, termination of the CPM might push global QAACT volumes back to pre-2012 level

volumes, falling to 302M in 2019 (Figure 32). Most of this decline would be the result of rapid erosion of QAACT sales in the private informal sector once QAACTs no longer held a retail price advantage over non-QAACTs. Although QAACT procurement in the private sector would decline under such an event, we expect that some or many outlets in the private formal sector would maintain of the use of QAACTs in preference over the use of non-QAACTs.

Figure 32 Event #3: Cessation of CPM post-2017: Evented QAACT procurement, by channel, 2016 - 2019 (millions)



Conclusion for Event 3: Impact of Termination of CPM

The CPM has catalysed the affordability and availability of QAACTs in the private sector markets of countries that were initial AMFm pilot countries. This program significantly boosted the annual global volumes of QAACTs sold. Given the five years of exposure to co-paid QAACTs, it is not surprising that termination of the CPM would have only a minor effect on overall ACT demand, but would induce the reverse effect on QAACT procurement: a retreat to pre-2012 volumes (mostly public sector). These changes would be driven by the switch in treatment use among private channel treatment seekers who can no longer afford QAACTs, from QAACTs to non-QAACTs or other antimalarials.

4. CLOSING

This report presents the second iteration in a series of publicly published comprehensive global forecast for demand and procurement for malaria rapid diagnostic tests, need, demand, and procurement for artemisinin-based malaria treatments, and resulting artemisinin API demand. As the data presented in this report are considered, it is important to keep in mind some of the caveats and weaknesses around our forecast models and forecasting in general. Each of the models used to project our forecasts do so through extrapolation of historical trends. They use periodical, historical data to project future demand for tests, antimalarials, and ACTs, and as such rely on trend analysis that in some instances may not accurately project rapid changes introduced into the market with the uptake of new initiatives or priorities. The model we have built is dynamic and allows for further exploration of the interactions between these commodities as global demand and procurement volumes shift. UNITAID and the Forecasting Consortium intend to periodically publish revised forecasts that will enable improved projections based on additional data that will be collected on an ongoing basis; owing to the recent Global Fund expert review panel approval of a quality assured rectal artesunate (QARAS) product, we will project public sector procurement for QARAS in subsequent reports.

5. APPENDIX: DATA TABLES

Table 5 List of countries by WHO region

Region	Country
Africa	Angola
	Benin
	Botswana
	Burkina Faso
	Burundi
	Cameroon
	Central African Republic
	Chad
	Comoros
	Congo
	Côte d'Ivoire
	Democratic Republic of the Congo
	Equatorial Guinea
	Eritrea
	Ethiopia
	Gabon
	Gambia
	Ghana
	Guinea
	Guinea-Bissau
	Kenya
	Liberia
	Madagascar
	Malawi
	Mali
	Mauritania
	Mozambique
	Namibia
	Niger
	Nigeria
	Rwanda
	Sao Tome and Principe
	Senegal
	Sierra Leone
	Swaziland
	Tanzania
	Togo
	Uganda
	Zambia
	Zimbabwe
Americas	Belize
	Bolivia
	Brazil

	Colombia Costa Rica Dominican Republic Ecuador French Guiana Guatemala Guyana Haiti Honduras Mexico Nicaragua Panama Peru Suriname Venezuela
Eastern Mediterranean	Afghanistan Djibouti Iran Oman Pakistan Saudi Arabia Somalia South Sudan Sudan Yemen
Europe	Tajikistan Turkmenistan
South-East Asia	Bangladesh Bhutan India Indonesia Myanmar Nepal Thailand Timor-Leste
Western Pacific	Australia Brunei Darussalam Cambodia China Lao PDR Malaysia Papua New Guinea Philippines Solomon Islands Vanuatu Vietnam

Table 6 Incident Fevers among malaria-at-risk populations, by geographical region, 2016 – 2019

Region	2016	2017	2018	2019
Africa	3,863,427,106	3,967,395,170	4,072,634,937	4,179,429,990
Americas	661,443,940	668,497,574	675,414,582	682,206,437
Eastern Mediterranean	1,889,027,103	1,928,867,228	1,968,597,059	2,008,166,869
Europe	20,125,805	20,493,118	20,854,778	21,211,072
South-East Asia	7,373,156,554	7,454,010,748	7,534,439,428	7,613,845,426
Western Pacific	1,232,476,932	1,246,475,975	1,260,178,047	1,273,596,708
TOTAL	**15,039,657,441**	**15,285,739,813**	**15,532,118,830**	**15,778,456,503**

Table 7 ACT Need (Incident fevers with likely malaria infection, among malaria-at-risk populations), by geographical region, 2016 – 2019

Region	2016	2017	2018	2019
Africa	648,002,700	664,661,311	681,324,459	698,139,568
Americas	6,996,365	7,058,153	7,116,933	7,174,028
Eastern Mediterranean	25,971,146	26,537,651	27,094,923	27,645,043
Europe	25,423	25,503	25,578	25,651
South-East Asia	226,312,281	228,191,295	230,125,767	232,048,384
Western Pacific	21,304,929	21,590,910	21,867,174	22,137,872
TOTAL	**928,612,843**	**948,064,823**	**967,554,835**	**987,170,546**

Table 8 ACT Demand by Channel, by Region, 2016 – 2019 (Baseline)

