



# DMPA IM Demand Forecasting: **Methodologies and Results**

# Introduction

Depot medroxyprogesterone acetate (DMPA) is a progestin-only injectable that provides three months of contraceptive protection. DMPA-IM is an intramuscular formulation of DMPA that is supplied through a mix of donor-funded and social marketing organization (SMO) procurement and, in some countries, government tenders.

There is a growing desire in the reproductive health community to better understand the global demand for DMPA IM as well as the ability of the market to fulfill additional future demand. Demand forecasts can be particularly useful for manufacturers, as increased visibility into future demand can inform key decisions. With this visibility, manufacturers may decide whether to invest in manufacturing capacity or international quality assurance processes, or to enter new markets. Demand forecasting may also inform the allocation of resources by donors and governments, or serve to highlight mismatches between supply and demand in a market. As such, demand forecasts were developed by two separate initiatives allow for a range of estimates and greater confidence in results.

The Coordinated Supply Planning (CSP) group of the Reproductive Health Supplies Coalition (RHSC) was formed in 2012 to improve supply chain coordination for family planning commodities among two key procurers, the United States Agency for International Development (USAID) and the United Nations Population Fund (UNFPA).<sup>1</sup> As part of these efforts, the CSP group developed demand forecasts to support contract negotiations, advocacy for commodity funding, and market-shaping discussions as well as production planning by suppliers. The CSP forecasts were meant to be dynamic and allow for annual updates as new data became available.

In January 2015, another forecasting initiative was undertaken by the William Davidson Institute (WDI), an independent nonprofit research and educational organization at the University of Michigan. WDI was contracted by the Concept Foundation to develop a global demand forecast for DMPA IM to better understand its current and future global market prospects, primarily in LICs and MICs, and to determine manufacturers' ability and capacity to meet demand over time. This project was supported by the Bill & Melinda Gates Foundation as part of a larger effort by the Concept Foundation to support manufacturers of generic DMPA IM.

While both initiatives used the same baseline data, the methodologies developed by each group differed. The CSP group explored multiple forecast scenarios using different data sources (consumption, historical shipments, and country quantification reports) including, for select scenarios, growth rates based on historical shipment data. By contrast, WDI developed growth rates for injectables use based on demographic data, applied these trends to historical demand data, and performed a scenario analysis to create a forecast range.

In July 2015, the two forecasting initiatives met to compare the data sources and methodologies used to develop each forecast.<sup>2</sup> The two groups agreed to collaborate to improve the baseline historical demand data, which could then be used by both. This alignment enabled a clear comparison between the methodologies and the results of each forecasting exercise. Both forecasts were shared during the RHSC Procurers and Manufacturers Summit in August 2015, providing stakeholders with visibility into future DMPA IM demand and an opportunity to discuss their feedback.

<sup>1</sup> The CSP group includes representatives from UNFPA, USAID, Clinton Health Access Initiative, John Snow, Inc. through the Implants Access Program and USAID | DELIVER PROJECT, and the RHSC.

<sup>2</sup> The need for coordination in forecasting was discovered during a DMPA Advisory Group meeting of the RHSC, at which it was determined that the Coalition should provide the neutral forum for the two initiatives to discuss their data and methodologies.

# Overview and data sources

Both the CSP and WDI DMPA IM demand forecasts cover the period 2014–2020 and were based on country-specific historical demand data from the public sector, the subsidized private sector, and select manufacturers of DMPA IM (Exhibit 1). The forecasts include 100 countries<sup>3</sup> for which historical demand data and demographic data were available.

<sup>3</sup> Historical shipment data from 100 LICs and MICs was collected to inform the baseline for both the WDI/Concept Foundation and CSP DMPA IM forecast. Additionally, shipments to Denmark and the UK were included under the assumption that these volumes were to procurer (i.e. UNFPA and SMOs) warehouses. Although these volumes were shipped to countries that were not considered low- or middle-income, the end shipment destination of these volumes would likely be to LICs and MICs. As a result, volumes from Denmark and the UK were included in the historical shipment totals. Because the WDI/Concept Foundation DMPA IM forecast required both historical shipment and demographic data, 96 of the 100 countries were included in final forecast projections and excluded countries where both data sources were not available (Fiji, Mongolia, Papua New Guinea, and Solomon Islands). The CSP DMPA IM forecast relied on all historical shipment data from 100 countries and includes shipments to procurer warehouses. Although there is a slight inconsistency in the total market based on the four missing countries, CSP and WDI determined the difference would not greatly affect the final figures. See Annex for list of countries included in DMPA IM demand forecast.

