FORECAST REPORT

GLOBAL MALARIA DIAGNOSTIC AND ARTEMISININ TREATMENT COMMODITIES DEMAND FORECAST

2015 – 2018

April 25, 2016

CLINTON HEALTH ACCESS INITIATIVE

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UCSF University of California San Francisco

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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	artesunate-amodiaquine
ASMQ	artesunate-mefloquine
ASPY	artesunate-pyronaridine
ASSP	artesunate-sulfadoxine pyrimethamine
BCG	Boston Consulting Group
CHAI	Clinton Health Access Initiative
CPM	Co-Payment Mechanism (formerly Private Sector Co-Payment Mechanism)
DHA-PPQ	dihydroartemisinin piperaquine
The Global Fund	Global Fund to fight AIDS, Tuberculosis, and Malaria
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 (part of USAID)
PSCM	Private Sector Co-payment Mechanism (see CPM)
QAACT(s)	quality assured artemisinin-based combination therapy/therapies
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
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 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 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), United States Agency for International Development's President's Malaria Initiative (PMI), and Medicines for Malaria Venture (MMV).

This forecast represents the first in a new series of projections that will be made over the next two years. The initial forecast, presented in this report, provides a baseline projection of the size of the malaria commodity market from 2015 to 2018. 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 injectable artesunate and oral artemisinin monotherapies, and estimates the size of the market for malaria rapid diagnostic tests RDTs.

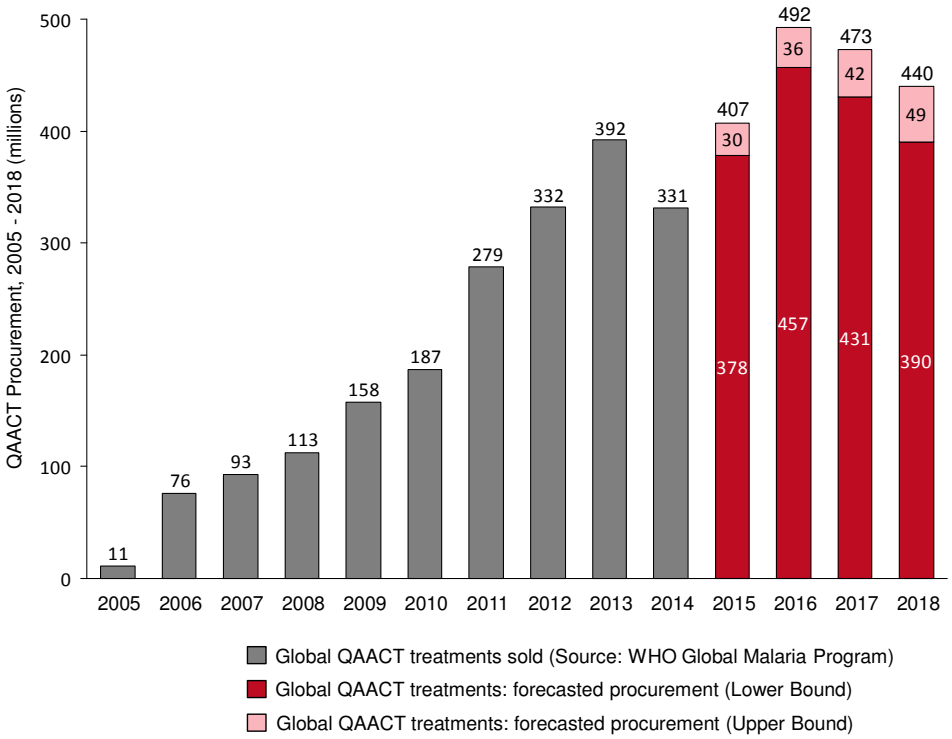
One key point about nomenclature warrants emphasis. This forecasting report distinguishes three terms that often are used interchangeably but mean very different things: “need”, “demand,” and “procurement”. For this report, “need” represents our projection of the total number of febrile cases where the 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. 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 makes forecasts need, demand, and procurement of artemisinin-based malaria treatments and demand and procurement of malaria rapid diagnostic tests (RDTs). Throughout the report, we define need as the number of treatments that are required to treat all febrile individuals who have a 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 diagnosis and treatment of suspected malaria. Furthermore, we define procurement as the number of quality-assured diagnostics or treatments that will be procured from manufacturers by public or private sector purchasers.

Procurement

QAACT market: Historical and forecast growth, 2005 – 2018 (millions)



- The global market for Quality-Assured ACTs (QAACTs) is projected to grow from 378M treatments ordered in 2015 to 457M treatments in 2016, due to an increase in public purchases for endemic country malaria programs. Unless there are reductions in ACT pricing or more funding is made available, the number of QAACTs ordered will decline slightly to 431M treatments in 2017, and 390M treatments in 2018.

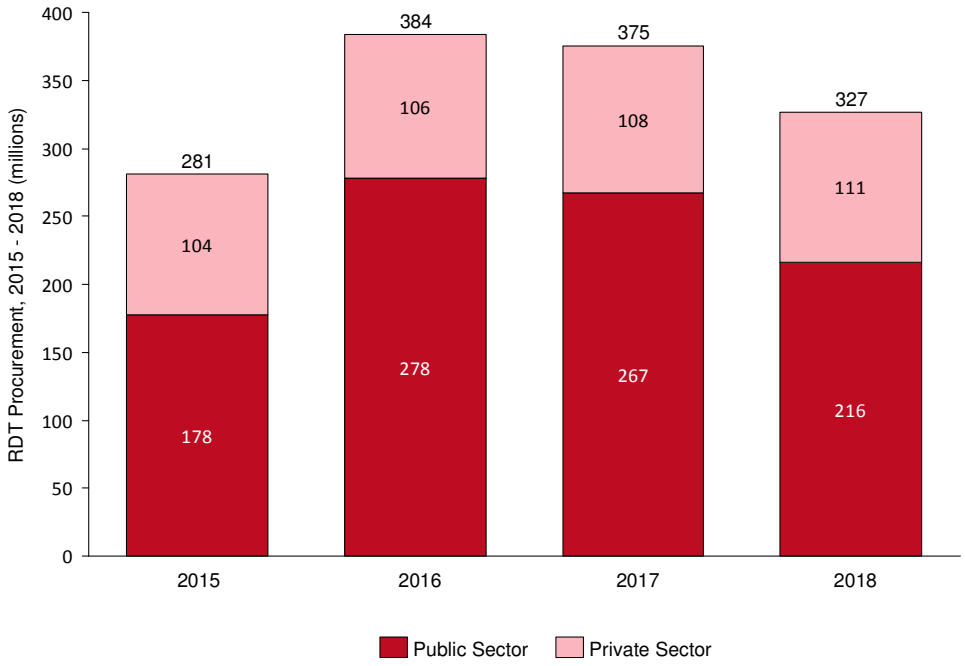
  There will be a marked shift in channel mix for QAACTs in this timeframe. Under the Affordable Medicines Facility – malaria (AMFm) pilot program, market participants in eight countries were eligible to obtain subsidized QAACTs for private market resale at a significantly lower price. In 2014, this program was incorporated into the Global Fund's New Funding Model (it is currently called the Co-Payment Mechanism [CPM]), with funding supporting the CPM transitioning to Global Fund grants in 2016. We project that the private subsidized channel will decline from approximately 150M treatments in 2015 to roughly 100M in 2016, and will hold steady through

2018. This decline in the private subsidized channel will be more than offset by the expansion of public channel orders, which we project will grow from less than 200M treatments in 2015 to approximately 320M in 2016. Since estimates of public channel procurement is based on already committed donor funding, unless new funding is made available, public channel procurement is expected to decline to 283M in 2017 and 236M in 2018.

- The share of orders among QAACT drug combinations is unlikely to change significantly during the next three years. There are currently six WHO-pre-qualified (WHO-PQ) suppliers for artesunate-amodiaquine (ASAQ), seven WHO-PQ suppliers for artemether-lumefantrine (AL), and one WHO-PQ supplier for each of dihydroartemisinin-piperaquine (DHA-PPQ), artesunate-pyronaridine (ASPY), and artesunate-mefloquine (ASMQ). The Global Fund has introduced a tender process by which floor volumes are established per supplier, guaranteeing each supplier a set volume through Global Fund procurement. In the AMFm pilot, approximately 80% of public funding for ACTs went to countries, most of whom used AL as their first-line therapy. With the application of the Global Fund's New Funding Model, greater public procurement budgets for other countries will lead to an increase to approximately 150M treatments for ASAQ in 2016. However, AL will continue to dominate the market for QAACTs through 2018.

- In the non-subsidized private sector (the premium private market), QAACT procurement is projected to increase over the next few years from 35M treatments in 2015 to 55M treatments in 2018.

RDT procurement by channel, 2015 - 2018 (millions)



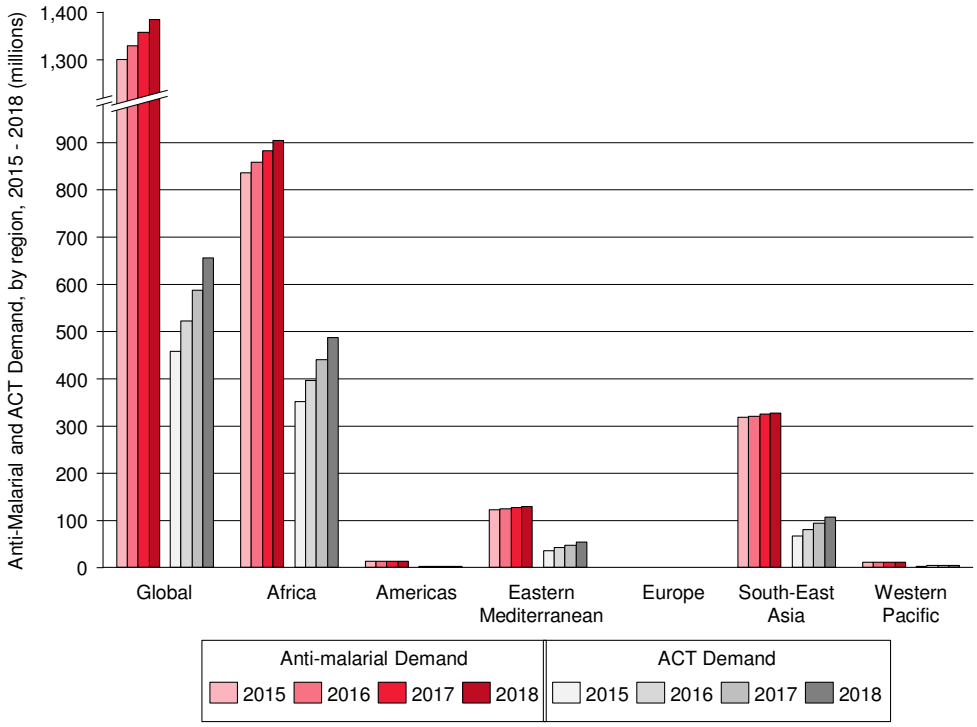
- Procurement of RDTs has grown sharply in recent years, and our forecast projects this trend to continue. We estimate global procurement of RDTs at 281M tests in 2015, rising to 384M in 2016. Modelled estimates of RDT procurement, which is based on currently committed and projected future funding, are projected to decline slightly in 2017 and 2018 unless additional funding is made available.

- Our procurement forecast is based on current procurement commitments that are affected by the availability of funding and changes in national strategic plans.

Demand

- The global market for antimalarial medicines is estimated to be 1.3B antimalarial treatment courses per year, and is forecast to grow to nearly 1.4B treatments by 2018. ACTs currently comprise roughly a third of this market, with their share expanding each year.

Antimalarial and ACT Demand, by region, 2015 - 2018 (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 2015 is projected to be 349M treatments, rising (assuming continued product availability) to 484M treatments in 2018. The majority of this demand (76%) will be met in the public channel.

- Over the next four years, private sector demand for ACTs 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.

- The market for non-quality-assured ACTs (non-QAACTs) is estimated at 108M treatments in 2015, rising to 171M treatments in 2018. Most of this demand will be in the private channel, with 53 – 55% being in the informal private channel.

- Among QAACT product combinations, AL will continue to have the highest market share, with consumer demand rising from 237M treatments in 2015 to 327M treatments in 2018. ASAQ is projected to remain in second place, with demand growing from 80M treatments in 2015 to 111M in 2018. Demand for artesunate-sulfadoxine pyrimethamine (ASSP) is expected to increase to 44M treatments in 2018, with India as the main product market.

- Demand for RDTs is expected to grow over this timeframe as well, from 406M tests in 2015 to 438M in 2018. Most of this demand will be met in the public channel, although the private formal and informal channels combine to meet up to a quarter of global demand.

- Artemisinin demand is expected to grow from 196 metric tons in 2015 to 228 metric tons in 2016, and remain flat at 226 and 230 metric tons in 2017 and 2018, respectively. The increase in artemisinin demand in 2016 is largely driven by a forecasted increase in QAACTs procured in 2016 by 79M. ACTs comprise the majority of global artemisinin API demand (97%), with QAACTs accounting for a large share (64-73%) of API demand.

- 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.

Need

- Our projections suggest that there were 13.7B fevers in 2015 among-at-risk populations, and that 1.37B 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.