Channel	Region	2016	2017	2018	2019
Public	Africa	241,642,434	267,688,777	294,520,820	322,164,020
	Americas	252,851	600,772	955,385	1,316,444
	Eastern Mediterranean	26,947,890	29,924,627	33,016,797	36,222,962
	Europe	38,569	42,243	45,958	49,739
	South-East Asia	13,332,246	15,249,857	17,204,141	19,191,282
	Western Pacific	1,263,104	1,482,667	1,707,376	1,936,606
	Public Total	283,477,094	314,988,943	347,450,477	380,881,053
Private Formal	Africa	44,070,967	51,003,899	58,231,255	65,779,446
	Americas	70,277	140,967	213,100	286,634
	Eastern Mediterranean	9,375,269	11,793,031	14,303,231	16,904,278
	Europe	11,603	13,399	15,231	17,106
	South-East Asia	37,764,379	48,146,161	58,748,087	69,554,839
	Western Pacific	631,247	795,720	963,748	1,134,960
	Private Formal Total	91,923,742	111,893,177	132,474,652	153,677,263
Private Informal	Africa	84,544,837	98,763,786	113,605,827	129,115,778
	Americas	82,975	171,253	261,377	353,294
	Eastern Mediterranean	10,197,557	12,090,883	14,063,870	16,116,213
	Europe	11,816	13,902	16,044	18,240
	South-East Asia	11,747,106	15,177,087	18,680,189	22,254,494
	Western Pacific	638,964	797,933	960,842	1,127,442
	Private Informal Total	107,223,255	127,014,844	147,588,149	168,985,461
Total *(across channels)*	Africa	370,258,238	417,456,462	466,357,902	517,059,244
	Americas	406,103	912,992	1,429,862	1,956,372
	Eastern Mediterranean	46,520,716	53,808,541	61,383,898	69,243,453
	Europe	61,988	69,544	77,233	85,085
	South-East Asia	62,843,731	78,573,105	94,632,417	111,000,615
	Western Pacific	2,533,315	3,076,320	3,631,966	4,199,008
Grand Total		482,624,091	553,896,964	627,513,278	703,543,777

Table 9 QAACT demand by channel, by region, by ACT type, 2016 - 2019 (Baseline - Lower bound)

Channel	Region	ACT Type	2016	2017	2018	2019
Public	**Africa**	AL	175,710,920	194,003,743	212,755,972	231,976,966
		ASAQ	65,479,744	73,180,946	81,206,667	89,573,212
		ASSP	448,738	500,705	554,433	609,721
		DHA-PPQ	-	-	-	-
		ASMQ	3,033	3,384	3,747	4,121
		Africa	***241,642,435***	***267,688,778***	***294,520,819***	***322,164,020***
	Americas	AL	55,479	129,583	204,654	280,589
		ASAQ	58	138	220	303
		ASSP	22,718	54,948	87,970	121,775
		DHA-PPQ	-	-	-	-
		ASMQ	174,596	416,103	662,540	913,778
		Americas	***252,851***	***600,772***	***955,384***	***1,316,445***
	Eastern Mediterranean	AL	18,176,476	19,966,503	21,832,472	23,771,196
		ASAQ	3,804,509	4,173,016	4,547,252	4,930,879
		ASSP	4,966,856	5,785,052	6,637,010	7,520,818
		DHA-PPQ	-	-	-	-
		ASMQ	50	56	63	69
		Eastern Mediterranean	***26,947,891***	***29,924,627***	***33,016,797***	***36,222,962***
	Europe	AL	32,179	34,948	37,747	40,598
		ASAQ	-	-	-	-
		ASSP	6,390	7,295	8,211	9,140
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Europe	***38,569***	***42,243***	***45,958***	***49,738***
	South-East Asia	AL	11,475,997	13,026,484	14,611,505	16,225,617
		ASAQ	1,696,040	1,990,608	2,287,292	2,587,769
		ASSP	1,219	1,613	2,015	2,424
		DHA-PPQ	-	-	-	-
		ASMQ	158,990	231,152	303,329	375,472
		South-East Asia	***13,332,246***	***15,249,857***	***17,204,141***	***19,191,282***
	Western Pacific	AL	930,323	1,093,866	1,262,034	1,434,227
		ASAQ	290,096	326,686	363,371	400,118
		ASSP	3,003	3,497	4,005	4,525
		DHA-PPQ	-	-	-	-
		ASMQ	39,682	58,619	77,966	97,735
		Western Pacific	***1,263,104***	***1,482,668***	***1,707,376***	***1,936,605***
	Public Total *(all regions)*	AL	***206,381,374***	***228,255,127***	***250,704,384***	***273,729,193***
		ASAQ	***71,270,447***	***79,671,3934***	***88,404,802***	***97,492,281***
		ASSP	***5,448,924***	***6,353,110***	***7,293,644***	***8,268,403***
		DHA-PPQ	***-***	***-***	***-***	***-***
		ASMQ	***376,351***	***709,314***	***1,047,645***	***1,391,175***
	Public Total		***283,477,096***	***314,988,945***	***347,450,475***	***380,881,052***
Private	**Africa**	AL	50,816,914	59,321,636	68,167,753	77,387,549
		ASAQ	7,800,896	9,344,831	10,955,471	12,636,092
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Africa	***58,617,810***	***68,666,467***	***79,123,224***	***90,023,641***
	Americas	AL	35,053	71,603	108,932	146,925
		ASAQ	588	1,170	1,766	2,374
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Americas	***35,641***	***72,773***	***110,698***	***149,299***
	Eastern Mediterranean	AL	3,052,064	3,538,366	4,043,064	4,565,299
		ASAQ	505,293	575,179	646,542	719,765
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-