The public-sector data used included historical shipments procured by USAID and UNFPA, as reported to the Reproductive Health Interchange (RHI). Data from the subsidized private sector included historical shipments procured by SMOs and reported in the RHI, sales data reported by various SMOs to DKT International, and disbursement data (i.e., volumes distributed to end users) shared by Marie Stopes International (MSI).<sup>4</sup> Concept Foundation shared historical shipment data from three manufacturers of generic DMPA IM which are members of the Generic Manufacturers Caucus for Reproductive Health (GEMS Caucus).<sup>5</sup> WDI and the CSP group then collaborated with select SMOs to mitigate the risk of double-counting.

<sup>4</sup> RHInterchange Home - MyAccessRH [Internet]. [cited 2015 Oct 24]. Available from: <https://www.myaccessrh.org/rhi-home>; DKT International | Contraceptive Social Marketing Statistics | DKT International [Internet]. [cited 2015 Jul 28]. Available from: <http://www.dktinternational.org/publications-resources/contraceptive-social-marketing-statistics/>.

<sup>5</sup> These manufacturers included: Jai Pharma Ltd. (formerly Famy Care, Ltd.), Helm AG, and PT. Tunggal Idaman Abdi.

## Exhibit 1: Historical demand data sources<sup>6</sup>

Entity	Type	Source	Year(s)	Notes
UNFPA	Shipments	RHI	2010–2014	
USAID	Shipments	RHI	2010–2014	
MSI	Disbursements	Direct	2011–2014	Includes volumes not reported to DKT
DKT, IPPF (International Planned Parenthood Federation), other SMOs	Disbursements	Website	2010–2013	Includes all SMO sales; excludes UNFPA and USAID-funded volumes
GEMS manufacturers	Shipments	Concept Foundation	2010–2013	

<sup>6</sup> Disbursement includes both sales and distribution volumes. Shipments to Denmark and the UK were included under the assumption that these volumes were to procurer (i.e. UNFPA and SMOs) warehouses and their end shipment destination would likely be to LICs and MICs.

# Methodology and Results

## WDI/Concept Foundation

To estimate future growth in DMPA IM shipment volumes, WDI’s model used demographic data to project growth in the number of women using injectables. For countries with both historical shipment and demographic data (96 of the 100 countries), the total number of women using injectables was calculated by multiplying three key market factors for each country and each year:

1. Number of women of reproductive age (WRA).
2. Contraceptive prevalence rate (CPR)—the percentage of those WRA who use contraception.
3. Injectables method share—the percentage of those contraceptive users who use injectables.

Country-specific estimates of the historical and projected population of WRA are published by the United Nations, Department of Economic and Social Affairs, Population Division (UNPD). For CPR and injectables method share, the WDI team gathered country-specific data through