- The number of fevers in parasitemic individuals is skewed heavily toward Africa. We estimate that approximately 1.1B of the 1.37B total “need” is among African populations, due to the much

higher level of parasitemia on that continent. In contrast, the share of total fevers in malaria-at-risk populations tracks overall population size closely, resulting in a larger share in Southeast Asian countries.

- The estimate of this "need" is expected to rise between 2015 and 2018, largely with population growth. Fevers in parasitemic populations are projected to increase from 1.37B to 1.46B 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. The growth in RDT procurement and use suggests that effective treatments will be allocated in a more appropriate manner than historical patterns of presumptive treatment for malaria have allowed. Moreover, the sharp decline in sales of oral 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 future editions of this forecast report, the Forecasting Consortium will include a series of scenarios that analyze how different market events will impact 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.

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 in 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 treatment subsidy mechanism whose goal was to increase access to appropriate, low priced antimalarial medicines in the retail/private sector, was launched, increasing the uncertainty about 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 diagnosis and treatment, changes in disease epidemiology, and the impact of key interventions and tools, demand forecasting for QAACTs continues to be important for many stakeholders invested in malaria 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 for artemisinin may drive farmers toward planting alternative cash crops, leading to a potential decline in the planted *A. annua* acreage, and another cycle of artemisinin price fluctuations. Meanwhile, several large-volume countries plan to continue subsidizing QAACTs through private sector co-payments in 2016, but the picture of support for private-sector QAACT co-payment subsidies in 2017 and beyond remains unclear. At the same time, countries are scaling up confirmatory diagnostic testing, 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 *Artemisia annua* farmers, semi-synthetic artemisinin producers, the artemisinin extractors, the manufacturers of rapid diagnostic tests (RDTs), artemisinin based active pharmaceutical ingredients (APIs), and finished products containing these APIs, the National Malaria Control Programs (NMCPs) and donors.

This project commences the second phase of the UNITAID ACT forecasting service, expanding the scope of the previous work to forecast ACT and artemisinin monotherapy 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 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 malaria with an ACT.

- **ACT Procurement** – The number of quality-assured 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 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. ACT 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-year forecast period, with this initial report forecasting the outputs listed above, at a global level, covering 2015 – 2018. 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 [http://unitaid.org/images/marketdynamics/publications/Global_malaria_diagnostic_and_artemisinin_treatment_commodities_demand_forecast_forecasting_methodology.pdf].

2. Forecast Outputs 2015 – 2018

ACT Need

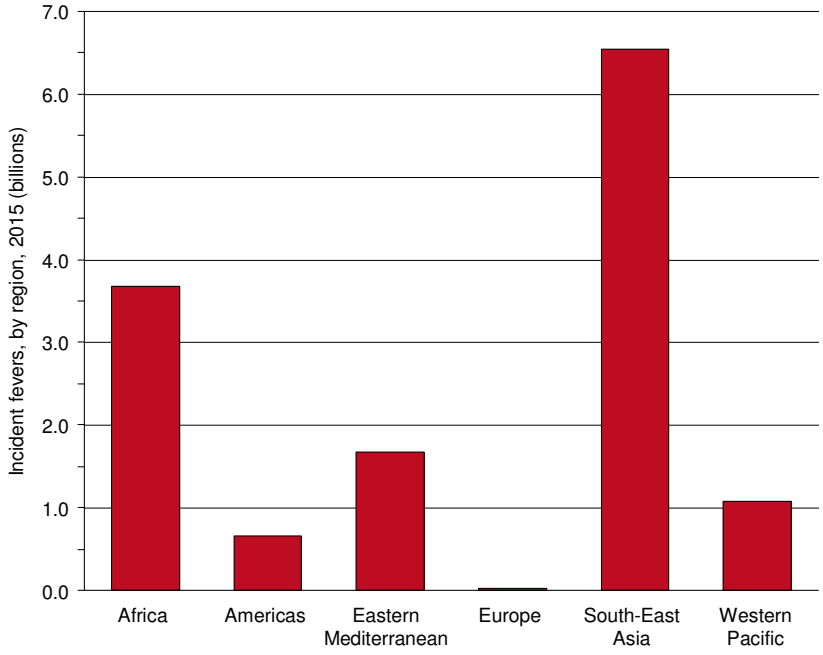
Using a decision-tree algorithm, based on febrile incidence extracted from national population-representative household surveys (see separately published methods for further details), we have estimated the number of malaria infections among febrile patients across the malaria-endemic world. Our method 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 Appendix B, 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 2015, there were around 13.7 billion incident fevers among the malaria-at-risk populations within the 89 countries included in our model (Figure 1).

FIGURE 1

Incident Fevers among malaria-at-risk populations, by region, 2015 (billions)

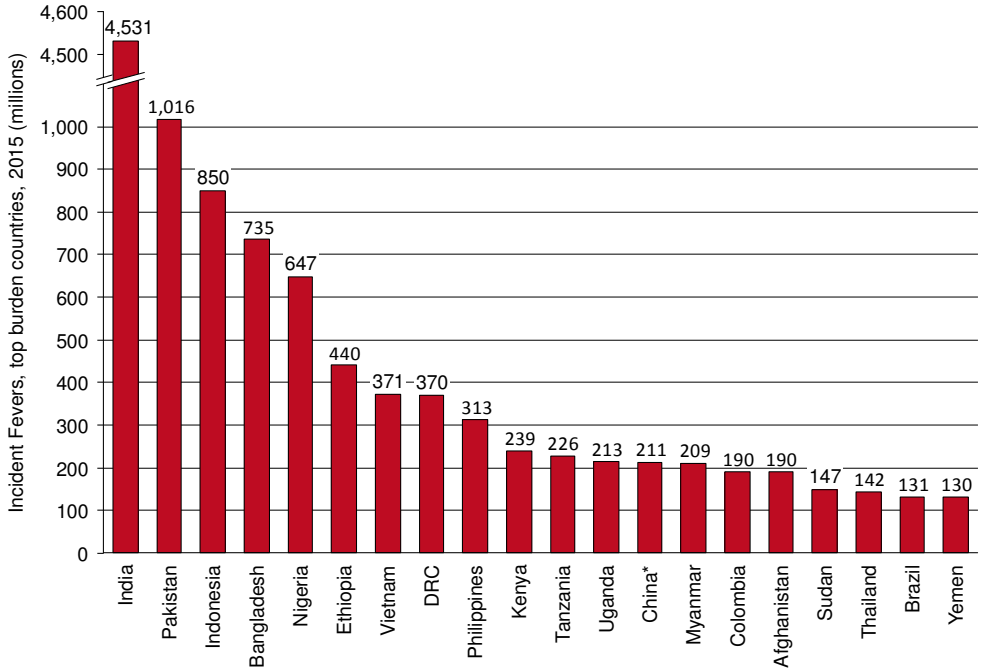


Adopting population-weighted 2010 global *P. falciparum* prevalence estimates obtained from the Malaria Atlas Project (MAP), we estimate that nearly half of all incident fevers in *P. falciparum* malaria at-risk populations occur in South-East Asia, a region comprising 8 countries – Bangladesh, Bhutan, 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 1, 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 3.7 billion fevers estimated in 2015, 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 2).

FIGURE 2

Incident fevers among P. falciparum malaria at-risk populations, top burden countries, 2015 (millions)

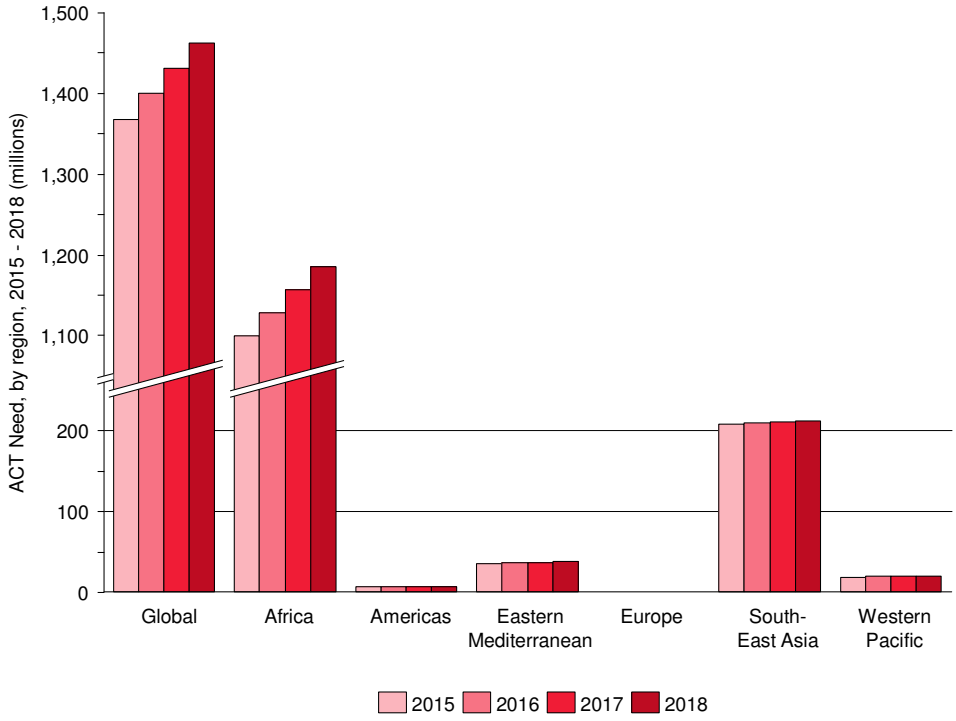


*Note: *China includes only Hainan and Yunnan provinces*

Applying adjusted malaria prevalence to the 2015 fever estimates results in an estimate of 1.37 billion incident fevers with microscopy/RDT-detectable malaria infection. If, in 2015, all such febrile cases were treated with an ACT (assuming all such events could be identified and treated appropriately), then a total of 1.37 billion ACTs would be required to meet this need (Figure 3). 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 4-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.

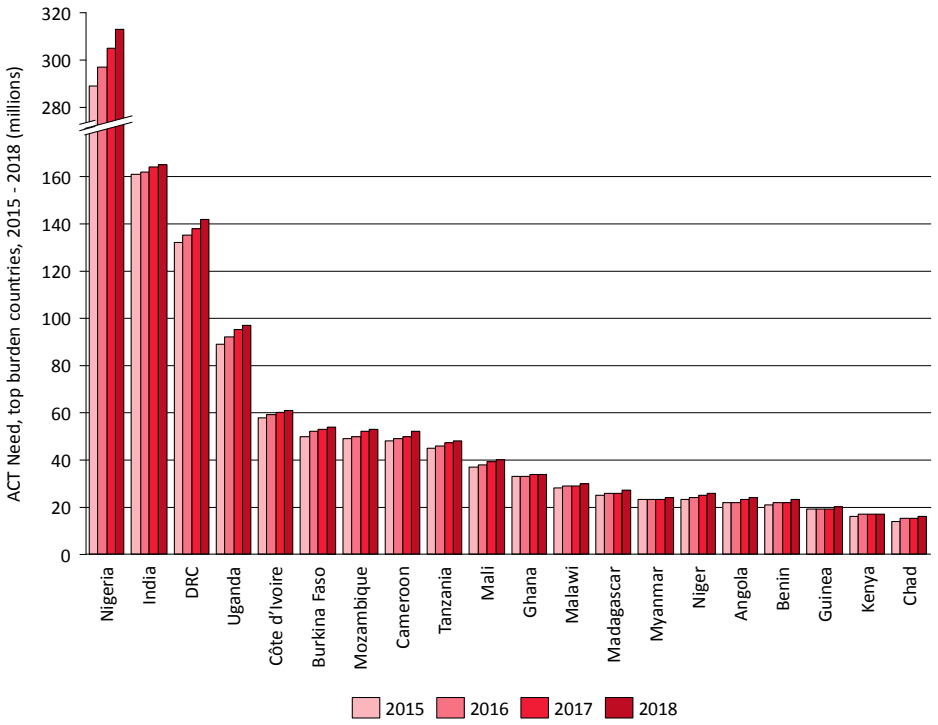
FIGURE 3
ACT Need, by region, 2015 - 2018 (millions)



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 4). 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 4
ACT Need, top burden countries, 2015 - 2018 (millions)



Discussion: ACT Need

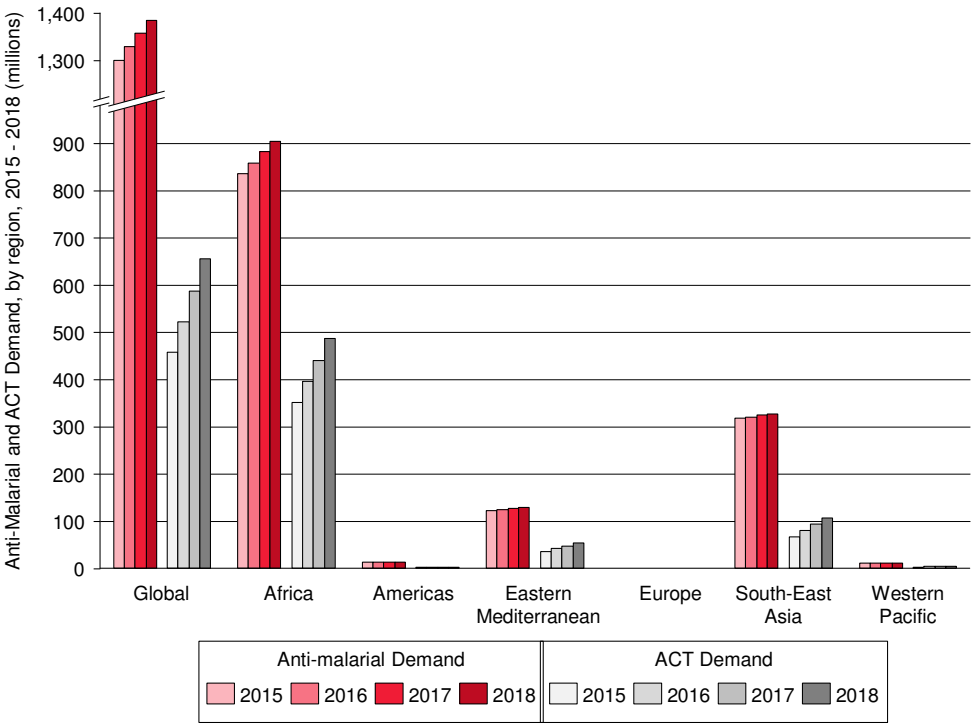
We defined ACT need as the number of antimalarial medicines required to treat all febrile illness concurrent with a detectable (by microscopy or RDT) falciparum malaria infection, regardless of whether (a) the individual with the febrile illness sought treatment for that illness, (b) whether a febrile 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 recorded cases figures, 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 1.37 billion in 2015 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 there exists a fairly large reservoir for potential malaria treatment need, and that while annual QAACT production currently exceeds case estimates, it comprises less than 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 ACT.