		Eastern Mediterranean	***3,557,357***	***4,113,545***	***4,689,606***	***5,285,064***
	Europe	AL	5,423	6,333	7,258	8,199
		ASAQ	23	31	39	47
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Europe	***5,446***	***6,364***	***7,297***	***8,246***
	South-East Asia	AL	14,797,538	18,877,646	23,044,262	27,292,184
		ASAQ	892	1,518	2,146	2,773
		ASSP				
		DHA-PPQ	-	-	-	-
		ASMQ	1,985	2,526	3,079	3,643
		South-East Asia	***14,800,415***	***18,881,690***	***23,049,487***	***27,298,600***
	Western Pacific	AL	251,086	322,356	395,371	469,941
		ASAQ	3,941	4,820	5,713	6,619
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Western Pacific	***255,027***	***327,176***	***401,084***	***476,560***
	Private Total *(all regions)*	AL	***68,958,078***	***82,137,940***	***95,766,640***	***109,870,097***
		ASAQ	***8,311,633***	***9,927,549***	***11,611,677***	***13,367,670***
		ASSP				
		DHA-PPQ	***-***	***-***	***-***	***-***
		ASMQ	***1,985***	***2,526***	***3,079***	***3,643***
	Private Total		***77,271,696***	***92,068,015***	***107,381,396***	***123,241,410***
TOTAL (across channels)	**Africa**	AL	226,527,834	253,325,379	280,923,725	309,364,515
		ASAQ	73,280,640	82,525,777	92,162,138	102,209,304
		ASSP	448,738	500,705	554,433	609,721
		DHA-PPQ	-	-	-	-
		ASMQ	3,033	3,384	3,747	4,121
		Africa	***300,260,245***	***336,355,245***	***373,644,043***	***412,187,661***
	Americas	AL	90,532	201,186	313,586	427,514
		ASAQ	646	1,308	1,986	2,677
		ASSP	22,718	54,948	87,970	121,775
		DHA-PPQ	-	-	-	-
		ASMQ	174,596	416,103	662,540	913,778
		Americas	***288,492***	***673,545***	***1,066,082***	***1,465,744***
	Eastern Mediterranean	AL	21,228,540	23,504,869	25,875,536	28,336,495
		ASAQ	4,309,802	4,748,195	5,193,794	5,650,644
		ASSP	4,966,856	5,785,052	6,637,010	7,520,818
		DHA-PPQ	-	-	-	-
		ASMQ	50	56	63	69
		Eastern Mediterranean	***30,505,248***	***34,038,172***	***37,706,403***	***41,508,026***
	Europe	AL	37,602	41,281	45,005	48,797
		ASAQ	23	31	39	47
		ASSP	6,390	7,295	8,211	9,140
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Europe	***44,015***	***48,607***	***53,255***	***57,984***
	South-East Asia	AL	26,273,535	31,904,130	37,655,767	43,517,801
		ASAQ	1,696,932	1,992,126	2,289,438	2,590,541
		ASSP	1,219	1,613	2,015	2,424
		DHA-PPQ	-	-	-	-
		ASMQ	160,975	233,678	306,407	379,115
		South-East Asia	***28,132,661***	***34,131,547***	***40,253,628***	***46,489,882***
	Western Pacific	AL	1,181,409	1,416,222	1,657,405	1,904,168
		ASAQ	294,037	331,506	369,084	406,737
		ASSP	3,003	3,497	4,005	4,525
		DHA-PPQ	-	-	-	-
		ASMQ	39,682	58,619	77,966	97,735
		Western Pacific	***1,518,131***	***1,809,844***	***2,108,460***	***2,413,165***
	Total	AL	***275,339,452***	***310,393,067***	***346,471,024***	***383,599,290***

	(all regions)	ASAQ	***79,582,080***	***89,598,943***	***100,016,479***	***110,859,951***
		ASSP	***5,448,924***	***6,353,110***	***7,293,644***	***8,268,403***
		DHA-PPQ*	***2,838,385***	***2,531,071***	***2,691,891***	***2,691,892***
		ASMQ	***378,336***	***711,840***	***1,050,723***	***1,394,818***
GRAND TOTAL (excluding DHA-PPQ)			***360,748,792***	***407,056,960***	***454,831,871***	***504,122,462***
GRAND TOTAL (including DHA-PPQ)			**363,587,177**	**409,588,031**	**457,523,762**	**506,814,354**

**DHA-PPQ split by region NA.*

Table 10 QAACT demand by channel, by region, by ACT type, 2016 - 2019 (Baseline - Upper bound)

Channel	Region	ACT Type	2016	2017	2018	2019
Public	**Africa**	AL	175,710,920	194,003,743	212,755,972	231,976,966
		ASAQ	65,479,744	73,180,946	81,206,667	89,573,212
		ASSP	448,738	500,705	554,433	609,721
		DHA-PPQ	-	-	-	-
		ASMQ	3,033	3,384	3,747	4,121
		Africa	***241,642,435***	***267,688,778***	***294,520,819***	***322,164,020***
	Americas	AL	55,479	129,583	204,654	280,589
		ASAQ	58	138	220	303
		ASSP	22,718	54,948	87,970	121,775
		DHA-PPQ	-	-	-	-
		ASMQ	174,596	416,103	662,540	913,778
		Americas	***252,851***	***600,772***	***955,384***	***1,316,445***
	Eastern Mediterranean	AL	18,176,476	19,966,503	21,832,472	23,771,196
		ASAQ	3,804,509	4,173,016	4,547,252	4,930,879
		ASSP	4,966,856	5,785,052	6,637,010	7,520,818
		DHA-PPQ	-	-	-	-
		ASMQ	50	56	63	69
		Eastern Mediterranean	***26,947,891***	***29,924,627***	***33,016,797***	***36,222,962***
	Europe	AL	32,179	34,948	37,747	40,598
		ASAQ	-	-	-	-
		ASSP	6,390	7,295	8,211	9,140
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Europe	***38,569***	***42,243***	***45,958***	***49,738***
	South-East Asia	AL	11,475,997	13,026,484	14,611,505	16,225,617
		ASAQ	1,696,040	1,990,608	2,287,292	2,587,769
		ASSP	1,219	1,613	2,015	2,424
		DHA-PPQ	-	-	-	-
		ASMQ	158,990	231,152	303,329	375,472
		South-East Asia	***13,332,l246***	***15,249,857***	***17,204,141***	***19,191,282***
	Western Pacific	AL	930,323	1,093,866	1,262,034	1,434,227
		ASAQ	290,096	326,686	363,371	400,118
		ASSP	3,003	3,497	4,005	4,525
		DHA-PPQ	-	-	-	-
		ASMQ	39,682	58,619	77,966	97,735
		Western Pacific	***1,263,104***	***1,482,668***	***1,707,376***	***1,936,605***
	Public Total *(all regions)*	AL	***206,381,374***	***228,255,127***	***250,704,384***	***273,729,193***
		ASAQ	***71,270,447***	***79,671,394***	***88,404,802***	***97,492,2281***
		ASSP	***5,448,924***	***6,353,110***	***7,293,644***	***8,268,403***
		DHA-PPQ	***-***	***-***	***-***	***-***
		ASMQ	***376,351***	***709,314***	***1,047,645***	***1,391,175***
	Public Total		***283,477,096***	***314,988,945***	***347,450,475***	***380,881,052***
Private	**Africa**	AL	62,718,826	72,886,175	83,466,961	94,497,714
		ASAQ	10,976,923	13,159,872	15,442,305	17,828,793
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Africa	**73,695,749**	**86,046,047**	**98,909,266**	**112,326,507**
	Americas	AL	71,751	145,281	220,366	296,876