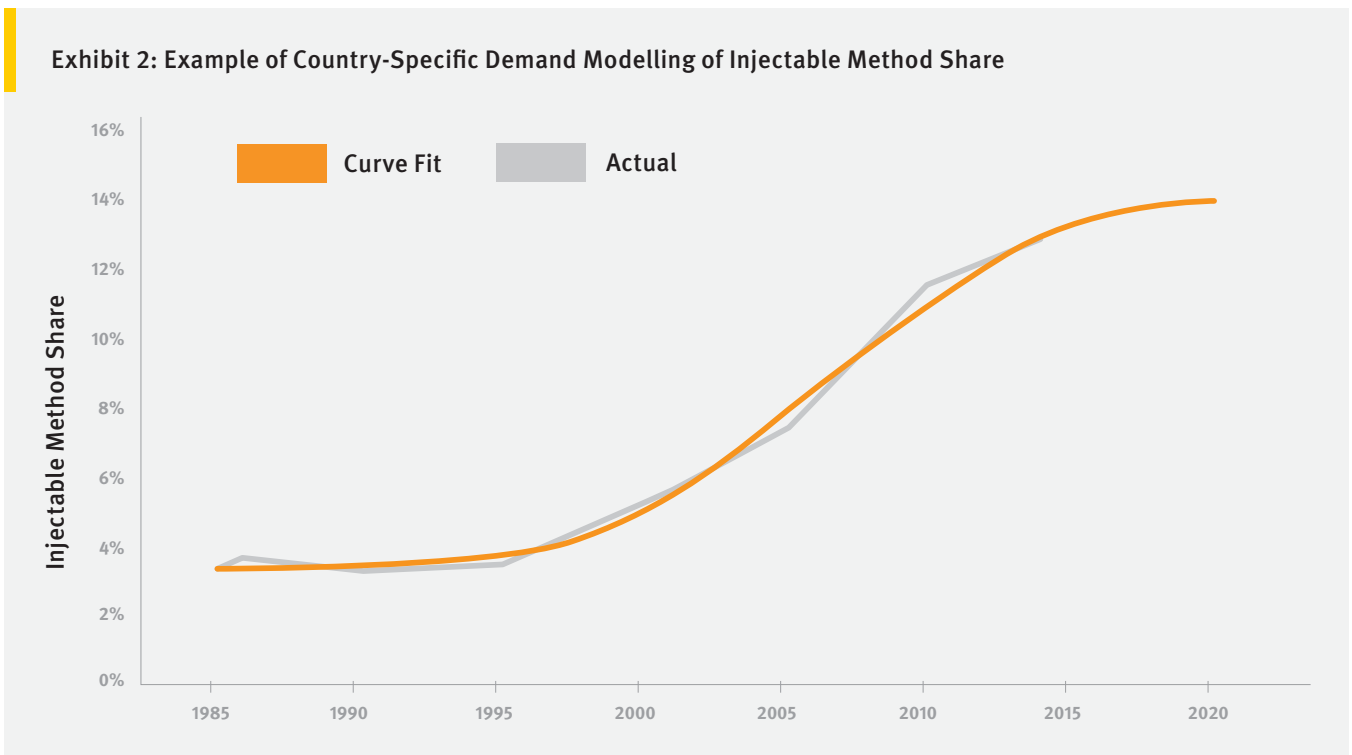
Demographic and Health Survey Program (DHS) surveys, Performance Monitoring and Accountability 2020 (PMA2020) reports, and other recent national surveys reported in Bertrand et al., 2014.<sup>7</sup>

Demographic data on method mix were sparse for many countries, with only 19 countries having five or more data points over time. To overcome this limitation, WDI estimated missing data points through linear interpolation and by aggregating by UN geographic region those countries with four or fewer data points. Historical demographic data on method share and CPR were then fit to a model<sup>8</sup> to estimate

7 The DHS Program: Demographic and Health Surveys. STATcompiler [Internet]. [cited 2015 Jul 28]. Available from: <http://www.statcompiler.com/>; Performance Monitoring and Accountability 2020 [Internet]. [cited 2015 Jul 28]. Available from: <http://www.pma2020.org/>; Bertrand JT, Sullivan TM, Knowles EA, Zeeshan MF, Shelton JD. Contraceptive method skew and shifts in method mix in low- and middle-income countries. *Int Perspect Sex Reprod Health* [Internet]. 2014 [cited 2014 Oct 29]. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/25271650>.

8 The model used a logistic equation to create a “line” of best fit

Exhibit 2: Example of Country-Specific Demand Modelling of Injectable Method Share



the projected method share and CPR for each country or region each year through 2020 (Exhibit 2).

The projected CPR, method share, and population of WRA were then multiplied for each country<sup>9</sup> each year to arrive at the number of women using injectables. For each country or region, the year-over-year growth rate in the number of women using injectables was calculated and then applied to aggregated historical demand data to create a DMPA IM demand forecast out to 2020.

Given the inherent uncertainty in projecting future demand, WDI performed a scenario analysis that illustrated the impact of potential changes to the three key market factors: country-specific population of WRA, CPR, and injectable method share. Each factor was varied by plus or minus 5 percent or 10 percent, and scenarios were created for the full factorial of

through the historical data. Such logistic equations are often chosen to model data in which a natural s-shaped curve is observed or expected over time.

<sup>9</sup> When country specific data is not available regional data was used as a proxy.