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 (1.3 billion in 2015, growing to 1.39 billion in 2018) and ACT demand (458 million in 2015, growing to 655 million in 2018) as a baseline (Figure 5), 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 352 million treatments in 2015, growing to 487 million treatments in 2018, and accounting for approximately 75% of global demand for ACTs. Furthermore, twenty countries comprise 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 5
Antimalarial and ACT Demand, by region, 2015 - 2018 (millions)



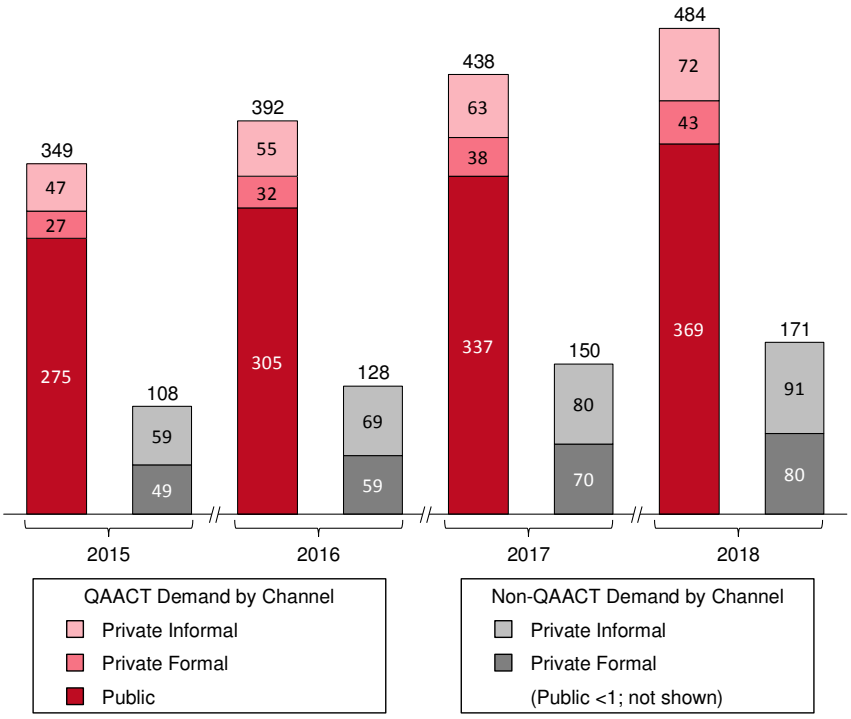
The public sector remains the main source of global ACT demand, accounting for approximately 60% of total ACT demand in 2015 (Figure 6). However, we expect that over the next four years, private sector ACT demand will grow faster than public sector demand, which will reduce the public sector's share of global ACT demand to 56% in 2018. Segmenting the two private channels, the informal private channel contributed the larger share of global ACT demand in 2015 (23%) while the formal private channel accounted for 17% of global ACT demand in 2015.

By applying estimates of QAACT use in the private sector, based on available ACTwatch country-level data, we have further segmented ACT demand estimates into QAACT and non-QAACT demand across each of these three channels (Figure 6). 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 to segment demand in the formal private and informal private channels by quality-assured drug classification. We estimate that 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.

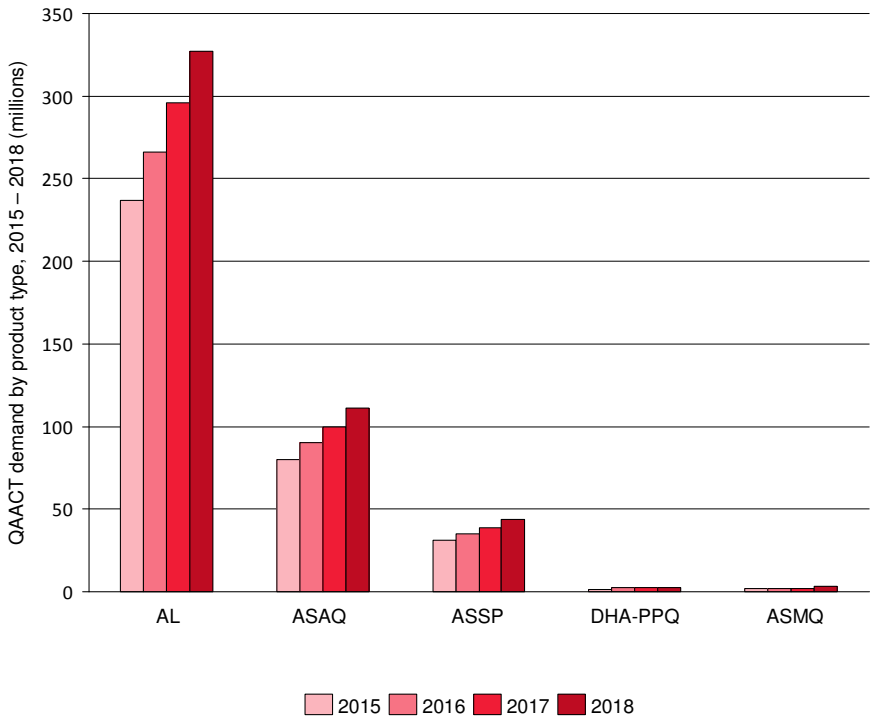
FIGURE 6

ACT global demand, by Quality-Assured drug classification and distribution channel, 2015 - 2018 (millions)



Further segmenting our global QAACT demand forecast by specific product types (Figure 7), AL will continue to comprise the majority of QAACT demand, with demand forecast to grow to 327 million treatments in 2018. We forecast ASSP demand to grow to 44 million treatments in 2018 with India comprising approximately 57% of ASSP use.

FIGURE 7
QAACT global demand, by product type, 2015 - 2018 (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 24% to 26% 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. The dynamics between the uptake of diagnostic testing at point of care facilities and ACT demand will be explored as an event in a future iteration of this forecast report.

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) 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 individual countries that procure QAACTs through the use of funds from the Global Fund;

- Historical QAACT spending on Global Fund grants;

- Historical QAACT procurement through USAID's PMI;

- For the private sector in countries taking part in the GF's Private Sector Co-Payment Mechanism (CPM), which supports a subsidized, private sector market for QAACTs, estimates of the 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), 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 nationally planned procurement volumes and product mix, and applies assumptions on QAACT pricing and associated procurement costs (based on publicly available Global Fund data, historical PMI procurement and funding data, and data from NMCPs) to calculate the total allocation of funds for commodity procurement. Applying historical trends in grant disbursements, we estimate the average pace and value of future grant disbursements at the national level, and from these figures, arrive at an annual estimate for QAACT procurement. In countries for which we do not have procurement plan data on which to base current funding allocations, we use data from past Global Fund grants to extrapolate historical spending on ACTs as a percentage of total malaria programmatic funding; by applying these estimated commodity spending rates to projected disbursements and incorporating price assumptions, we arrive at projections for QAACT volumes in these countries.

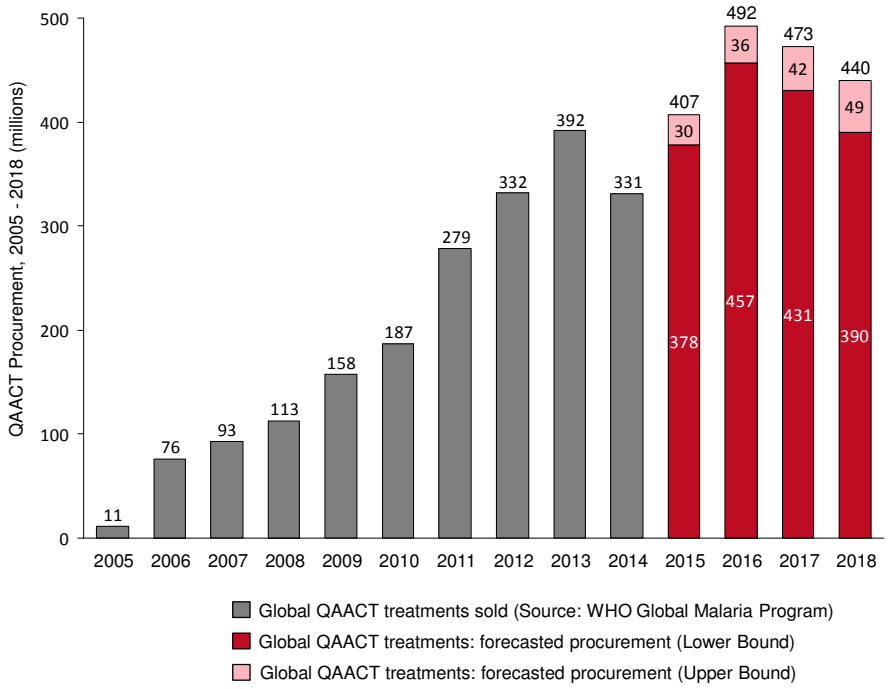
Historically, the US Government's President's Malaria Initiative (PMI) helped coordinate country-level efforts in the provision and rapid scale-up of ACTs. Given programmatic flexibilities in the treatment commodity procurement space, PMI has also been successful in filling developing gaps in treatment 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 private sector co-payment mechanism, while financial commitments for the continuation of CPM QAACT procurement are unclear beyond 2016, we have assumed that in CPM-participating countries, subsidized private sector QAACT treatment volumes in 2017 and 2018 will be equivalent to 2016 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 378 million QAACTs to be procured across all channels in 2015, with this figure peaking at 457 million in 2016

before declining to 431 million and 390 million QAACTs in 2017 and 2018, respectively (Figure 8). Our upper bound case projects forecasts 407 million QAACTs to be procured in 2015, with this number peaking to 492 million in 2016 before declining to 473 million and 440 million in 2017 and 2018, respectively. The underlying difference driving these outputs is a varying assumption for QAACT comprising proportion of ACT procurement in the premium private sector.

FIGURE 8

QAACT market: Historical and forecast growth, 2005 – 2018 (millions)



In 2015, QAACT procurement is highest in the public sector followed by the private subsidized sector (CPM) and the premium private sector (Figure 9). Although the prices of ACTs have come down substantially, they cost much more than other sub-optimal antimalarials, which explains the relatively low volumes in the private non-subsidized sector (premium private sector). Growth in QAACT procurement from 2015 to 2016 is largely driven by planned procurement in the public sector, and the African region will continue to constitute the majority of QAACT treatments procured in the public sector as a handful of high-volume African countries plan to increase funding allocations for ACT procurement in 2016 (Figure 10). The subsequent decrease in 2017 and 2018 is also driven by a decrease in projected funding allocation for ACT procurement in the public sector, as the model applies country-specific historical spending to current funding envelopes to forecast available funds for procurement in 2017 and 2018.