		ASAQ	1,245	2,449	3,682	4,941
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Americas	**72,996**	**147,730**	**224,048**	**301,817**
	Eastern Mediterranean	AL	8,362,561	10,411,850	12,539,297	14,742,877
		ASAQ	898,340	1,021,995	1,148,698	1,279,162
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Eastern Mediterranean	***9,260,901***	***11,433,845***	***13,687,995***	***16,022,039***
	Europe	AL	11,572	13,431	15,327	17,263
		ASAQ	43	57	71	86
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Europe	***11,615***	***13,488***	***15,398***	***17,349***
	South-East Asia	AL	31,752,760	40,521,164	49,475,311	58,603,313
		ASAQ	1,592	2,690	3,790	4,890
		ASSP				
		DHA-PPQ	-	-	-	-
		ASMQ	4,220	5,367	6,538	7,732
		South-East Asia	***31,758,575***	***40,529,221***	***49,485,639***	***58,615,934***
	Western Pacific	AL	500,152	620,323	743,679	869,913
		ASAQ	68,987	99,066	129,338	159,753
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	50,421	68,376	86,634	105,177
		Western Pacific	***619,560***	***787,765***	***959,651***	***1,134,843***
	Private Total	AL	***103,417,622***	***124,598,224***	***146,460,941***	***169,027,955***
	(all regions)	ASAQ	***11,947,130***	***14,286,129***	***16,727,884***	***19,277,625***
		ASSP				
		DHA-PPQ	***-***	***-***	***-***	***-***
		ASMQ	***54,641***	***73,743***	***93,172***	***112,909***
	Private Total		***115,419,393***	***138,958,096***	***163,281,997***	***188,418,490***
TOTAL (across channels)	**Africa**	AL	238,429,746	266,889,918	296,222,933	326,474,680
		ASAQ	76,456,667	86,340,818	96,648,972	107,402,005
		ASSP	448,738	500,705	554,433	609,721
		DHA-PPQ	-	-	-	-
		ASMQ	3,033	3,384	3,747	4,121
		Africa	***315,338,184***	***353,734,825***	***393,430,085***	***434,490,527***
	Americas	AL	127,230	274,864	425,020	577,465
		ASAQ	1,303	2,587	3,902	5,244
		ASSP	22,718	54,948	87,970	121,775
		DHA-PPQ	-	-	-	-
		ASMQ	174,596	416,103	662,540	913,778
		Americas	***325,847***	***748,502***	***1,179,432***	***1,618,262***
	Eastern Mediterranean	AL	26,539,037	30,378,353	34,371,769	38,514,073
		ASAQ	4,702,849	5,195,011	5,695,950	6,210,041
		ASSP	4,966,856	5,785,052	6,637,010	7,520,818
		DHA-PPQ	-	-	-	-
		ASMQ	50	56	63	69
		Eastern Mediterranean	***36,208,792***	***41,358,472***	***46,704,792***	***52,245,001***
	Europe	AL	43,751	48,379	53,074	57,861
		ASAQ	43	57	71	86
		ASSP	6,390	7,295	8,211	9,140
		DHA-PPQ	-	-	-	-
		ASMQ		-	-	-
		Europe	***50,184***	***55,731***	***61,356***	***67,087***
	South-East Asia	AL	43,228,757	53,547,648	64,086,816	74,828,930
		ASAQ	1,697,632	1,993,298	2,291,082	2,592,659
		ASSP	1,219	1,613	2,015	2,424

		DHA-PPQ	-	-	-	-
		ASMQ	163,210	236,519	309,867	383,204
		South-East Asia	***45,090,818***	***55,779,078***	***66,689,780***	***77,807,217***
	Western Pacific	AL	1,430,475	1,714,189	2,005,713	2,304,140
		ASAQ	359,083	425,752	492,709	559,871
		ASSP	3,003	3,497	4,005	4,525
		DHA-PPQ	-	-	-	-
		ASMQ	90,103	126,995	164,600	202,912
		Western Pacific	***1,882,664***	***2,270,433***	***2,667,027***	***3,071,448***
	Total	AL	***309,798,996***	***352,853,351***	***397,165,325***	***442,757,149***
	(all regions)	ASAQ	***83,217,577***	***93,957,523***	***105,132,686***	***116,769,906***
		ASSP	***5,448,924***	***6,353,110***	***7,293,644***	***8,268,403***
		DHA-PPQ*	***2,838,385***	***2,531,071***	***2,691,891***	***2,691,892***
		ASMQ	***430,993***	***783,057***	***1,140,816***	***1,504,084***
GRAND TOTAL (excluding DHA-PPQ)			***398,896,489***	***453,947,041***	***510,732,472***	***569,299,542***
GRAND TOTAL (including DHA-PPQ)			**401,734,874**	**456,478,112**	**513,424,363**	**571,991,434**

**DHA-PPQ split by region NA.*

Table 11 QAACT procurement by channel, by region, by ACT type, 2016 - 2019 (Baseline - Lower bound)