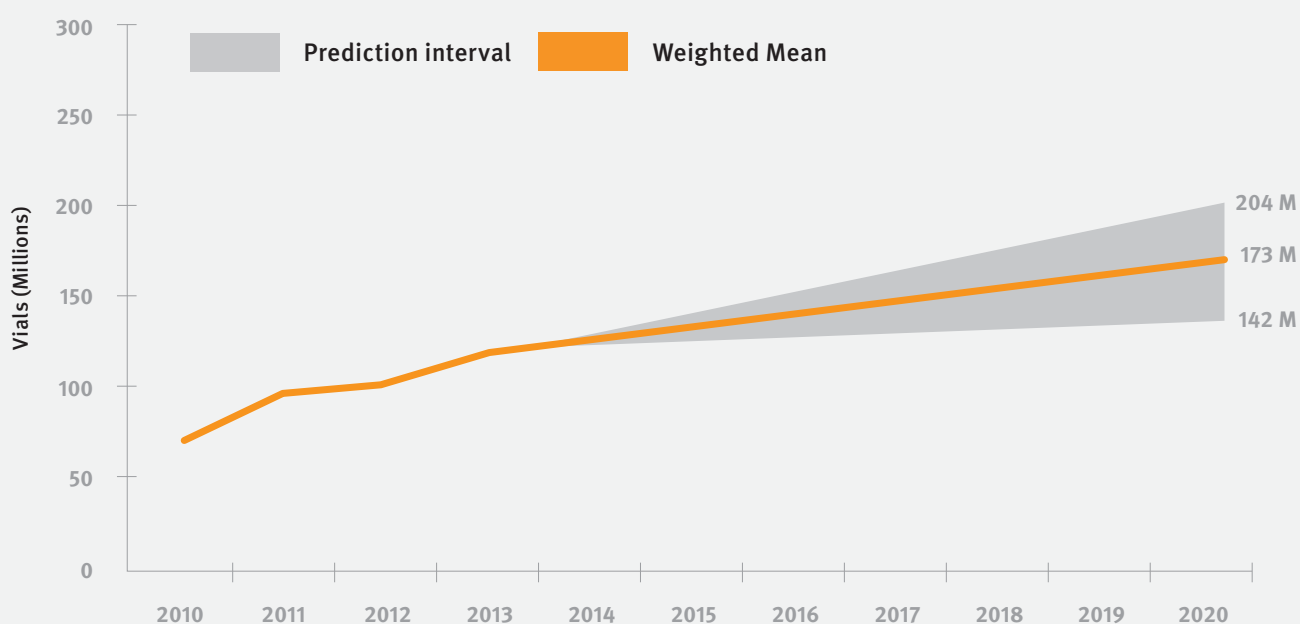
combinations of these changes (n=125). Scenarios were then weighted in terms of probability of occurrence<sup>10</sup> and the weighted mean estimate for each year across all scenarios was calculated. A prediction interval (PI)<sup>11</sup> based on the weighted mean estimate and the weighted standard deviation of all scenarios for each year was then calculated to illustrate a potential range within which the forecast estimate will likely fall with a 95 percent probability.

The final WDI/Concept Foundation estimates of forecasted DMPA IM demand are shown in Exhibit 3. Demand is forecasted to reach 173 million units by 2020, with a 95 percent PI of 142 million units to 204 million units.

<sup>10</sup> The probability of occurrence assumes that the existing estimates were the most likely scenario and that any change in the variables was less likely (i.e., the probability of all three variables changing by 10 percent is less than the probability of one or two variables changing by 10 percent). In this way, the range of the forecast was narrowed to capture the scenarios most likely to occur.

<sup>11</sup> Prediction interval is an estimate of an interval in which the future observations of demand will fall with a certain probability.

**Exhibit 3: WDI/Concept Foundation DMPA IM Demand Forecast Results (Millions of Vials)**



	2015	2016	2017	2018	2019	2020
Upper 95% PI	143.7	155.6	167.6	179.6	191.6	203.6
Weighted mean	133.8	141.3	148.9	156.7	164.6	172.6
Lower 95% PI	123.9	127.0	130.4	133.9	137.7	141.6

## CSP

The CSP group estimates DMPA IM demand by aggregating country-specific forecasts among a subset of 29 countries with available data and extrapolating the results to the broader market.<sup>12</sup> The CSP group produces three forecast scenarios. Two scenarios, historical shipment and consumption-based forecast scenarios, are used as inputs into a third 'blended' scenario.