FIGURE 9
QAACT procurement, by channel, 2015 - 2018 (millions)

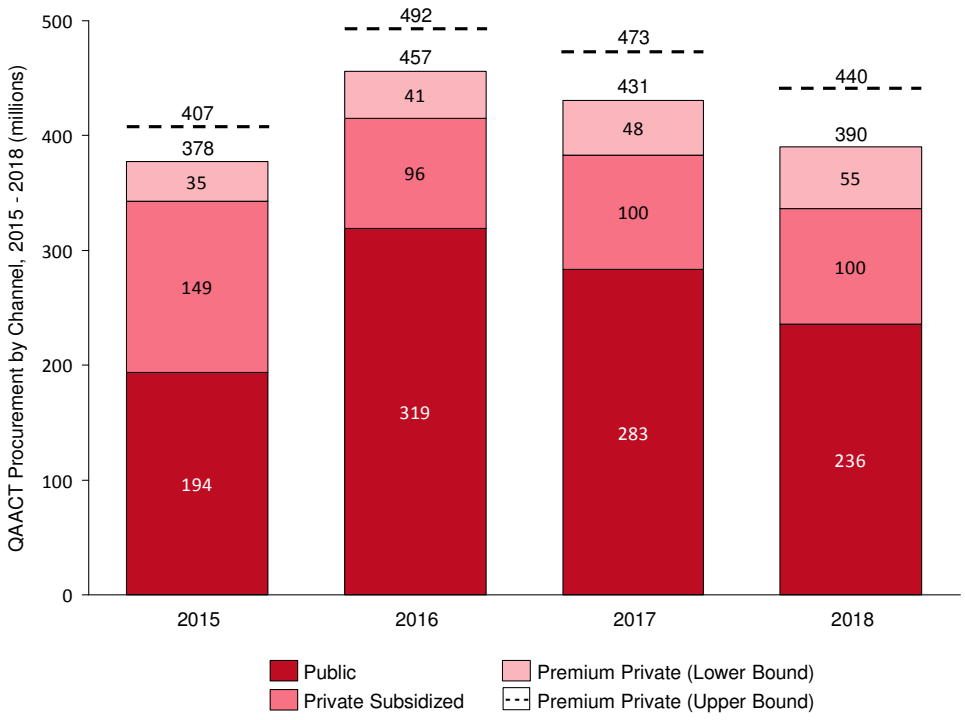
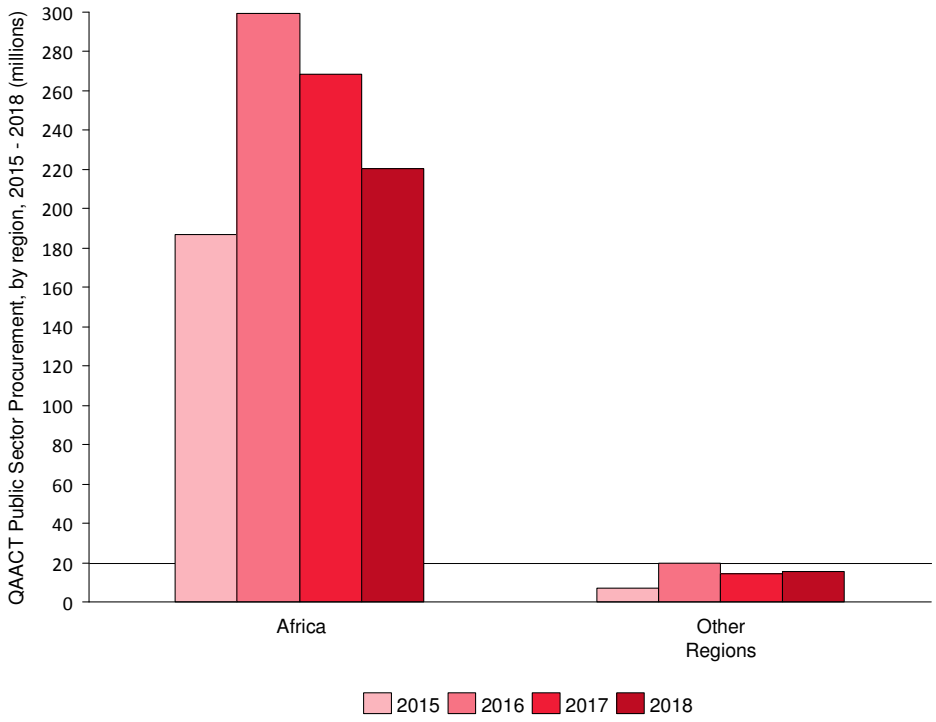


FIGURE 10

QAACT public sector procurement, by region (Africa and others), 2015 – 2018 (millions)

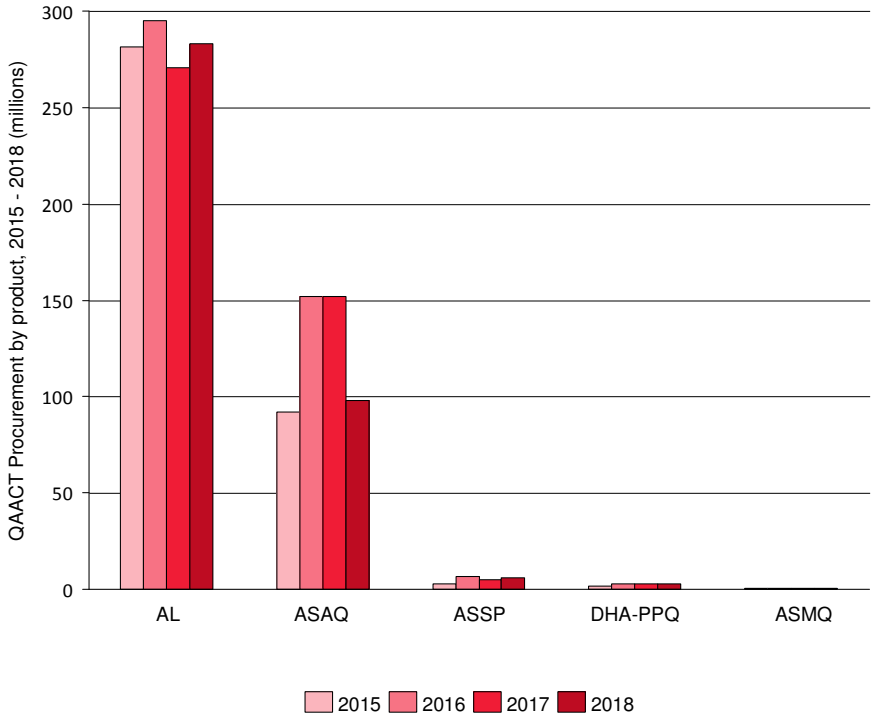


AL will continue to dominate the QAACT market, despite the increase in ASAQ procurement expected in 2016/2017 (Figure 11). The expected increase in ASAQ procurement is driven by an increase in planned procurement in the public sector among a handful of African countries which have ASAQ as the first line treatment, with DRC accounting for the largest increase.

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.

FIGURE 11

QAACT procurement, by product type, 2015 – 2018 (millions)



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, as a number of countries complete their planned procurements on the current funding cycle while some large-volume countries (e.g., DRC) simultaneously begin a two year QAACT procurement surge. Our current procurement estimates (e.g., the decline in 2017-2018), 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 envelope scheme is that it has perhaps shifted the financial-geographical-product balance in the ACT 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 using ASAQ as their recommended first-line therapy. Thus, while AL will continue to dominate the QAACT market, we expect that ASAQ volumes will increase in 2016 and 2017 with planned procurements in DRC and other nations that have adopted ASAQ as their first-line therapy.

Our demand model and procurement models produce different estimates for QAACT demand (349M in 2015, growing to 484M in 2018) and QAACT procurement (378M to 407M in 2015, and 390M to 440M in 2018) 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 known procurement plans and current understanding of national financial commitments to commodity procurement, with gaps filled by historical trend data. Given the continuing

expansion in ACT use in recent years, these projections demonstrate that QAACT procurement is likely not keeping pace with demand, leaving a demand gap that will likely be filled by non-QAACTs.

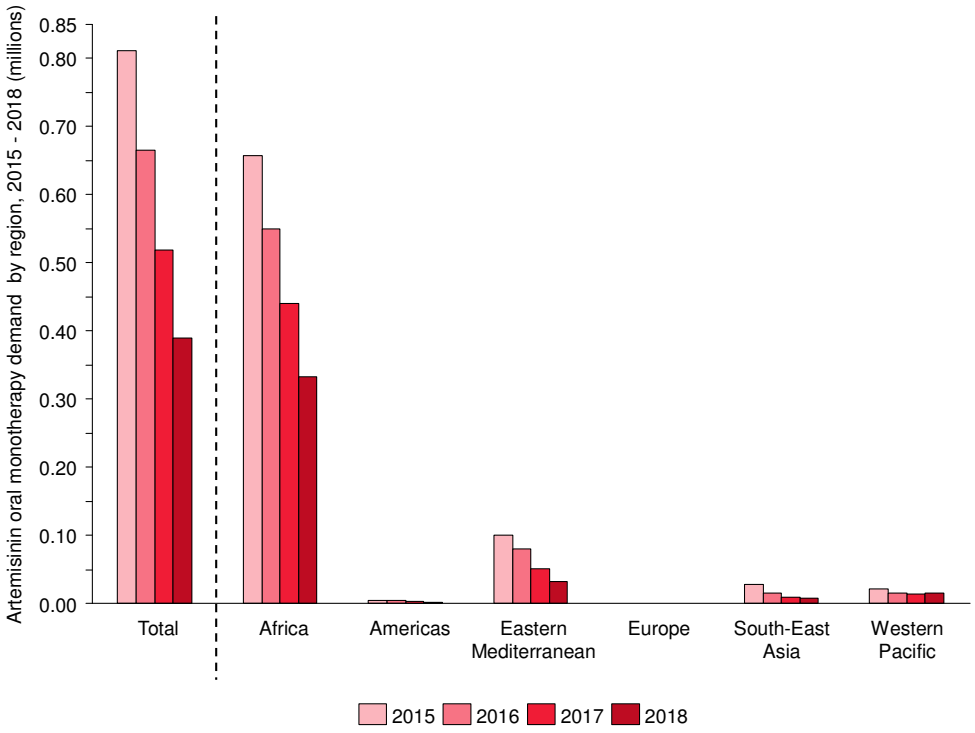
Because we have little information about the magnitude of the next Global Fund replenishment, nor what the future allocations will be for each disease area or country funding envelope, we have applied historical ACT spend, by country, to existing country funding envelopes to project QAACT procurement beyond 2017. 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.

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 12). 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 658,000 treatments in 2015, to 333,000 in 2018.

FIGURE 12

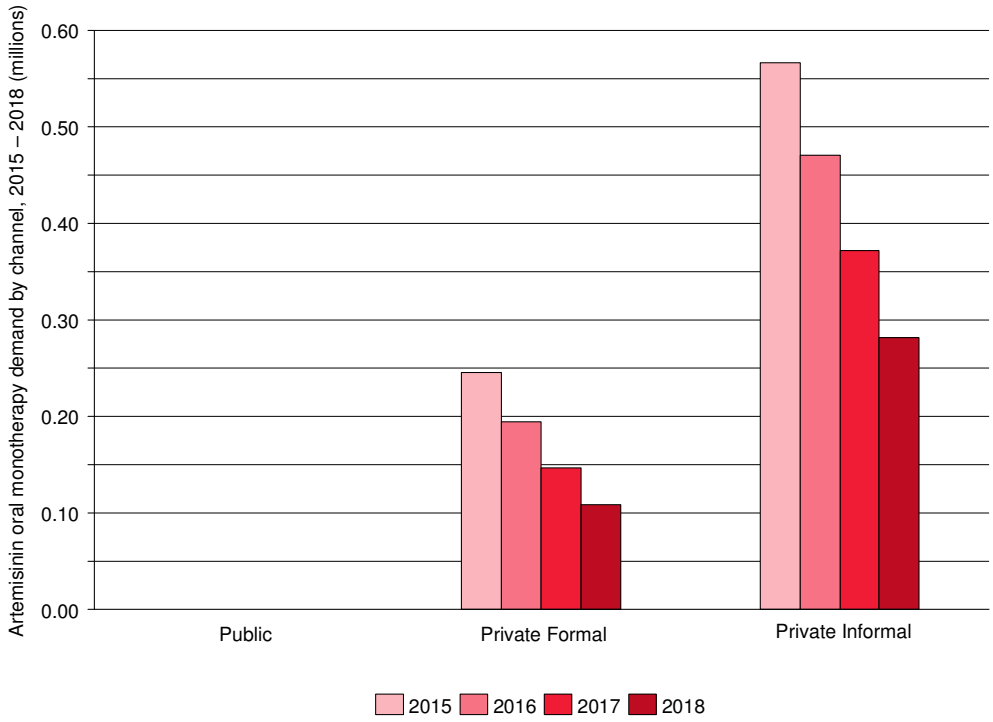
Artemisinin oral monotherapy global demand, by region, 2015 – 2018 (millions)



We have assumed that there is little to no use of oral artemisinin monotherapies in the public sector (Figure 13). 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 390,000 oral artemisinin monotherapies across both private sector channels in 2018.

FIGURE 13

Artemisinin oral monotherapy global demand by channel, 2015 – 2018 (millions)



We forecast demand for injectable artemisinin-derivative products is 53 million (unit: 60mg. vials) in 2015 and will increase to 84 million vials in 2018 (Figure 14). Demand for rectal artemisinin-derivative products and we forecast it too will increase, from 9.8 million total suppositories (units: 80mg. artemether; 100mg. artesunate) in 2015 to 13.4 million suppositories in 2018 (Figure 15). To estimate the demand for parenteral and rectal formulations of artemisinin in the private sector, we scaled IMS private sector sales data for these therapies based on an extrapolation of total artemisinin therapy demand, which was in turn based on a reconciliation of IMS sales data and our demand model baseline for oral ACTs. To estimate demand in the public sector, we used a combination of IMS data and publicly available Global Fund data.