Channel	Region	ACT Type	2016	2017	2018	2019
Public	**Africa**	AL	141,504,700	133,627,100	141,982,800	135,718,200
		ASAQ	56,182,400	60,642,500	66,987,500	62,582,200
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Africa Public Total		***197,687,100***	***194,269,600***	***208,970,300***	***198,300,300***
	Americas	AL	3,000	6,400	6,400	5,400
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Americas Public Total		***3,000***	***6,400***	***6,400***	***5,400***
	Eastern Mediterranean	AL	1,296,500	1,699,700	1,539,700	1,539,700
		ASAQ	1,440,900	1,506,600	1,481,000	1,507,100
		ASSP	1,177,900	1,474,200	1,328,600	1,348,400
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Eastern Med. Public Total		***3,915,300***	***4,680,500***	***4,349,200***	***4,395,200***
	Europe	AL	-	100	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Europe Public Total		***-***	***100***	***-***	***-***
	South-East Asia	AL	795,700	462,600	572,100	524,300
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-

		ASMQ	-	-	-	-
	South-East Asia Public Total		***795,700***	***462,600***	***572,100***	***524,300***
	Western Pacific	AL	874,000	748,300	91,300	95,100
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	175,000	141,400	87,000	106,600
		ASMQ	23,500	22,300	23,300	28,500
	Western Pacific Public Total		***1,072,600***	***912,000***	***201,600***	***230,300***
	Public Total (all regions)	AL	***144,474,000***	***136,544,200***	***144,192,300***	***137,882,800***
		ASAQ	***57,623,300***	***62,149,100***	***68,468,500***	***64,089,300***
		ASSP	***1,177,900***	***1,474,200***	***1,328,600***	***1,348,400***
		DHA-PPQ	***175,000***	***141,400***	***87,000***	***106,600***
		ASMQ	***23,500***	***22,300***	***23,300***	***28,500***
	PUBLIC TOTAL		***203,473,700***	***200,331,200***	***214,099,700***	***203,455,700***
Private Subsidized	**Africa**	AL	99,144,600	57,820,100	57,820,100	57,820,100
		ASAQ	8,002,100	4,413,100	4,413,100	4,413,100
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Africa Pvt. Sub. Total		***107,146,700***	***62,233,200***	***62,233,200***	***62,233,200***
	Americas	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Americas Pvt. Sub. Total		***-***	***-***	***-***	***-***
	Eastern Mediterranean	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Eastern Med. Pvt. Sub. Total		***-***	***-***	***-***	***-***
	Europe	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Europe Pvt. Sub. Total		***-***	***-***	***-***	***-***
	South-East Asia	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	South-East Asia Pvt. Sub. Total		***-***	***-***	***-***	***-***
	Western Pacific	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Western Pacific Pvt. Sub. Total		***-***	***-***	***-***	***-***

	Private Subsidized	AL	***99,144,600***	***57,820,100***	***57,820,100***	***57,820,100***
	Total	ASAQ	***8,002,100***	***4,413,100***	***4,413,100***	***4,413,100***
	(all regions)	ASSP				
		DHA-PPQ				
		ASMQ				
	PRIVATE SUBSIDIZED TOTAL		***107,146,700***	***62,233,200***	***62,233,200***	***62,233,200***
Premium Private	**Africa**	AL	16,720,500	18,983,700	21,347,000	23,812,900
		ASAQ	3,802,900	4,561,500	5,356,000	6,186,500
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Africa Pre. Pvt. Total		***20,523,400***	***23,545,100***	***26,703,100***	***29,999,500***
	Americas	AL	35,100	71,600	108,900	146,900
		ASAQ	600	1,200	1,800	2,400
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Americas Pre. Pvt. Total		***35,600***	***72,800***	***110,700***	***149,300***
	Eastern Mediterranean	AL	3,052,100	3,538,400	4,043,100	4,565,300
		ASAQ	505,300	575,200	646,500	719,800
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Eastern Med. Pre. Pvt. Total		***3,557,400***	***4,113,500***	***4,689,600***	***5,285,100***
	Europe	AL	5,400	6,400	7,300	8,200
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Europe Pre. Pvt. Total		***5,400***	***6,500***	***7,300***	***8,200***
	South-East Asia	AL	14,797,500	18,877,600	23,044,300	27,292,200
		ASAQ	900	1,500	2,100	2,800
		ASSP	293,700	373,700	455,500	539,000
		DHA-PPQ	-	-	-	-
		ASMQ	2,000	2,500	3,100	3,600
	South-East Asia Pre. Pvt. Total		***15,094,100***	***19,255,400***	***23,505,000***	***27,837,600***
	Western Pacific	AL	251,100	322,400	395,400	470,000
		ASAQ	3,900	4,800	5,700	6,600
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Western Pacific Pre. Pvt. Total		***255,000***	***327,200***	***401,100***	***476,600***
		AL	***34,861,700***	***41,800,000***	***48,945,900***	***56,295,500***
	Premium Private	ASAQ	***4,313,600***	***5,144,200***	***6,012,200***	***6,918,100***
	Total	ASSP	***293,700***	***373,700***	***455,500***	***539,000***
	(all regions)	DHA-PPQ	***-***	***-***	***-***	***-***
		ASMQ	***2,000***	***2,500***	***3,100***	***3,600***
	PREMIUM PRIVATE TOTAL		***39,470,900***	***47,320,400***	***55,416,800***	***63,756,200***
TOTAL (across	**Africa**	AL	257,369,800	210,430,900	221,149,900	217,351,200
		ASAQ	67,987,400	69,617,100	76,756,600	73,181,800