To develop the historical shipment and consumption-based forecasts among 100 countries, a subset of 29 focal countries were first selected. The focal countries included 1) countries that account for approximately 80 percent of historical demand for DMPA IM between 2012 and 2013 and 2) countries with more than 40 million women of reproductive age.<sup>13</sup> For each of these two scenario forecasts, the projected demand from the 29 focal countries is aggregated, and these results are then extrapolated to the broader market of 100 countries.

For the blended forecast, the CSP group determined the best of the historical shipment, consumption-based, or country quantification report scenarios for each of the 100 countries based on the quality and availability of data.

The following sections outline the methodologies for each of the three scenarios used by the CSP group:

<sup>12</sup> The historical 2013 share of the total market was estimated using the 2013 DMPA IM demand data by country described in Exhibit 1.

<sup>13</sup> Although India had a WRA population greater than 40 million, it was excluded as a focal country due to limited data visibility; United Nations Population Division Department of Economic and Social Affairs. World Population 2012 [Internet]. [cited 2016 Jan 12]. Available from: <http://www.un.org/en/development/desa/population/publications/trends/wpp2012.shtml>.

- › Scenario 1 - Historical shipment forecast
- › Scenario 2 - Consumption-based forecast
- › Scenario 3 - Blended forecast

### Historical Shipment Forecast

DMPA IM demand is forecasted from 2014 through 2020 using a simple linear extrapolation of historical shipment data by country from 2011 through 2013. The data sources for the historical shipment forecast scenario are the same as for the WDI/Concept Foundation forecast described above. This scenario is used primarily as an input to the blended forecast, and therefore it is not shown on the graphs below.

### Consumption-Based Forecast

The consumption-based forecast relied primarily on data from 1) the Procurement Planning and Monitoring Report (PPMR), a database<sup>14</sup> containing monthly data from countries on consumption and desired stock levels and 2) various sources of historical demand data used to develop aggregate growth rates and estimate historical DMPA IM market share.

Average monthly consumption (AMC) of DMPA IM in the 29 focal countries was forecasted using aggregate growth rates based on supplier-reported historical shipments or other market intelligence.<sup>15</sup> Annual injectable shipments were then estimated by multiplying forecasted AMC with a country's

<sup>14</sup> Procurement Planning and Monitoring Reports [Internet]. [cited 2016 Jan 12]. Available from: <http://ppmr.rhsupplies.org/content?id=1>.

<sup>15</sup> Categories of growth will be described in the "Growth Rates" section.

#### Exhibit 4: CSP Focal Countries (N=29)

Afghanistan	El Salvador	Kenya	Nigeria	Tanzania
Bangladesh	Ethiopia	Madagascar	Pakistan	Uganda
Burkina Faso	Ghana	Malawi	Papua New Guinea	Yemen, Rep.
Cameroon	Guatemala	Mali	Philippines	Zambia
Congo Dem Rep	Haiti	Mozambique	Rwanda	Zimbabwe
Ecuador	Indonesia	Myanmar	Senegal	

maximum desired months of stock.<sup>16</sup> This methodology assumes that countries estimate annual demand at the beginning of the year based on projected annual consumption levels and that they procure additional quantities to account for buffer stock. Finally, the proportion of injectable demand accounted for by DMPA IM was estimated based on historical RHI data or, if additional market intelligence was available, by manually defining market shares.

## Growth Rates

Consumption was forecasted for each of the 29 focal countries by assigning them to one of three aggregate growth categories (low, medium, and high)<sup>17</sup> based on the historical growth of injectable shipments.<sup>18</sup> If additional market intelligence suggested higher or lower growth trends in the future, growth rates for individual countries could be adjusted manually.

The three aggregate growth categories were developed based on historical shipments to FP2020's 69 countries.<sup>19</sup> First, baseline 2014 growth rates were developed for each growth category using historical supplier-reported shipment data<sup>20</sup> from 2011 to 2013.<sup>21</sup> Next, because injectable demand

cannot be expected to grow at the same baseline rate year-over-year, growth rate changes in over time were forecasted. The CSP group modeled subsequent year-over-year changes in growth based on the implied year-over-year changes in growth associated with a fitted logarithmic trend of annual injectable shipments from 2009 through 2011.<sup>22</sup> The same change in growth rates was applied across all levels of growth.