FIGURE 14

Injectable artemisinin demand, by channel, 2015 - 2018 (60 mg. vials - millions)

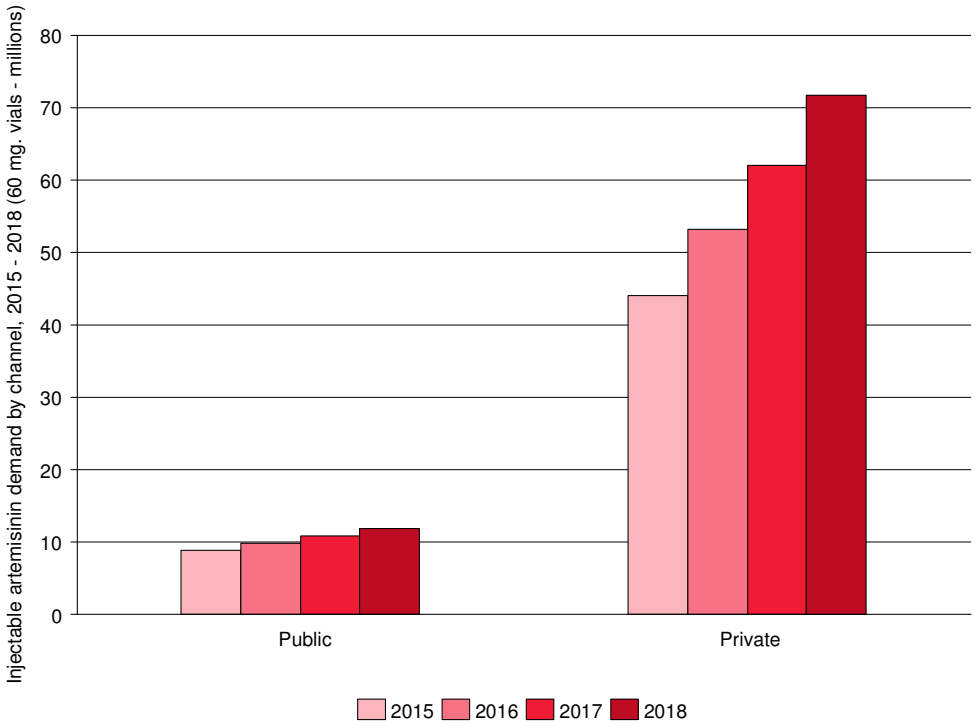
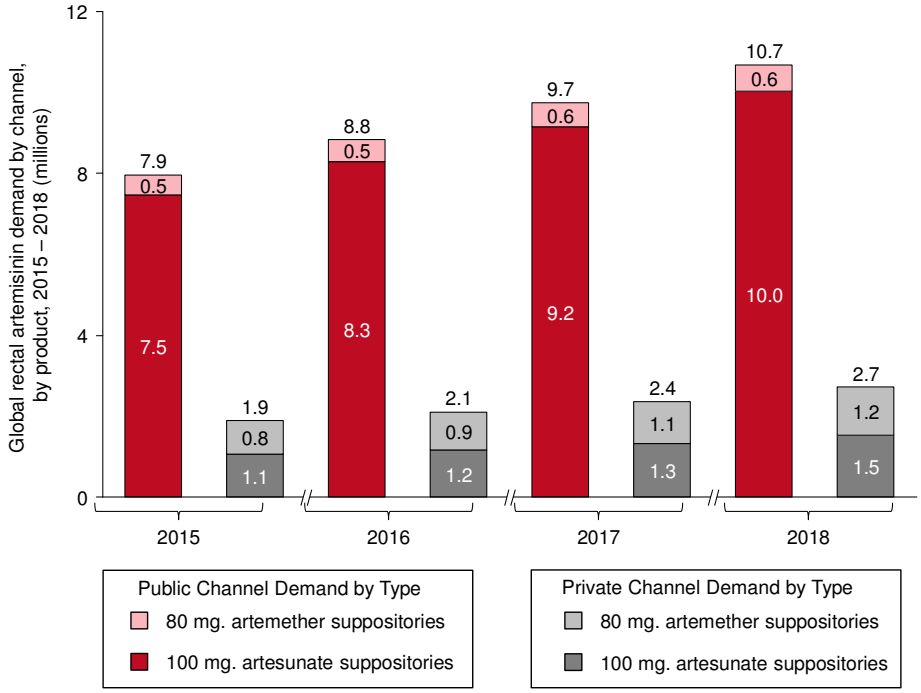


FIGURE 15

Global rectal artemisinin demand by channel, by product, 2015 – 2018 (millions)



Discussion: Artemisinin Monotherapy Demand

This report represents the first publicly published forecast for oral 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 artemisinin monotherapies will drop from 811,000 treatments in 2015 to 390,000 treatments in 2018. 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 monotherapies. While the estimated demand volumes for injectable/rectal artesunate may exceed severe malaria caseloads, current sales data for this class of medicines indicate that there is likely to be some off-label use.

QA-Injectable Artesunate Procurement

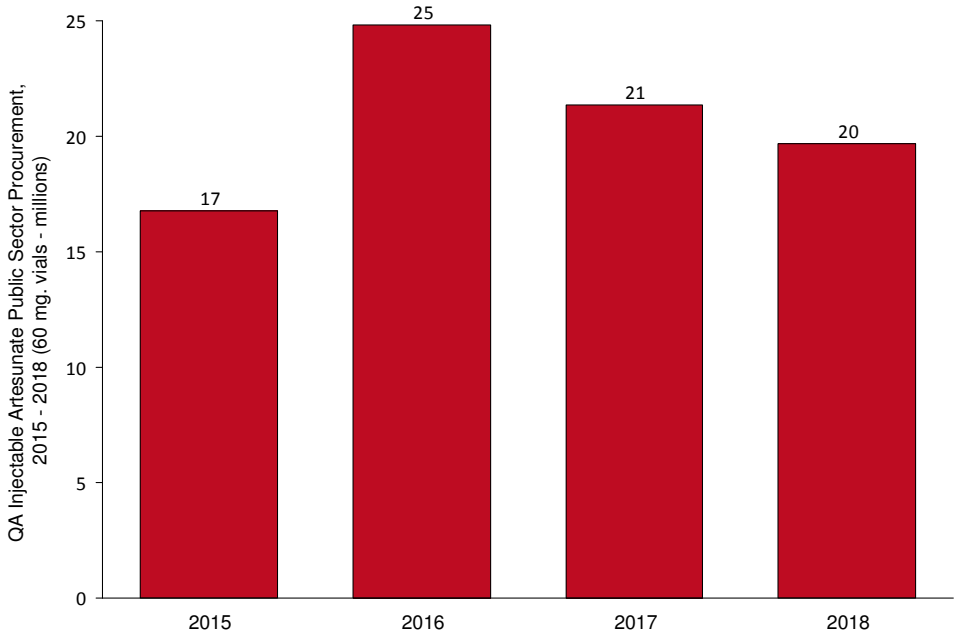
Since the publication of the seminal SEAQUAMAT and AQUAMAT clinical trials, which demonstrated that replacing administration of quinine with injectable artesunate, in treatment of patients with severe malaria, resulted in 34.7% and 22.5% reductions in in-hospital adult and child mortality respectively (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 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 QA injectable artesunate but expect that it will be a small fraction of that in the public sector.

We forecast public sector QA injectable artesunate procurement to be 17 million 60 mg. vials in 2015, with this figure peaking at 25 million in 2016 before declining to 21 million and 20 million 60 mg. vials of QA injectable artesunate in 2017 and 2018, respectively (Figure 16). Growth in QA injectable artesunate procurement from 2015 to 2016 is largely driven by a planned increase in Global Fund funding allocations towards injectable artesunate procurement in 2016. The decrease in QA injectable artesunate procurement between 2016 and 2017 is driven by limited visibility of confirmed orders in the Global Fund's next grant making cycle and our expectation that principal recipients of Global Fund grants will allocate funding for QA injectable artesunate procurement across the three years in the replenishment cycle, rather than across two of the three years.

FIGURE 16

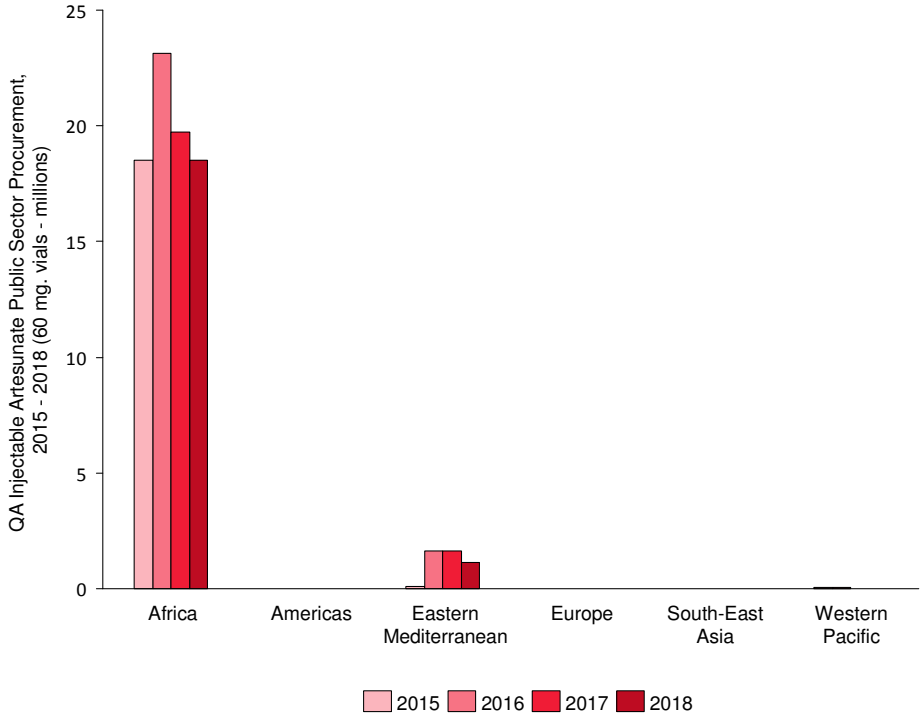
QA injectable artesunate public sector procurement, 2015 - 2018 (60 mg. vials - millions)



The African region will procure the majority of QA injectable artesunate in the public sector (Figure 17). The Eastern Mediterranean region will also procure a significant volume of QA injectable artesunate; however, this is procurement that will come largely from countries on the African continent – Sudan and South Sudan.

FIGURE 17

QA injectable artesunate public sector procurement, by region, 2015 - 2018 (60 mg. vials - millions)



Discussion: QA Injectable Artesunate Procurement

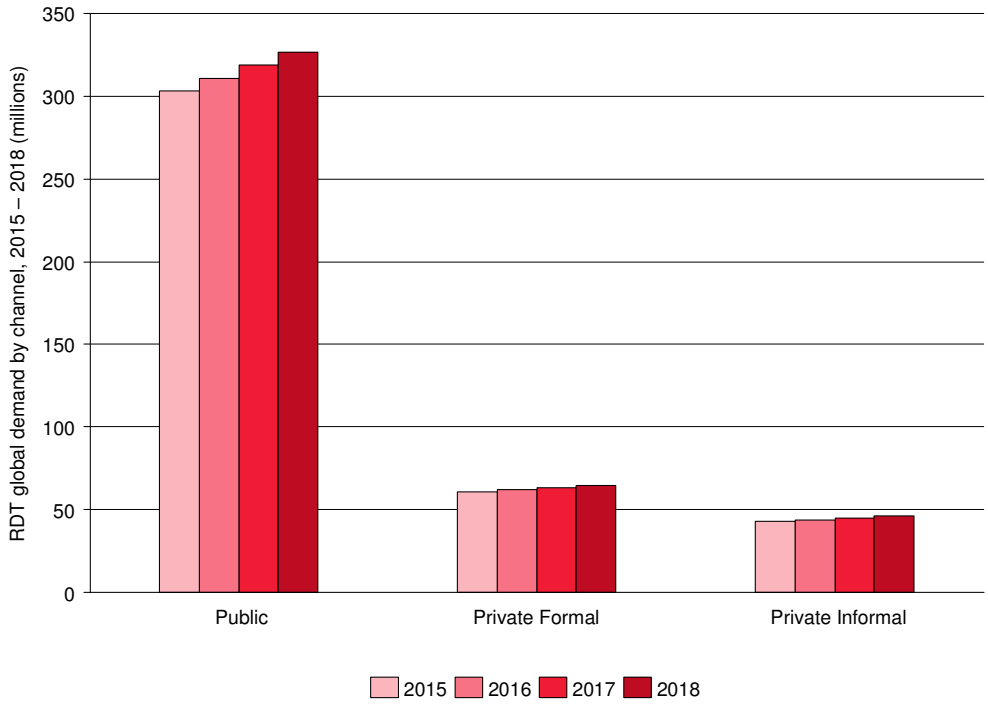
This output represents another achievement for this project: the first publicly available forecast for injectable artesunate procurement. Over the past few years, there has been a significant push to switch the first-line therapy for severe malaria from injectable quinine to injectable artesunate. These efforts include 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 QA injectable artesunate. While we currently forecast a peak followed by a slight decline in QA injectable artesunate procurement, the decline is due to anticipated shifts during funding transitions, and we expect that the QA injectable artesunate market will stabilize with annual volumes about midway between current volumes and 2016 peak volumes. It is important to note that the model projecting QA injectable artesunate demand is a different from the model supporting our procurement forecasts, and therefore outputs between the two may not align.