channels)		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Africa Total		***325,357,200***	***280,047,900***	***297,906,600***	***290,533,000***
	Americas	AL	38,100	78,000	115,300	152,300
		ASAQ	600	1,200	1,800	2,400
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Americas Total		***38,600***	***79,200***	***117,100***	***154,700***
	Eastern Mediterranean	AL	4,348,600	5,238,100	5,582,800	6,105,000
		ASAQ	1,946,200	2,081,800	2,127,500	2,226,900
		ASSP	1,177,900	1,474,200	1,328,600	1,348,400
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Eastern Med. Total		***7,472,700***	***8,794,000***	***9,038,800***	***9,680,300***
	Europe	AL	5,400	6,400	7,300	8,200
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Europe Total		***5,400***	***6,500***	***7,300***	***8,200***
	South-East Asia	AL	15,593,200	19,340,200	23,616,400	27,816,500
		ASAQ	900	1,500	2,100	2,800
		ASSP	293,700	373,700	455,500	539,000
		DHA-PPQ	-	-	-	-
		ASMQ	2,000	2,500	3,100	3,600
	South-East Asia Total		***15,889,800***	***19,718,000***	***24,077,100***	***28,361,900***
	Western Pacific	AL	1,125,100	1,070,700	486,700	565,100
		ASAQ	3,900	4,800	5,700	6,600
		ASSP	-	-	-	-
		DHA-PPQ	175,000	141,400	87,000	106,600
		ASMQ	23,500	22,300	23,300	28,500
	Western Pacific Total		***1,327,600***	***1,239,200***	***602,700***	***706,900***
	Total (all regions)	AL	***278,480,300***	***236,164,300***	***250,958,400***	***251,998,400***
		ASAQ	***69,939,000***	***71,706,400***	***78,893,700***	***75,420,500***
		ASSP	***1,471,600***	***1,847,900***	***1,784,100***	***1,887,400***
		DHA-PPQ	***175,000***	***141,400***	***87,000***	***106,600***
		ASMQ	***25,500***	***24,800***	***26,400***	***32,100***
GRAND TOTAL			***350,091,400***	***309,884,800***	***331,749,700***	***329,445,000***

Table 12 QAACT procurement by channel, by region, by ACT type, 2016 - 2019 (Baseline - Upper bound)

Channel	Region	ACT Type	2016	2017	2018	2019
Public	**Africa**	AL	141,504,700	133,627,100	141,982,800	135,718,200
		ASAQ	56,182,400	60,642,500	66,987,500	62,582,200
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Africa Public Total		***197,687,100***	***194,269,600***	***208,970,300***	***198,300,300***
	Americas	AL	3,000	6,400	6,400	5,400
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Americas Public Total		***3,000***	***6,400***	***6,400***	***5,400***
	Eastern Mediterranean	AL	1,296,500	1,699,700	1,539,700	1,539,700
		ASAQ	1,440,900	1,506,600	1,481,000	1,507,100
		ASSP	1,177,900	1,474,200	1,328,600	1,348,400
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Eastern Med. Public Total		***3,915,300***	***4,680,500***	***4,349,200***	***4,395,200***
	Europe	AL	-	100	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Europe Public Total		***-***	***100***	***-***	***-***
	South-East Asia	AL	795,700	462,600	572,100	524,300
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	South-East Asia Public Total		***795,700***	***462,600***	***572,100***	***524,300***
	Western Pacific	AL	874,000	748,300	91,300	95,100
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	175,000	141,400	87,000	106,600
		ASMQ	23,500	22,300	23,300	28,500
	Western Pacific Public Total		***1,072,600***	***912,000***	***201,600***	***230,300***
	Public Total (all regions)	AL	***144,474,000***	***136,544,200***	***144,192,300***	***137,882,800***
		ASAQ	***57,623,300***	***62,149,100***	***68,468,500***	***64,089,300***
		ASSP	***1,177,900***	***1,474,200***	***1,328,600***	***1,348,400***
		DHA-PPQ	***175,000***	***141,400***	***87,000***	***106,600***
		ASMQ	***23,500***	***22,300***	***23,300***	***28,500***
	PUBLIC TOTAL		***203,473,700***	***200,331,200***	***214,099,700***	***203,455,700***
Private Subsidized	**Africa**	AL	99,144,600	57,820,100	57,820,100	57,820,100
		ASAQ	8,002,100	4,413,100	4,413,100	4,413,100
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Africa Pvt. Sub. Total		***107,146,700***	***62,233,200***	***62,233,200***	***62,233,200***
	Americas	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-

	Americas Pvt. Sub. Total		**-**	**-**	**-**	**-**
	Eastern Mediterranean	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Eastern Mediterranean Pvt. Sub. Total		**-**	**-**	**-**	**-**
	Europe	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Europe Pvt. Sub. Total		**-**	**-**	**-**	**-**
	South-East Asia	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	South-East Asia Pvt. Sub. Total		**-**	**-**	**-**	**-**
	Western Pacific	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Western Pacific Pvt. Sub. Total		**-**	**-**	**-**	**-**
	Private Subsidized Total (all regions)	AL	***99,144,600***	***57,820,100***	***57,820,100***	***57,820,100***
		ASAQ	***8,002,100***	***4,413,100***	***4,413,100***	***4,413,100***
		ASSP				
		DHA-PPQ				
		ASMQ				
	PRIVATE SUBSIDIZED TOTAL		***107,146,700***	***62,233,200***	***62,233,200***	***62,233,200***
Premium Private	**Africa**	AL	26,500,900	30,060,500	33,779,600	37,661,700
		ASAQ	6,729,900	8,081,300	9,499,800	10,986,400
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Africa Pre. Pvt. Total		***33,230,700***	***38,141,700***	***43,279,400***	***48,648,000***
	Americas	AL	71,700	145,300	220,400	296,900
		ASAQ	1,200	2,400	3,700	4,900
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Americas Pre. Pvt. Total		***73,000***	***147,700***	***224,000***	***301,800***
	Eastern Mediterranean	AL	8,362,600	10,411,800	12,539,300	14,742,900
		ASAQ	898,300	1,022,000	1,148,700	1,279,200
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Eastern Med. Pre. Pvt. Total		***9,260,900***	***11,433,800***	***13,688,000***	***16,022,000***
	Europe	AL	11,600	13,400	15,300	17,300
		ASAQ	-	100	100	100
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Europe Pre. Pvt. Total		***11,600***	***13,500***	***15,400***	***17,300***
	South-East Asia	AL	31,752,800	40,521,200	49,475,300	58,603,300