## Blended Forecast

The blended forecast selects the best available forecast scenario for each country. The scenarios were prioritized based on the following ranking:

1. Consumption-based forecast – see methodology above.
2. Historical shipment forecast – see methodology above.
3. Country quantification report – Where available, CSP consulted reports from MOH-led quantification exercises held in country. When these included relevant information on forecasted consumption or MOH-endorsed supply plans, forecasted annual demand for DMPA IM was recorded for the years available.

CSP members reviewed the available forecast scenarios and selected the best ones (or other market intelligence) for each of the 100 countries, when available. Because not all countries had an available DMPA IM forecast, the CSP group estimated DMPA IM demand among the 100 countries by aggregating available country-specific forecasts and extrapolating the results to the broader market.

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16 The average desired months of stock is approximately 14 months across countries reporting data on injectables to the PPMR.

17 Aggregate growth rates were developed because individual country demand exhibited significant fluctuations year-over-year. Country-specific growth rates were calculated and selected. Based on selected country-specific growth rates, countries were assigned a category of low, medium, and high based on their position in the distribution of growth rates across all countries.

18 First, growth rates were estimated for each country using the available data and selected based on the best available estimate, as determined by the number of years of data available. A three-, two-, and one-year compounded annual growth rate (CAGR) and average annual growth rate (AAGR) were estimated by country depending on the data available. Selected country growth rate prioritized a longer period of time and the CAGR over the AAGR. Outlier growth rates that were less than -50 percent or greater than 150 percent were excluded. Next, each country was ranked as low, medium, or high based on the percentile distribution of selected country growth rates. Countries with selected growth rates that were in the bottom third of the growth rate distribution were identified as "low" growth, the middle third were "medium" growth, and the top third were "high" growth.

19 FP2020's 69 focus countries are defined as countries with a 2010 gross national per capita annual income (GNI) less than or equal to US\$2,500. Although South Africa made an FP2020 commitment, its GNI was greater than US\$2,500 per year.

20 Clinton Health Access Initiative. Family Planning Market Report [Internet]. [cited 2015 Jul 28]. Available from: <http://www.clintonhealthaccess.org/content/uploads/2016/03/CHAI-FP-Market-Report.pdf>

21 Historical injectable shipments were aggregated by growth category. For example, injectable shipments associated with countries

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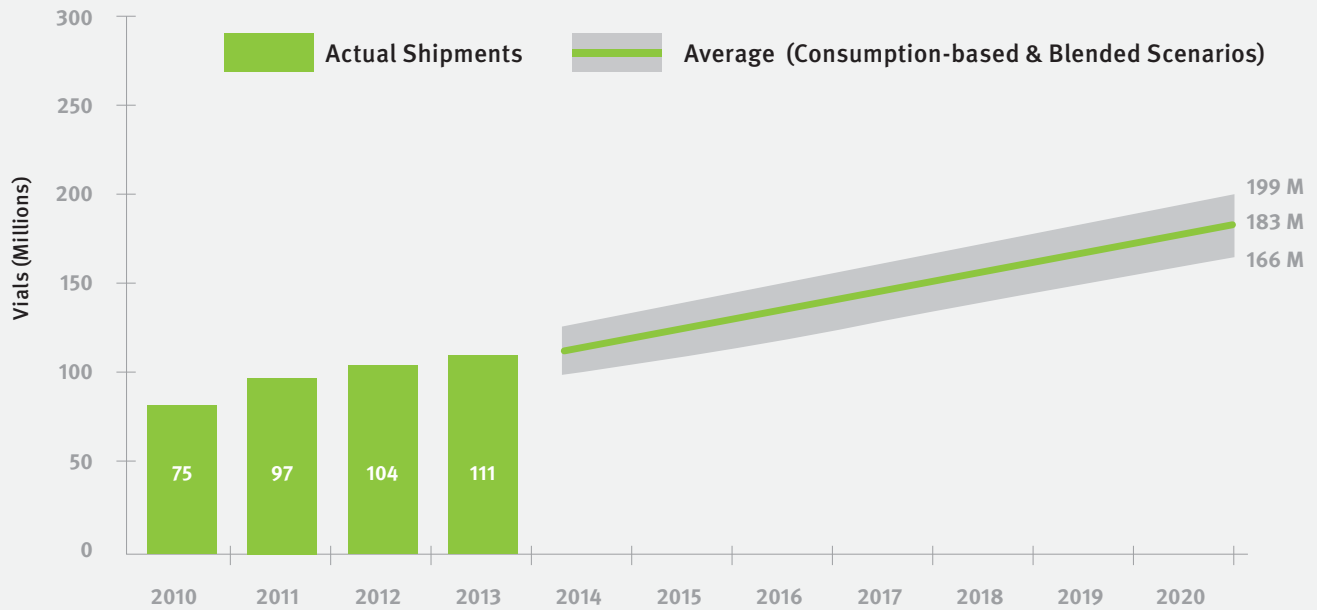
assigned as "low" growth category were aggregated together. In addition, shipments were aggregated across the FP2020 69 countries for the "overall" growth rate. After aggregating historical shipment volumes by growth rate category, three-, two-, and one-year CAGRs and AAGRs were estimated by growth rate category. Upon review, a set of growth rates were selected. During this iteration, the two-year AAGR for each category of growth was selected.