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 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. Overall, the majority of RDT testing is forecast to take place in the public sector, reaching 327 million tests in 2018, and accounting for approximately 75% of all RDT testing (Figure 18). 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 18

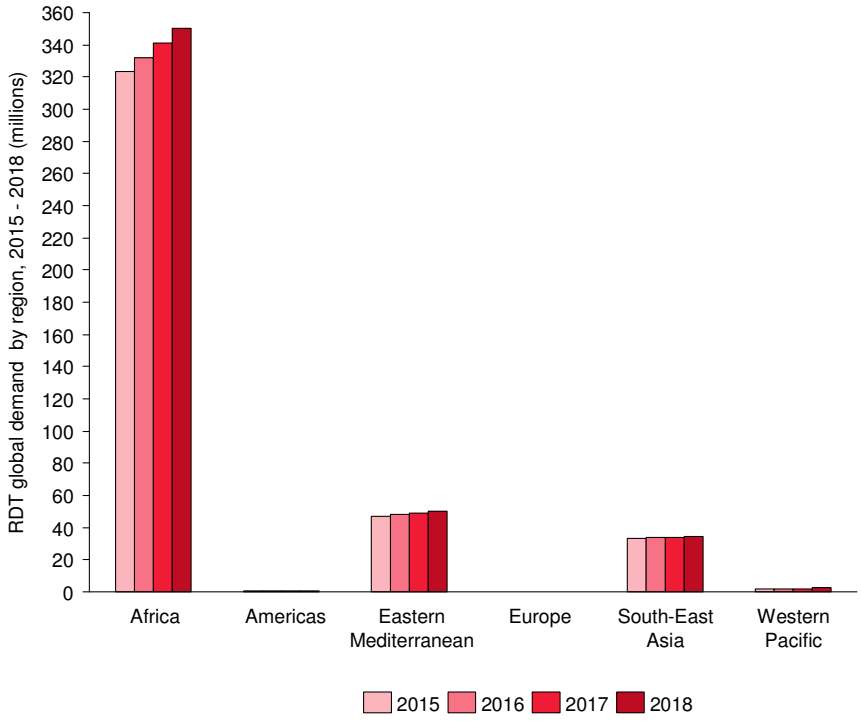
RDT global demand, by channel, 2015 - 2018 (millions)



RDT demand is highest in Africa, where we forecast it will reach 350 million tests, across all treatment channels, in 2018 (Figure 19). 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 19
RDT global demand by region, 2015 – 2018 (millions)



Discussion: RDT Demand

This first forecast for global RDT demand estimates that 75% of all RDTs are currently used in the public sector. We forecast demand for RDTs will expand from 303 million RDTs in 2015 to 327 million tests in 2018. 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. This model does not incorporate new

initiatives undertaken by governments wanting to expand RDT use in the public or private sector, and as such may forecast demand that is at times lower than our procurement figures.

RDT procurement

As is the case with QA-injectable artesunate 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 2014 World Malaria Report) to the private sector test forecast outputs from the demand model (described above).

We forecast global RDT procurement to be 281 million in 2015, peaking at 384 million in 2016, remaining flat at 375 million in 2017, before declining to 327 million RDTs in 2018 (Figure 20). Growth in RDT procurement from 2015 to 2016 is largely driven by increased planned procurement in the public sector, primarily in Africa (Figure 21). Conversely, the decrease in RDT procurement from 2017 to 2018 is driven by a decrease in projected funding allocation for RDT procurement in the public sector in 2018, as the model applies average historical spending (which is generally lower) to current funding envelopes to forecast available funds for procurement in 2017 and 2018.

FIGURE 20

RDT procurement by channel, 2015 - 2018 (millions)

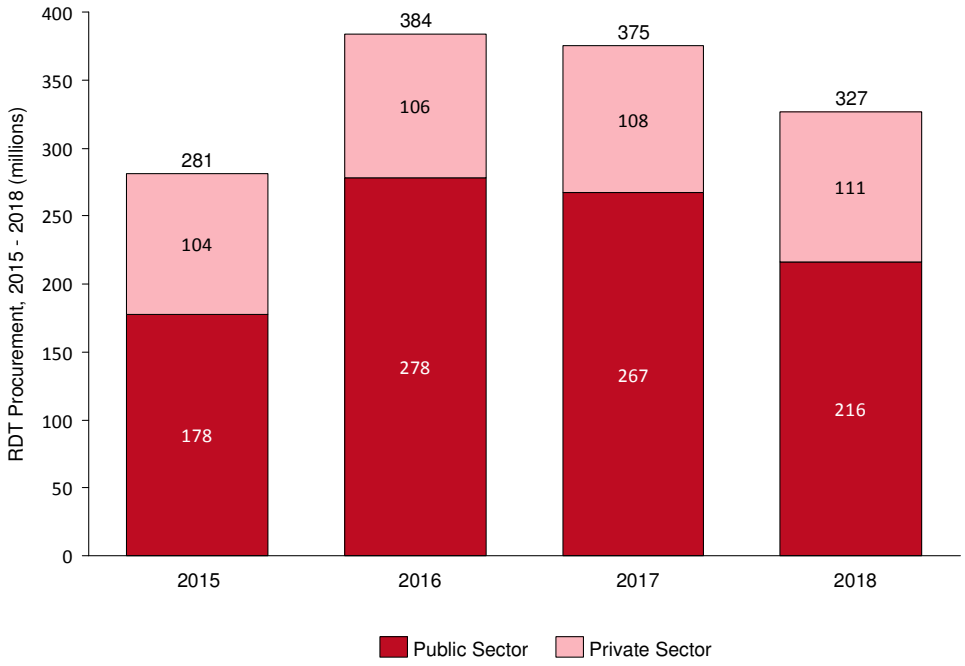
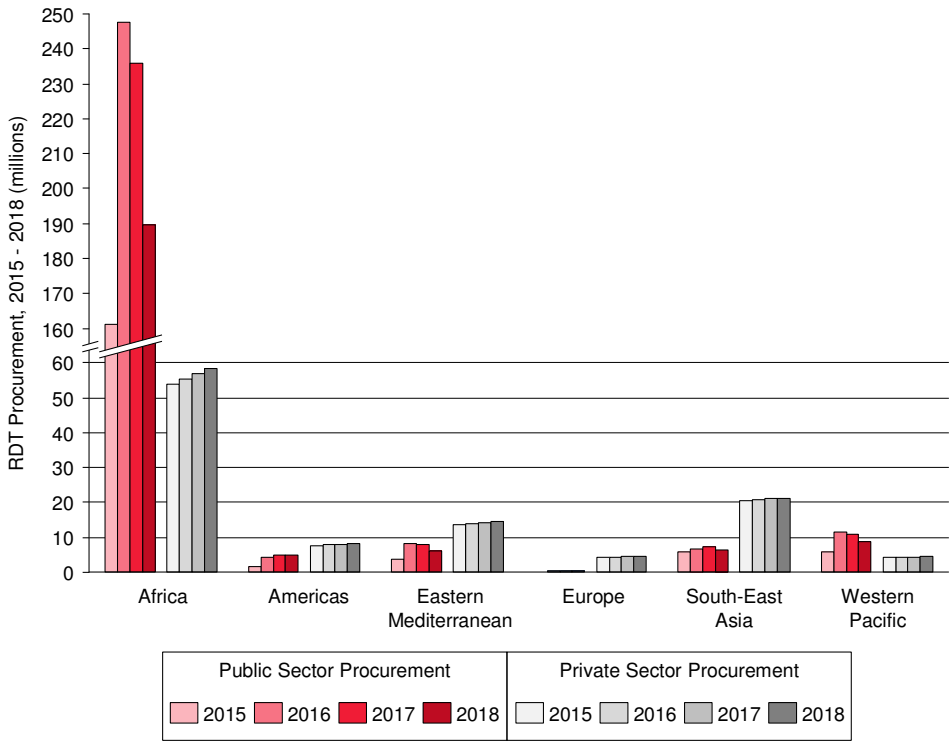


FIGURE 21
RDT procurement by region, by channel, 2015 - 2018 (millions)



Discussion: RDT Procurement

RDT procurement will peak in 2016, driven by the same country procurement plan and budgeting dynamics that will lead to a peak in QAACT procurement in 2016. Because we have little information on funding allocations and country procurement plans beyond 2017, 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 channels and 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. We plan to explore the dynamics between expanded access to RDTs and ACT demand and procurement in a future iteration of this forecast report.

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 22). We forecast global demand for artemisinin will rise from 197 metric tons (MT) in 2015 to 229 MTs in 2016, and remain stable at 227 MTs and 232 MTs in 2017 and 2018, respectively (Figure 23). 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 artemisinin monotherapies (Figure 6, Figure 8, Figure 12, Figure 14, Figure 15).

FIGURE 22

Artemisinin derivatives' demand by derivative, 2015 – 2018 (MTs)

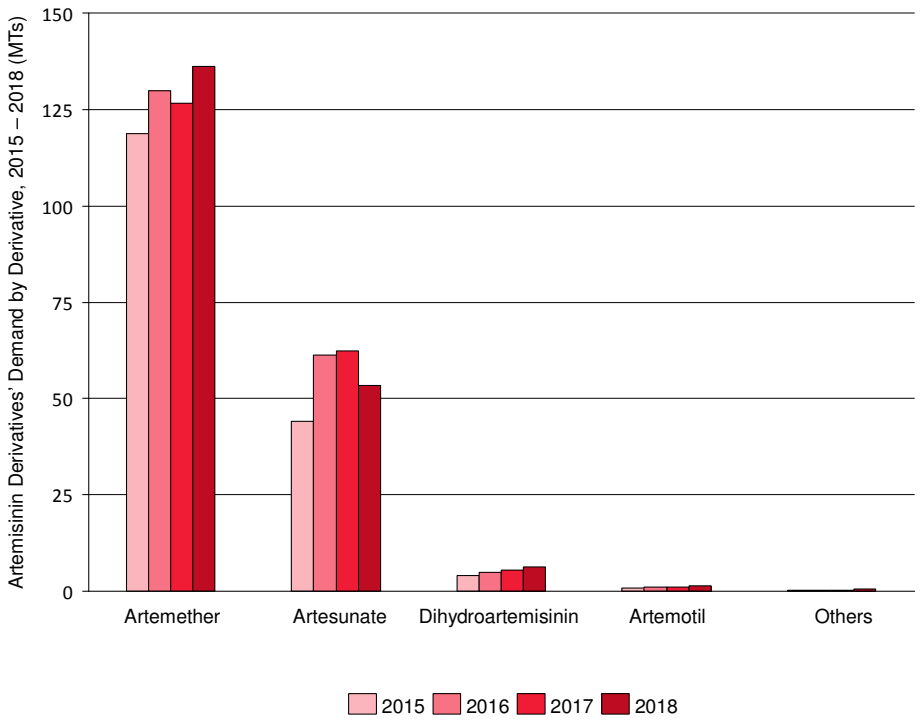
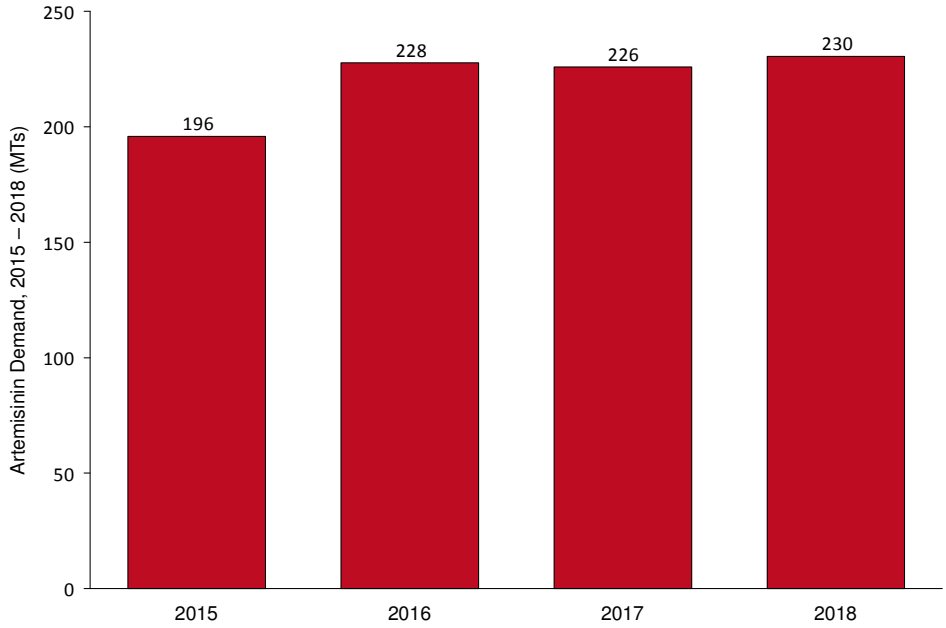


FIGURE 23
Artemisinin demand for API, 2015 – 2018 (MTs)



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 196 MT of artemisinin was required to meet global demand for artemisinin-containing medicines in 2015. With the forecast growth in procurement of QAACTs and demand for all other artemisinin-containing medicines in 2016, we forecast demand for artemisinin to climb to 228 metric tons in 2016. It is expected to remain stable in 2017 and 2018 at 226 and 230 metric tons respectively as the QAACT procurement comes back down while the demand for all other artemisinin containing medicines, and specifically, non-QAACTs, continues to rise. ACTs comprise 97% of global artemisinin demand, with QAACTs commanding approximately 64% to 73% of global artemisinin demand. The ACT share of artemisinin demand is only bound to increase as 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.

3. Closing

This report presents the first 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 publish revised forecasts each calendar quarter that will enable improved projections based on additional data that will be collected on an ongoing basis.

