



**USAID**  
FROM THE AMERICAN PEOPLE

# DELIVER PROJECT

## Using Inventory Turnover to Assess Supply Chain Performance



USAID | DELIVER PROJECT 2012

Secretary Javid Akhtar, Population Welfare Department, Government of Punjab, speaks about the importance of the logistics management information system and data visibility.

**"It is of paramount importance that all stakeholders (PWD, DOH, LHW) from all districts of Pakistan start reporting through the Logistics Management Information System (LMIS), enabling better contraceptive logistics and procurement planning."**

—Mr. Javid Akhtar, Secretary, Population Welfare Department, Government of Punjab

### APRIL 2013

This publication was produced for review by the U.S. Agency for International Development. It was prepared by the USAID | DELIVER PROJECT, Task Order 4.

U.S. Agency for International Development  
[www.usaid.gov](http://www.usaid.gov)

In Pakistan, a new web-based logistics management information system (LMIS) is improving visibility into the country's public health supply chain. The system gives stakeholders the information they need to respond effectively to client demand for contraceptives.

To measure the performance of the new system, the USAID | DELIVER PROJECT compared inventory turnover ratios—an industry measure of supply chain efficiency—in districts that use a web-based LMIS with ratios in districts that use the traditional paper-based system.

An inventory turnover ratio measures the number of units dispensed in relation to the average unit inventory. A higher turnover ratio, together with desired inventory availability, demonstrates the effective use of resources for distribution of products throughout the supply chain.

With the goal of improving public health through health system strengthening, the USAID | DELIVER PROJECT has provided support for information systems and warehousing since 2009, in partnership with the Government of Pakistan (GoP) and the USAID Mission in Pakistan.

Project interventions, such as the introduction of the web-based LMIS, are designed to improve the availability of supplies, which can be achieved, in part, by modernizing supply chain management systems to make necessary information available to those who need it. The new LMIS system was rolled out to 19 districts in July 2011 and will be expanded to all 143 districts during the next year.

Visibility provided by a web-based LMIS informs stakeholders and facilitates forecasting, more accurate quantification, procurement planning, budgeting, and the ability to respond to stockouts. Access to LMIS data at the Central Warehouse can improve stock status at lower levels as warehouse managers are able to better respond to client demand.

In Pakistan, to estimate the initial impact of this intervention, the project analyzed data for goods issued from higher levels to

lower levels in the supply chain for 2010 and 2011 and found that the web-based LMIS increases performance and efficiency into the supply chain, as measured through inventory turnover ratios.

Over the course of a year, the web-based LMIS was customized to be fully responsive to the multi-dimensional needs of a complex stakeholder environment that included both the public sector (Population Welfare Department [PWD], Department of Health [DOH], Lady Health Worker [LHW] Program) and the private sector (Population Services International/Greenstar Social Marketing, Family Planning Association of Pakistan, Marie Stopes Society).

Before launching the system, retrospective data from January 2010 to July 2011 were entered manually in the system for all districts, and the 19 participating districts received equipment and training for staff members so they could enter data into the system going forward.

Reconciled district-level data from the 124 districts not yet enrolled in the web-based LMIS are regularly collected and manually entered in the system by the provincial logistics managers. The small number of districts involved in the initial rollout makes analyzing the outputs challenging. However, since the web-based system was implemented in phases, the project was able to analyze inventory turnover in participating districts and compare it with the turnover in districts still using the paper-based system. This allowed the project to identify inventory management improvements that resulted from the intervention and to ensure improved availability of supplies.



USAID | DELIVER PROJECT 2012

Supplies at the Central Warehouse in Karachi. Increased visibility into all levels of the supply chain allows program managers to respond more effectively to stock status issues.

## Inventory Turnover Analysis

Inventory turnover ratio is a common measure of performance within supply chains. While there are various ways to calculate the ratio, the following is the most applicable in the public health supply chain context, where commodities are not sold:

$$\text{Inventory Turnover Ratio} = \frac{\text{Units dispensed during a time period}}{\text{Average unit inventory during the time period}}$$

For example, you would get an inventory turnover rate of 5 when you dispense 100 units in a certain period of time, and your average number of units in stock during that period is 20. This means that you have turned over your stock five times in this period.

The ratio allows program managers to better understand the speed with which commodities are moving through the system. Using logistics data from Pakistan, the project calculated the inventory turnover ratio on a monthly basis from quarter 1 of 2010 through quarter 3 of 2012. This analysis was conducted for male condoms, two-month injectables, three-month injectables, intra-uterine devices (IUDs), progestin-only pills, and combined oral contraceptives distributed through the PWD system.

While the supply chain in Pakistan continues to evolve as a result of decentralization, and contraceptive availability gradually increases with the efforts of the DOH, the LHW program, and the People's Primary Health Care Initiative (PPHI), the data available from the LHW and DOH programs during the 2010-2012 time period were not robust enough for this type of analysis. The inconsistencies in the data available from these various sources indicate a need to streamline requisitioning, distribution, and reporting across important stakeholders.