22 RHI data was used because it captured a longer time horizon relative to supplier-reported shipment data, which was only available for 3 years.

## Forecast Results

The CSP forecast expects the demand of DMPA IM to increase from 166–199 million vials by 2020 (Exhibit 5).

Exhibit 5: CSP DMPA IM Demand Forecast (Millions of Vials)



Scenario	2015	2016	2017	2018	2019	2020
Blended	131.8	143.6	156.3	169.7	183.9	198.8
Consumption-based	112.0	121.1	131.3	142.2	153.9	166.3
Average	121.9	132.3	143.8	156.0	168.9	182.5

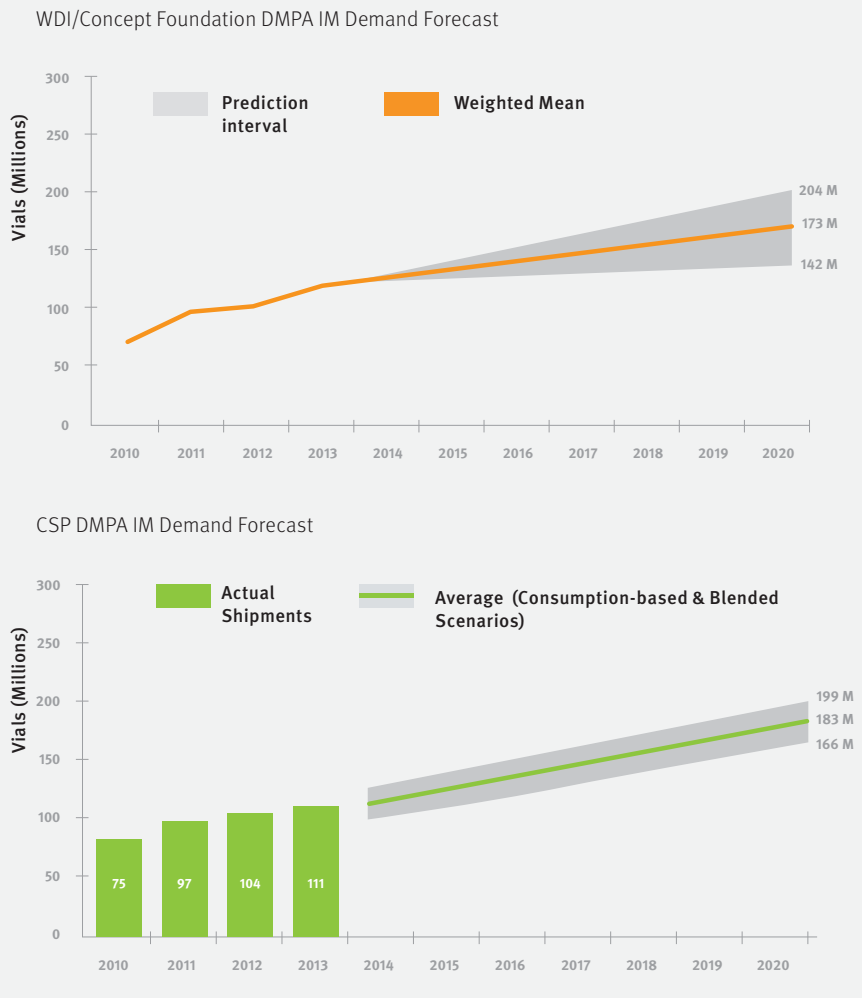


# Conclusion

Although these organizations took different approaches to estimating growth rates, the results are similar. Confidence is enhanced by two distinct approaches coming to the same conclusion. Moving forward, the CSP group will work to refine and update DMPA IM demand forecasts and may adopt aspects of the WDI/Concept Foundation methodology<sup>23</sup>

<sup>23</sup> While refinements may be ongoing, the frequency of forecast updates is contingent upon the availability of updated historical demand data.