		ASAQ	1,600	2,700	3,800	4,900
		ASSP	624,500	794,100	967,400	1,144,100
		DHA-PPQ	-	-	-	-
		ASMQ	4,200	5,400	6,500	7,700
	South-East Asia Pre. Pvt. Total		***32,383,000***	***41,323,300***	***50,453,000***	***59,760,000***
	Western Pacific	AL	500,200	620,300	743,700	869,900
		ASAQ	69,000	99,100	129,300	159,800
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	50,400	68,400	86,600	105,200
	Western Pacific Pre. Pvt. Total		***619,600***	***787,800***	***959,700***	***1,134,900***
	Premium Private	AL	**67,199,700**	**81,772,500**	**96,773,600**	**112,191,900**
	Total	ASAQ	**7,700,100**	**9,207,500**	**10,785,400**	**12,435,200**
	(all regions)	ASSP	**624,500**	**794,100**	**967,400**	**1,144,100**
		DHA-PPQ	**-**	**-**	**-**	**-**
		ASMQ	**54,600**	**73,800**	**93,100**	**112,900**
	PREMIUM PRIVATE TOTAL		***75,578,800***	***91,847,900***	***108,619,500***	***125,884,100***
TOTAL (across channels)	**Africa**	AL	267,150,200	221,507,700	233,582,500	231,200,000
		ASAQ	70,914,400	73,136,900	80,900,400	77,981,700
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Africa Total		***338,064,500***	***294,644,500***	***314,482,900***	***309,181,500***
	Americas	AL	74,700	151,700	226,800	302,300
		ASAQ	1,200	2,400	3,700	4,900
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Americas Total		***76,000***	***154,100***	***230,400***	***307,200***
	Eastern	AL	9,659,100	12,111,500	14,079,000	16,282,600
	Mediterranean	ASAQ	2,339,200	2,528,600	2,629,700	2,786,300
		ASSP	1,177,900	1,474,200	1,328,600	1,348,400
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Eastern Mediterranean Total		***13,176,200***	***16,114,300***	***18,037,200***	***20,417,200***
	Europe	AL	11,600	13,500	15,300	17,300
		ASAQ	-	100	100	100
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
	Europe Total		***11,600***	***13,600***	***15,400***	***17,300***
	South-East Asia	AL	32,548,500	40,983,800	50,047,400	59,127,600
		ASAQ	1,600	2,700	3,800	4,900
		ASSP	624,500	794,100	967,400	1,144,100
		DHA-PPQ	-	-	-	-
		ASMQ	4,200	5,400	6,500	7,700
	South-East Asia Total		***33,178,700***	***41,785,900***	***51,025,100***	***60,284,300***
	Western Pacific	AL	1,374,200	1,368,600	835,000	965,000
		ASAQ	69,000	99,100	129,300	159,800
		ASSP	-	-	-	-
		DHA-PPQ	175,000	141,400	87,000	106,600
		ASMQ	73,900	90,700	109,900	133,700
	Western Pacific Total		***1,692,200***	***1,699,800***	***1,161,300***	***1,365,200***
	Total	AL	***310,818,300***	***276,136,800***	***298,786,000***	***307,894,800***
	(all regions)	ASAQ	***73,325,400***	***75,769,800***	***83,667,000***	***80,937,700***
		ASSP	***1,802,400***	***2,268,300***	***2,296,000***	***2,492,500***
		DHA-PPQ	***175,000***	***141,400***	***87,000***	***106,600***
		ASMQ	***78,100***	***96,100***	***116,400***	***141,400***

GRAND TOTAL	*386,199,300*	*354,412,200*	*384,952,400*	*391,572,900*

Table 13 Oral artemisinin monotherapy demand by region and channel, 2016 – 2019

Channel	Region	2016	2017	2018	2019
Public	Africa	-	-	-	-
	Americas	-	-	-	-
	Eastern Mediterranean	-	-	-	-
	Europe	-	-	-	-
	South-East Asia	-	-	-	-
	Western Pacific	-	-	-	-
	Public Total	**-**	**-**	**-**	**-**
Private Formal	Africa	184,597	139,460	101,689	83,765
	Americas	476	531	443	358
	Eastern Mediterranean	42,945	27,936	17,974	12,518
	Europe	79	50	32	21
	South-East Asia	6,089	4,332	3,828	3,782
	Western Pacific	7,045	7,327	7,957	8,934
	Private Formal Total	**241,230**	**179,637**	**131,089**	**107,860**
Private Informal	Africa	367,741	288,037	213,319	179,532
	Americas	562	645	544	441
	Eastern Mediterranean	61,063	39,094	24,672	16,764
	Europe	80	52	33	23
	South-East Asia	4,668	3,963	3,622	3,553
	Western Pacific	6,823	6,774	7,100	7,809
	Private Formal Total	**440,938**	**338,564**	**252,944**	**214,640**
Total *(across channels)*	Africa	552,337	427,497	314,174	261,780
	Americas	1,038	1,175	987	798
	Eastern Mediterranean	104,008	67,030	42,646	29,282
	Europe	159	103	65	44
	South-East Asia	10,758	8,295	7,450	7,335
	Western Pacific	13,868	14,101	15,056	16,742
Grand Total		**682,168**	**518,201**	**384,867**	**324,017**

Table 14 QA Injectable artesunate public sector procurement by region, 2016 – 2019 (60 mg. vials)

Region	2016	2017	2018	2019
Africa	28,619,100	28,563,700	26,516,000	25,380,400
Americas	-	-	-	-
Eastern Mediterranean	901,000	1,157,000	1,057,100	1,049,000
Europe	-	200	100	100
South-East Asia	12,400	17,600	17,000	8,700
Western Pacific	87,600	79,300	16,700	18,400
TOTAL	**29,620,100**	**29,817,900**	**27,607,000**	**26,456,600**

Table 15 Private sector Injectable artemisinin demand, by region, 2016 – 2019 (Standard Units: Artemether 80 mg, Artemotil 150 mg, AS 60 mg)