4. Appendix: Data Tables

TABLE 1

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 2

Incident Fevers among malaria-at-risk populations, by geographical region, 2015 – 2018

Region	2015	2016	2017	2018
Africa	3,679,621,800	3,778,605,200	3,878,434,500	3,979,372,900
Americas	654,850,000	662,736,400	670,490,700	678,120,700
Eastern Mediterranean	1,674,104,900	1,704,474,200	1,735,101,200	1,765,929,500
Europe	20,305,800	20,717,200	21,120,600	21,516,500
South-East Asia	6,546,463,800	6,616,967,000	6,685,139,800	6,751,349,100
Western Pacific	1,081,356,500	1,093,871,300	1,106,050,000	1,117,907,200
TOTAL	***13,656,702,900***	***13,877,371,300***	***14,096,336,900***	***14,314,195,800***

TABLE 3

ACT Need (Incident fevers with likely malaria infection, among malaria-at-risk populations), by geographical region, 2015 – 2018

Region	2015	2016	2017	2018
Africa	1,098,770,000	1,127,861,300	1,156,741,900	1,185,618,000
Americas	6,836,500	6,907,100	6,974,600	7,039,500
Eastern Mediterranean	35,493,700	36,243,400	36,982,000	37,713,400
Europe	300	300	300	300
South-East Asia	207,558,400	209,408,600	211,072,400	212,590,000
Western Pacific	18,652,100	18,934,800	19,203,100	19,459,900
TOTAL	***1,367,310,900***	***1,399,355,500***	***1,430,974,400***	***1,462,421,100***

Table 4

ACT Demand by Channel, by Region, 2015 – 2018

Channel	Region	2015	2016	2017	2018
Public	Africa	234,543,900	259,429,600	285,102,800	311,437,500
	Americas	922,300	1,274,600	1,634,000	2,000,200
	Eastern Mediterranean	19,812,500	22,252,800	24,775,700	27,383,800
	Europe	26,900	31,400	36,100	40,900
	South-East Asia	18,125,300	20,766,100	23,437,300	26,138,700
	Western Pacific	1,607,100	1,846,100	2,089,100	2,336,100
	Public Total	**275,037,900**	**305,600,600**	**337,075,000**	**369,337,100**

Formal Private	Africa	31,763,600	36,811,600	42,081,800	47,582,300
	Americas	206,600	278,600	352,200	427,200
	Eastern Mediterranean	7,722,200	9,545,900	11,428,000	13,370,100
	Europe	6,500	8,400	10,300	12,300
	South-East Asia	36,351,300	44,536,600	52,846,700	61,274,400
	Western Pacific	534,600	645,500	758,200	872,600
	Formal Private Total	**76,585,000**	**91,826,600**	**107,477,200**	**123,539,000**
Informal Private	Africa	85,223,200	98,800,000	112,977,500	127,774,700
	Americas	250,000	338,500	429,000	521,400
	Eastern Mediterranean	8,049,300	9,528,800	11,062,900	12,652,400
	Europe	9,400	12,100	14,900	17,800
	South-East Asia	12,017,500	14,737,000	17,510,200	20,335,700
	Western Pacific	759,100	893,400	1,030,600	1,170,500
	Informal Private Total	**106,308,500**	**124,309,800**	**143,025,000**	**162,472,500**
Total *(across channels)*	Africa	351,530,800	395,041,100	440,162,100	486,794,500
	Americas	1,379,000	1,891,700	2,415,100	2,948,800
	Eastern Mediterranean	35,583,900	41,327,500	47,266,600	53,406,300
	Europe	42,800	52,000	61,300	71,000
	South-East Asia	66,494,100	80,039,600	93,794,100	107,748,800
	Western Pacific	2,900,800	3,385,100	3,877,900	4,379,100
TOTAL		***457,931,400***	***521,736,900***	***587,577,200***	***655,348,500***

TABLE 5

QAACT procurement by channel, by region, by ACT type (Lower bound)

Channel	Region	ACT Type	2015	2016	2017	2018
Public	**Africa**	AL	119,495,200	169,901,300	140,110,400	145,880,900
		ASAQ	67,386,400	129,321,800	128,623,800	74,499,900
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Africa	***186,881,600***	***299,223,100***	***268,734,200***	***220,380,700***
	Americas	AL	117,200	132,200	144,200	135,500
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Americas	***117,200***	***132,200***	***144,200***	***135,500***
	Eastern Mediterranean	AL	2,500	4,854,300	2,388,000	3,420,400
		ASAQ	910,700	2,699,200	2,700,100	1,707,200
		ASSP	175,800	3,323,100	1,752,400	2,431,100
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Eastern Med.	***1,089,100***	***10,876,600***	***6,840,500***	***7,558,700***
	Europe	AL	700	4,600	4,200	4,900
		ASAQ	1,100	7,100	4,200	5,400
		ASSP	-	200	100	100
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Europe	***1,800***	***11,800***	***8,500***	***10,500***
	South-East Asia	AL	2,225,100	2,616,000	2,130,900	2,407,400
		ASAQ	1,134,300	2,087,900	1,782,300	1,956,700
		ASSP	172,300	223,000	200,000	178,400
		DHA-PPQ	1,134,300	2,087,900	1,782,300	1,956,700

		ASMQ	-	-	-	-
		South-East Asia	***4,666,000***	***7,014,900***	***5,895,500***	***6,499,100***
	Western Pacific	AL	681,100	781,000	787,400	714,000
		ASAQ	10,800	21,400	21,400	21,400
		ASSP	300	600	600	600
		DHA-PPQ	416,700	750,400	748,700	735,200
		ASMQ	20,800	12,200	12,400	17,400
		Western Pacific	***1,129,700***	***1,565,600***	***1,570,500***	***1,488,500***
	Public Total (all regions)	AL	*122,521,800*	*178,289,500*	*145,565,100*	*152,563,100*
		ASAQ	*69,443,400*	*134,137,400*	*133,131,800*	*78,190,400*
		ASSP	*348,400*	*3,546,800*	*1,953,100*	*2,610,200*
		DHA-PPQ	*1,551,100*	*2,838,400*	*2,531,100*	*2,691,900*
		ASMQ	*20,800*	*12,200*	*12,400*	*17,400*
	PUBLIC TOTAL		***193,885,500***	***318,824,300***	***283,193,400***	***236,073,000***
Subsidized Private	**Africa**	AL	130,893,200	83,638,000	86,498,900	86,498,900
		ASAQ	18,156,200	12,721,900	13,363,000	13,363,000
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Africa	***149,049,400***	***96,359,800***	***99,861,900***	***99,861,900***
	Americas	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Americas	***-***	***-***	***-***	***-***

	Eastern Mediterranean	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Eastern Med.	**-**	**-**	**-**	**-**
	Europe	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Europe	**-**	**-**	**-**	**-**
	South-East Asia	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		South-East Asia	**-**	**-**	**-**	**-**
	Western Pacific	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Western Pacific	**-**	**-**	**-**	**-**

	Private Subsidized Total (all regions)	AL	*130,893,200*	*83,638,000*	*86,498,900*	*86,498,900*
		ASAQ	*18,156,200*	*12,721,900*	*13,363,000*	*13,363,000*
		ASSP				
		DHA-PPQ				
		ASMQ				
	SUBSIDIZED PRIVATE TOTAL		***149,049,400***	***96,359,800***	***99,861,900***	***99,861,900***
Premium Private	**Africa**	AL	13,926,700	15,734,500	17,769,200	20,133,400
		ASAQ	3,854,000	4,493,600	5,164,400	5,874,400
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Africa	***17,780,700***	***20,228,100***	***22,933,600***	***26,007,800***
	Americas	AL	32,300	43,900	55,700	67,600
		ASAQ	-	-	-	-
		ASSP	26,000	35,700	45,700	55,800
		DHA-PPQ	-	-	-	-
		ASMQ	49,900	66,700	83,800	101,400
		Americas	***108,200***	***146,300***	***185,200***	***224,900***
	Eastern Mediterranean	AL	2,200	2,800	3,600	4,400
		ASAQ	338,300	385,500	433,700	482,900
		ASSP	2,093,500	2,413,700	2,747,500	3,095,100
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Eastern Med.	***2,434,000***	***2,802,000***	***3,184,800***	***3,582,400***
	Europe	AL	31,200	27,800	34,200	42,100
		ASAQ	-	-	-	-
		ASSP	1,200	1,600	1,900	2,300
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Europe	***32,400***	***29,400***	***36,100***	***44,400***

	South-East Asia	AL	13,662,700	17,313,100	20,481,100	23,565,400
		ASAQ	-	-	-	-
		ASSP	268,000	341,900	406,800	464,700
		DHA-PPQ	-	-	-	-
		ASMQ	100,700	116,400	132,000	147,300
		South-East Asia	***14,031,400***	***17,771,400***	***21,019,900***	***24,177,400***
	Western Pacific	AL	149,700	178,600	208,200	238,600
		ASAQ	51,500	87,300	62,600	97,400
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	114,300	127,900	141,800	155,900
		Western Pacific	***315,500***	***393,700***	***412,600***	***492,000***
	Premium Private Total (all regions)	AL	*27,804,800*	*33,300,700*	*38,552,100*	*44,051,500*
		ASAQ	*4,243,900*	*4,966,400*	*5,660,700*	*6,454,700*
		ASSP	*2,388,700*	*2,792,900*	*3,201,900*	*3,617,900*
		DHA-PPQ	-	-	-	-
		ASMQ	*264,900*	*311,000*	*357,600*	*404,600*
	PREMIUM PRIVATE TOTAL		***34,702,300***	***41,370,900***	***47,772,200***	***54,528,900***
TOTAL (across channels)	**Africa**	AL	264,315,100	269,273,800	244,378,500	252,513,200
		ASAQ	89,396,600	146,537,300	147,151,200	93,737,300
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Africa	***353,711,700***	***415,811,000***	***391,529,700***	***346,250,400***
	Americas	AL	149,500	176,100	199,900	203,100
		ASAQ	-	-	-	-
		ASSP	26,000	35,700	45,700	55,800
		DHA-PPQ	-	-	-	-
		ASMQ	49,900	66,700	83,800	101,400
		Americas	***225,400***	***278,500***	***329,400***	***360,400***

	Eastern Mediterranean	AL	4,700	4,857,100	2,391,600	3,424,800
		ASAQ	1,249,000	3,084,700	3,133,800	2,190,100
		ASSP	2,269,300	5,736,800	4,499,900	5,526,200
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Eastern Med.	***3,523,100***	***13,678,600***	***10,025,300***	***11,141,100***
	Europe	AL	31,900	32,400	38,400	47,000
		ASAQ	1,100	7,100	4,200	5,400
		ASSP	1,200	1,800	2,000	2,400
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Europe	***34,200***	***41,200***	***44,600***	***54,900***
	South-East Asia	AL	15,887,800	19,929,100	22,612,000	25,972,800
		ASAQ	1,134,300	2,087,900	1,782,300	1,956,700
		ASSP	440,300	564,900	606,800	643,100
		DHA-PPQ	1,134,300	2,087,900	1,782,300	1,956,700
		ASMQ	100,700	116,400	132,000	147,300
		South-East Asia	***18,697,400***	***24,786,300***	***26,915,400***	***30,676,500***
	Western Pacific	AL	830,800	959,600	995,600	952,600
		ASAQ	62,300	108,700	84,000	118,800
		ASSP	300	600	600	600
		DHA-PPQ	416,700	750,400	748,700	735,200
		ASMQ	135,100	140,100	154,200	173,300
		Western Pacific	***1,445,200***	***1,959,300***	***1,983,100***	***1,980,500***
	Total (all regions)	AL	*281,219,800*	*295,228,100*	*270,616,000*	*283,113,500*
		ASAQ	*91,843,300*	*151,825,700*	*152,155,500*	*98,008,300*
		ASSP	*2,737,100*	*6,339,800*	*5,155,000*	*6,228,100*
		DHA-PPQ	*1,551,000*	*2,838,300*	*2,531,000*	*2,691,900*
		ASMQ	*285,700*	*323,200*	*370,000*	*422,000*
TOTAL			***377,637,100***	***456,555,000***	***430,827,500***	***390,463,800***

TABLE 6

QAACT procurement by channel, by region, by ACT type (Upper bound)

Channel	Region	ACT Type	2015	2016	2017	2018
Public	**Africa**	AL	119,495,200	169,901,300	140,110,400	145,880,900
		ASAQ	67,386,400	129,321,800	128,623,800	74,499,900
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Africa	**186,881,600**	**299,223,100**	**268,734,200**	**220,380,700**
	Americas	AL	117,200	132,200	144,200	135,500
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Americas	***117,200***	***132,200***	***144,200***	***135,500***

	Eastern Mediterranean	AL	2,500	4,854,300	2,388,000	3,420,400
		ASAQ	910,700	2,699,200	2,700,100	1,707,200
		ASSP	175,800	3,323,100	1,752,400	2,431,100
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Eastern Med.	**1,089,100**	**10,876,600**	**6,840,500**	**7,558,700**
	Europe	AL	700	4,600	4,200	4,900
		ASAQ	1,100	7,100	4,200	5,400
		ASSP	-	200	100	100
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Europe	***1,800***	***11,800***	***8,500***	***10,500***