**Exhibit 6: Comparison of CSP and WDI/Concept Foundation DMPA IM Demand Forecast**



Members of both initiatives are grateful to all individuals who contributed data and insights throughout the development of these forecasts. Additional support from existing partners and other stakeholders, particularly in the form of data and information sharing, will further improve future demand forecasts and better inform key decisions that impact contraceptive access.

The CSP group would like to specifically acknowledge and thank Ashley Nguyen from CHAI for her work as the technical lead on development and refinement of the CSP forecast methodology and outputs.

For questions about the CSP forecast, please contact Alexis Heaton (alexis\_heaton@jsi.com). For questions about the WDI/Concept Foundation forecast, please contact Mike Krautmann (mpkrautm@umich.edu) or Leslie Arney (lesarney@umich.edu).

# Annex

Historical shipment data from 100 LICs and MICs was collected to inform the baseline for both the WDI/Concept Foundation and CSP DMPA IM forecast. Additionally, shipments to Denmark and the UK were included under the assumption that these volumes were sent to procurer (i.e. UNFPA and SMOs) warehouses. Although these volumes were shipped to countries that were not considered low- or middle-income, the end shipment destination of these volumes would likely be to LICs and MICs. As a result, volumes from Denmark and the UK were included in the historical shipment totals.

Because the WDI/Concept Foundation DMPA IM forecast required both historical shipment and demographic data, 96 of the 100 countries were included in final forecast projections and excluded countries where both data sources were not available (Fiji, Mongolia, Papua New Guinea, and Solomon Islands). The CSP DMPA IM forecast relied on all historical shipment data from 100 countries and includes shipments to procurer warehouses. Although there is a slight inconsistency in the total market based on the four missing countries, CSP and WDI determined the difference would not greatly affect the final figures.

Afghanistan	Cote d'Ivoire	Honduras	Moldova	Solomon Islands
Albania	Congo Dem Rep	India	Mongolia	South Africa
Algeria	Djibouti	Indonesia	Mozambique	Sri Lanka
Angola	Dominican Republic	Iraq	Myanmar	St Lucia
Bangladesh	Korea Dem Rep	Jamaica	Namibia	West Bank and Gaza
Barbados	Ecuador	Jordan	Nepal	Sudan
Belize	Egypt Arab Rep	Kazakhstan	Nicaragua	Suriname
Benin	El Salvador	Kenya	Niger	Tajikistan
Bhutan	Equatorial Guinea	Kyrgyz Republic	Nigeria	Tanzania
Bolivia	Eritrea	Lao PDR	Oman	Timor-Leste
Botswana	Ethiopia	Lebanon	Pakistan	Togo
Burkina Faso	Fiji	Lesotho	Panama	Turkmenistan
Burundi	Gabon	Liberia	Papua New Guinea	Uganda
Cabo Verde	Gambia	Macedonia FYR	Paraguay	Ukraine
Cambodia	Ghana	Madagascar	Philippines	Uzbekistan
Cameroon	Guatemala	Malawi	Congo Rep	Venezuela RB
Central African Republic	Guinea	Maldives	Rwanda	Vietnam
Chad	Guinea-Bissau	Mali	Sao Tome and Principe	Yemen Rep
Colombia	Guyana	Mauritania	Senegal	Zambia
Costa Rica	Haiti	Mexico	Sierra Leone	Zimbabwe



## The Reproductive Health Supplies Coalition

The Coalition is a global partnership of public, private, and non-governmental organizations dedicated to ensuring that everyone in low- and middle-income countries can access and use affordable, high-quality supplies for their better reproductive health. It brings together agencies and groups with critical roles in providing contraceptives and other reproductive health supplies. These include multilateral and bilateral organizations, private foundations, governments, civil society, and private sector representatives.