Region	Product Type	2016	2017	2018	2019
Africa	Artemotil	11,362	13,406	15,001	16,976
	AS	4,761,396	5,426,976	6,233,382	7,056,063
	Artemether	14,475,903	16,739,160	19,339,827	21,999,893
	Africa	***19,248,660***	***22,179,542***	***25,588,209***	***29,072,932***
Americas	Artemotil	31	63	96	129
	AS	13,574	27,572	41,830	56,369
	Artemether	-	-	-	-
	Americas	***13,605***	***27,635***	***41,926***	***56,498***
Eastern Mediterranean	Artemotil	3,094	3,559	4,046	4,556
	AS	1,675,563	2,021,403	2,388,892	2,767,048
	Artemether	2,870,684	4,143,388	5,520,869	6,906,538
	Eastern Mediterranean	***4,549,342***	***6,168,349***	***7,913,808***	***9,678,142***
Europe	Artemotil	5	6	6	7
	AS	2,074	2,411	2,757	3,113
	Artemether	-	-	-	-
	Europe	***2,079***	***2,416***	***2,763***	***3,121***
South-East Asia	Artemotil	7,842,642	9,980,610	12,165,118	14,393,095
	AS	413,464	530,047	648,922	769,954
	Artemether	809,203	892,059	1,215,263	1,454,989
	South-East Asia	***9,065,309***	***11,402,716***	***14,029,304***	***16,618,038***
Western Pacific	Artemotil	204	243	284	326
	AS	126,659	156,668	188,759	220,709
	Artemether	34,063	49,720	65,475	81,304
	Western Pacific	***160,926***	***206,632***	***254,518***	***302,339***
Private Total	Artemotil	**7,857,338**	**9,997,886**	**12,184,551**	**14,415,089**
(all regions)	AS	**6,992,731**	**8,165,077**	**9,504,543**	**10,873,257**
	Artemether	**18,189,852**	**21,824,327**	**26,141,434**	**30,442,724**

Table 16 Private sector Rectal artemisinin demand, by region, by formulation, 2016 – 2019

Region	Formulation	2016	2017	2018	2019
Africa	80mg. artemether	1,572,363	1,827,829	2,113,712	2,389,490
	100 mg. artesunate	2,052,983	2,500,884	2,756,077	3,154,662
Americas	80mg. artemether	1,918	3,897	5,912	7,966
	100 mg. artesunate	2,333	4,739	7,190	9,689
Eastern Mediterranean	80mg. artemether	191,377	220,116	250,257	281,775
	100 mg. artesunate	232,771	267,726	304,387	342,723
Europe	80mg. artemether	293	341	390	440
	100 mg. artesunate	357	414	474	535
South-East Asia	80mg. artemether	8,740	11,669	14,628	17,615
	100 mg. artesunate	10,630	14,193	17,792	21,426
Western Pacific	80mg. artemether	12,599	15,050	17,581	20,186
	100 mg. artesunate	15,324	18,305	21,384	24,552
Private Total	**80mg. artemether**	**1,787,290**	**2,078,901**	**2,402,478**	**2,717,473**
	100 mg. artesunate	**2,314,398**	**2,806,262**	**3,107,303**	**3,553,588**

Table 17 RDT demand by channel, by region, 2016 – 2019

Channel	Region	2016	2017	2018	2019
Public	Africa	344,334,869	353,856,216	363,518,541	373,341,721
	Americas	479,694	484,835	489,905	494,899
	Eastern Mediterranean	49,413,619	50,605,270	51,831,463	53,079,843
	Europe	-	-	-	-
	South-East Asia	13,636,311	13,779,131	13,922,631	14,064,705
	Western Pacific	3,467,214	3,520,385	3,573,572	3,625,977
	Public Total	**411,331,707**	**422,245,837**	**433,336,111**	**444,607,145**
Private Formal	Africa	72,502,682	74,540,020	76,608,633	78,715,750
	Americas	74,891	75,721	76,540	77,348
	Eastern Mediterranean	17,567,131	17,973,003	18,388,932	18,810,595
	Europe	-	-	-	-
	South-East Asia	28,898,927	29,213,204	29,529,985	29,843,964

	Western Pacific	2,079,126	2,111,165	2,143,229	2,174,848
	Private Formal Total	**121,122,757**	**123,913,113**	**126,747,319**	**129,622,504**
Private Informal	Africa	36,855,672	37,870,796	38,901,479	39,950,751
	Americas	25,791	26,082	26,369	26,651
	Eastern Mediterranean	5,285,949	5,415,302	5,548,606	5,684,357
	Europe	-	-	-	-
	South-East Asia	2,565,324	2,595,318	2,625,046	2,654,453
	Western Pacific	827,872	840,975	853,984	866,858
	Private Informal Total	**45,560,607**	**46,748,473**	**47,955,484**	**49,183,070**
Total *(across channels)*	Africa	453,693,223	466,267,032	479,028,653	492,008,221
	Americas	580,376	586,638	592,814	598,897
	Eastern Mediterranean	72,266,699	73,993,574	75,769,001	77,574,795
	Europe	-	-	-	-
	South-East Asia	45,100,562	45,587,653	46,077,662	46,563,122
	Western Pacific	6,374,211	6,472,525	6,570,785	6,667,683
GRAND TOTAL		**578,015,071**	**592,907,423**	**608,038,915**	**623,412,719**

Table 18 RDT public sector procurement, by region, 2016 – 2019

Region	2016	2017	2018	2019
Africa	236,453,400	282,689,900	256,231,600	245,490,800
Americas	2,383,500	2,014,300	1,879,100	1,711,200
Eastern Mediterranean	4,395,900	5,288,200	4,474,300	4,533,900
Europe	40,500	27,000	27,000	27,000
South-East Asia	5,167,000	3,887,200	4,367,600	4,174,900
Western Pacific	8,124,100	9,181,000	6,732,300	5,631,700
TOTAL	**256,564,400**	**303,087,600**	**273,711,800**	**261,569,500**

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