	South-East Asia	AL	2,225,100	2,616,000	2,130,900	2,407,400
		ASAQ	1,134,300	2,087,900	1,782,300	1,956,700
		ASSP	172,300	223,000	200,000	178,400
		DHA-PPQ	1,134,300	2,087,900	1,782,300	1,956,700
		ASMQ	-	-	-	-
		South-East Asia	**4,666,000**	**7,014,900**	**5,895,500**	**6,499,100**
	Western Pacific	AL	681,100	781,000	787,400	714,000
		ASAQ	10,800	21,400	21,400	21,400
		ASSP	300	600	600	600
		DHA-PPQ	416,700	750,400	748,700	735,200
		ASMQ	20,800	12,200	12,400	17,400
		Western Pacific	***1,129,700***	***1,565,600***	***1,570,500***	***1,488,500***

	Public Total (all regions)	AL	*122,521,800*	*178,289,500*	*145,565,100*	*152,563,100*
		ASAQ	*69,443,400*	*134,137,400*	*133,131,800*	*78,190,400*
		ASSP	*348,400*	*3,546,800*	*1,953,100*	*2,610,200*
		DHA-PPQ	*1,551,100*	*2,838,400*	*2,531,100*	*2,691,900*
		ASMQ	*20,800*	*12,200*	*12,400*	*17,400*
	PUBLIC TOTAL		***193,885,500***	***318,824,300***	***283,193,400***	***236,073,000***
Subsidized Private	**Africa**	AL	130,893,200	83,638,000	86,498,900	86,498,900
		ASAQ	18,156,200	12,721,900	13,363,000	13,363,000
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Africa	**149,049,400**	**96,359,800**	**99,861,900**	**99,861,900**
	Americas	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-

		Americas	**-**	**-**	**-**	**-**
	Eastern Mediterranean	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Eastern Med.	**-**	**-**	**-**	**-**
	Europe	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Europe	**-**	**-**	**-**	**-**
	South-East Asia	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-

		ASMQ	-	-	-	-
		South-East Asia	**-**	**-**	**-**	**-**
	Western Pacific	AL	-	-	-	-
		ASAQ	-	-	-	-
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Western Pacific	**-**	**-**	**-**	**-**
	Private Subsidized Total	AL	*130,893,200*	*83,638,000*	*86,498,900*	*86,498,900*
	(all regions)	ASAQ	*18,156,200*	*12,721,900*	*13,363,000*	*13,363,000*
		ASSP				
		DHA-PPQ				
		ASMQ				
	PRIVATE SUBSIDIZED TOTAL		***149,049,400***	***96,359,800***	***99,861,900***	***99,861,900***

Premium Private	**Africa**	AL	18,466,400	21,197,600	24,060,400	27,043,800
		ASAQ	6,330,700	7,396,500	8,524,600	9,696,500
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Africa	**24,797,100**	**28,594,100**	**32,585,000**	**36,740,200**
	Americas	AL	203,500	274,700	347,900	422,500
		ASAQ	12,600	17,000	21,500	26,100
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Americas	***216,100***	***291,600***	***369,300***	***448,500***

	Eastern Mediterranean	AL	6,537,700	8,032,400	9,585,300	11,187,800
		ASAQ	871,100	996,000	1,126,700	1,260,600
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Eastern Med.	**7,408,800**	**9,028,400**	**10,712,100**	**12,448,400**
	Europe	AL	692,700	863,300	1,037,300	1,214,300
		ASAQ	200	200	300	300
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	-	-	-	-
		Europe	***692,800***	***863,500***	***1,037,500***	***1,214,600***
	South-East Asia	AL	30,100,500	36,868,300	43,741,900	50,715,500
		ASAQ	12,600	14,400	16,300	18,200
		ASSP	615,900	754,300	894,900	1,037,600
		DHA-PPQ	-	-	-	-
		ASMQ	13,500	16,500	19,600	22,700

		South-East Asia	**30,742,400**	**37,653,600**	**44,672,700**	**51,794,000**
	Western Pacific	AL	407,700	472,500	539,800	608,500
		ASAQ	136,100	170,800	205,700	240,800
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-
		ASMQ	37,800	51,400	64,400	77,600
		Western Pacific	***581,600***	***694,700***	***810,000***	***927,000***
	Premium Private Total (all regions)	AL	*56,408,400*	*67,708,700*	*79,312,600*	*91,192,500*
		ASAQ	*7,363,300*	*8,595,000*	*9,895,100*	*11,242,500*
		ASSP	*615,900*	*754,300*	*894,900*	*1,037,600*
		DHA-PPQ	-	-	-	-
		ASMQ	*51,300*	*67,900*	*84,000*	*100,300*
	PREMIUM PRIVATE TOTAL		***64,438,800***	***77,125,900***	***90,186,600***	***103,572,900***
TOTAL (across channels)	**Africa**	AL	268,854,800	274,736,900	250,669,700	259,423,600
		ASAQ	91,873,300	149,440,200	150,511,400	97,559,400
		ASSP	-	-	-	-
		DHA-PPQ	-	-	-	-

	ASMQ	-	-	-	-
	Africa	**360,728,100**	**424,177,000**	**401,181,100**	**356,982,800**
Americas	AL	320,700	406,900	492,100	558,000
	ASAQ	12,600	17,000	21,500	26,100
	ASSP	-	-	-	-
	DHA-PPQ	-	-	-	-
	ASMQ	-	-	-	-
	Americas	***333,300***	***423,800***	***513,500***	***584,000***
Eastern Mediterranean	AL	6,540,200	12,886,700	11,973,300	14,608,200
	ASAQ	1,781,800	3,695,200	3,826,800	2,967,800
	ASSP	175,800	3,323,100	1,752,400	2,431,100
	DHA-PPQ	-	-	-	-
	ASMQ	-	-	-	-
	Eastern Med.	**8,497,900**	**19,905,000**	**17,552,600**	**20,007,100**
Europe	AL	693,400	867,900	1,041,500	1,219,200
	ASAQ	1,300	7,300	4,500	5,700
	ASSP	-	200	100	100

	DHA-PPQ	-	-	-	-
	ASMQ	-	-	-	-
	Europe	***694,600***	***875,300***	***1,046,000***	***1,225,100***
South-East Asia	AL	32,325,600	39,484,300	45,872,800	53,122,900
	ASAQ	1,146,900	2,102,300	1,798,600	1,974,900
	ASSP	788,200	977,300	1,094,900	1,216,000
	DHA-PPQ	1,134,300	2,087,900	1,782,300	1,956,700
	ASMQ	13,500	16,500	19,600	22,700
	South-East Asia	**35,408,400**	**44,668,500**	**50,568,200**	**58,293,100**
Western Pacific	AL	1,088,800	1,253,500	1,327,200	1,322,500
	ASAQ	146,900	192,200	227,100	262,200
	ASSP	300	600	600	600
	DHA-PPQ	416,700	750,400	748,700	735,200
	ASMQ	58,600	63,600	76,800	95,000
	Western Pacific	***1,711,300***	***2,260,300***	***2,380,500***	***2,415,500***

	Total (all regions)	AL	*309,823,500*	*329,636,200*	*311,376,600*	*330,254,400*
		ASAQ	*94,962,800*	*155,454,200*	*156,389,900*	*102,796,100*
		ASSP	*964,300*	*4,301,200*	*2,848,000*	*3,647,800*
		DHA-PPQ	*1,551,000*	*2,838,300*	*2,531,000*	*2,691,900*
		ASMQ	*72,100*	*80,100*	*96,400*	*117,700*
TOTAL			***407,373,600***	***492,310,000***	***473,242,000***	***439,507,800***

TABLE 7

Artemisinin oral monotherapy demand by region and channel, 2015 – 2018

Channel	Region	2015	2016	2017	2018
Public	Africa	-	-	-	-
	Americas	-	-	-	-
	Eastern Mediterranean	-	-	-	-
	Europe	-	-	-	-
	South-East Asia	-	-	-	-
	Western Pacific	-	-	-	-
	Public Total	**-**	**-**	**-**	**-**
Formal Private	Africa	179,518	147,950	114,490	84,556
	Americas	2,006	1,888	1,326	889
	Eastern Mediterranean	37,423	30,234	19,439	12,466
	Europe	63	57	39	26
	South-East Asia	17,169	8,021	5,040	3,915
	Western Pacific	9,187	6,301	6,406	6,833
	Formal Private Total	**245,366**	**194,451**	**146,740**	**108,685**
Informal Private	Africa	478,290	402,547	325,449	248,068
	Americas	2,427	2,294	1,615	1,085
	Eastern Mediterranean	62,754	50,473	32,005	20,060
	Europe	92	82	56	37
	South-East Asia	10,554	6,934	4,860	3,808
	Western Pacific	12,368	8,702	8,147	8,194
	Informal Private Total	**566,485**	**471,032**	**372,133**	**281,251**
Total *(across channels)*	Africa	657,808	550,496	439,939	332,624
	Americas	4,433	4,182	2,940	1,974
	Eastern Mediterranean	100,177	80,707	51,445	32,525
	Europe	155	139	95	63
	South-East Asia	27,723	14,955	9,900	7,724
	Western Pacific	21,555	15,003	14,553	15,027
TOTAL		***811,851***	***665,483***	***518,873***	***389,936***

TABLE 8

QA injectable artesunate public sector procurement by region, 2015 – 2018

Region	2015	2016	2017	2018
Africa	16,638,000	23,141,500	19,715,700	18,527,900
Americas	-	-	-	-
Eastern Mediterranean	101,800	1,637,900	1,618,700	1,138,300
Europe	-	-	-	-
South-East Asia	-	-	-	-
Western Pacific	34,400	33,000	20,000	18,900
TOTAL	***16,774,200***	***24,812,500***	***21,354,400***	***19,685,200***

TABLE 9
RDT demand by channel, by region, 2015 – 2018

Channel	Region	2015	2016	2017	2018
Public	Africa	255,084,451	262,014,900	268,998,288	276,063,168
	Americas	475,104	481,194	487,199	493,125
	Eastern Mediterranean	34,672,890	35,486,596	36,317,216	37,162,459
	Europe	-	-	-	-
	South-East Asia	10,893,510	11,001,748	11,104,846	11,203,773
	Western Pacific	1,663,389	1,690,521	1,716,882	1,742,559
	Public Total	**302,789,343**	**310,674,959**	**318,624,431**	**326,665,084**
Formal Private	Africa	32,059,098	32,956,816	33,866,297	34,790,930
	Americas	74,871	75,859	76,833	77,796
	Eastern Mediterranean	8,157,565	8,321,317	8,489,600	8,661,460
	Europe	-	-	-	-
	South-East Asia	20,087,180	20,304,013	20,509,896	20,707,043
	Western Pacific	333,640	338,870	344,001	349,041
	Formal Private Total	**60,712,354**	**61,996,874**	**63,286,627**	**64,586,271**
Informal Private	Africa	36,303,748	37,304,900	38,314,394	39,334,941
	Americas	25,145	25,478	25,810	26,139
	Eastern Mediterranean	4,043,572	4,136,655	4,232,514	4,330,610
	Europe	-	-	-	-
	South-East Asia	2,288,202	2,313,740	2,339,024	2,364,005
	Western Pacific	196,755	199,980	203,175	206,338
	Informal Private Total	**42,857,423**	**43,980,753**	**45,114,917**	**46,262,034**

Total *(across channels)*	Africa	323,447,297	322,276,616	341,178,979	350,189,039
	Americas	575,120	582,530	589,842	597,061
	Eastern Mediterranean	46,874,027	47,944,568	49,039,330	50,154,530
	Europe	-	-	-	-
	South-East Asia	33,268,892	33,619,501	33,953,766	34,274,821
	Western Pacific	2,193,784	2,229,372	2,264,059	2,297,937
Total		***406,359,120***	***416,652,586***	***427,025,975***	***437,513,389***

TABLE 10

RDT procurement by channel, by region, 2015 – 2018

Channel	Region	2015	2016	2017	2018
Public	Africa	160,981,900	247,610,700	235,994,500	189,665,100
	Americas	1,626,900	4,073,900	4,717,500	4,738,000
	Eastern Mediterranean	3,536,900	8,184,500	7,703,400	6,000,200
	Europe	71,600	187,400	228,500	253,700
	South-East Asia	5,690,600	6,651,800	7,273,000	6,422,400
	Western Pacific	5,615,000	11,300,200	10,956,600	8,787,200
	Public Total	**177,523,000**	**278,008,600**	**266,873,500**	**215,866,500**
Private	Africa	53,766,800	55,247,900	56,744,100	58,260,000
	Americas	7,518,900	7,696,900	7,874,600	8,053,100
	Eastern Mediterranean	13,530,100	13,825,800	14,129,200	14,438,700
	Europe	4,219,400	4,322,900	4,427,600	4,533,600
	South-East Asia	20,444,200	20,680,100	20,905,400	21,122,400
	Western Pacific	4,090,300	4,204,100	4,320,800	4,440,400
	Private Total	**103,569,800**	**105,977,600**	**108,401,500**	**110,848,300**
Total	Africa	214,748,700	302,858,600	292,738,600	247,925,100
	Americas	9,145,800	11,770,800	12,592,100	12,791,100
	Eastern Mediterranean	17,067,000	22,010,300	21,832,600	20,438,900
	Europe	4,291,000	4,510,300	4,656,100	4,787,300
	South-East Asia	26,134,800	27,331,900	28,178,400	27,544,800
	Western Pacific	9,705,300	15,504,300	15,277,400	13,227,600
TOTAL		***281,092,700***	***383,986,200***	***375,275,000***	***326,714,800***

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