In situations where stock levels remain adequate to meet demand, increased inventory turnover ratios demonstrate an improving rate of return for the system and suggest that reducing the amount of buffer stock may be possible, since stock is regularly flowing through the system. These insights from inventory turnover ratios analysis will assist any system redesign to reduce buffer stock and/or overall inventory pipeline within constraints of the system such as storage capacity and availability of transportation funds.

Inventory turnover ratio benchmarks are often available for private sector industries with many actors. In the public health logistics sector, these benchmarks are not readily available. However, when comparing the inventory turnover ratio of districts where the web-based LMIS has been rolled out to those still using the paper-based LMIS, relative efficiency can be assessed by evaluating two indicators. First, districts with the web-based LMIS (“pilot districts”) would be expected to have a higher turnover ratio than districts using a paper-based system (“control districts”), as the paper-based system has less visibility to inventory levels. Second, pilot districts would be expected to show a decrease in turnover ratio variability due to more timely visibility into the actual commodity need. In this situation, commodity supply will better match actual need, whereas with the paper-based system, reduced visibility hinders the ability to match commodity need in a timely manner. However, since supply chain interventions are being implemented system-wide (nation-wide), improvements are expected in both the paper-based and web-based LMIS districts over time. One such intervention is the change in inventory policy in December 2011<sup>1</sup> from monthly to quarterly deliveries to the district warehouses, meaning these warehouses must now hold more stock (three months of stock instead of one month). As average inventory holdings rise while the amounts dispensed remain unchanged, inventory turnover at the district warehouse would be expected to decrease.

## Results

The analysis consisted of calculating the average and the variation in the monthly inventory turnover ratio per quarter for each of the commodities assessed. This was done for commodities issued from the Central Warehouse to the district level (district), as well as from the district to the facility level (facility). A comparison was then done, at both the district and facility levels, between those where the web-based LMIS was rolled out in July 2011 and those still using the paper-based system. Facility level data was aggregated to the district level, so all analysis and comparisons are confined to the district level.

During the analysis, some data quality concerns were identified. Known data issues, which affected less than 0.3 percent of the data records used, were then minimized or excluded. The following is an analysis of the average inventory turnover ratio and turnover variance for male condoms, three-month injectable contraceptives, and oral contraceptives.

### District Level Results

#### Male Condoms

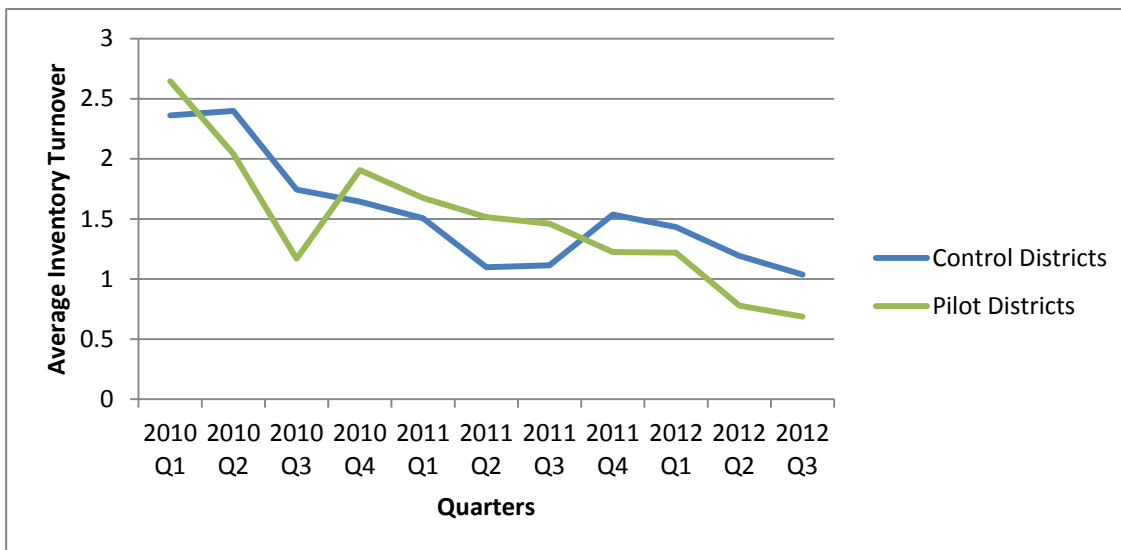
For male condoms, there is no notable difference in the average inventory turnover trend between the pilot and the control districts. The desired trend is for inventory turnover in the districts using the web-based LMIS to remain the same or to increase, as this indicates that commodities are moving through the warehouse at the same or a more rapid rate. In this case, the turnover rate decreased, resulting from the change in inventory policy from monthly to quarterly deliveries from the Province warehouses described

---

<sup>1</sup> Quarterly distribution discussed and approved in 19-20 December 2011 meeting. Notification issued regarding modified requisition(CLR-6) by P&D on April 20<sup>th</sup> 2012.

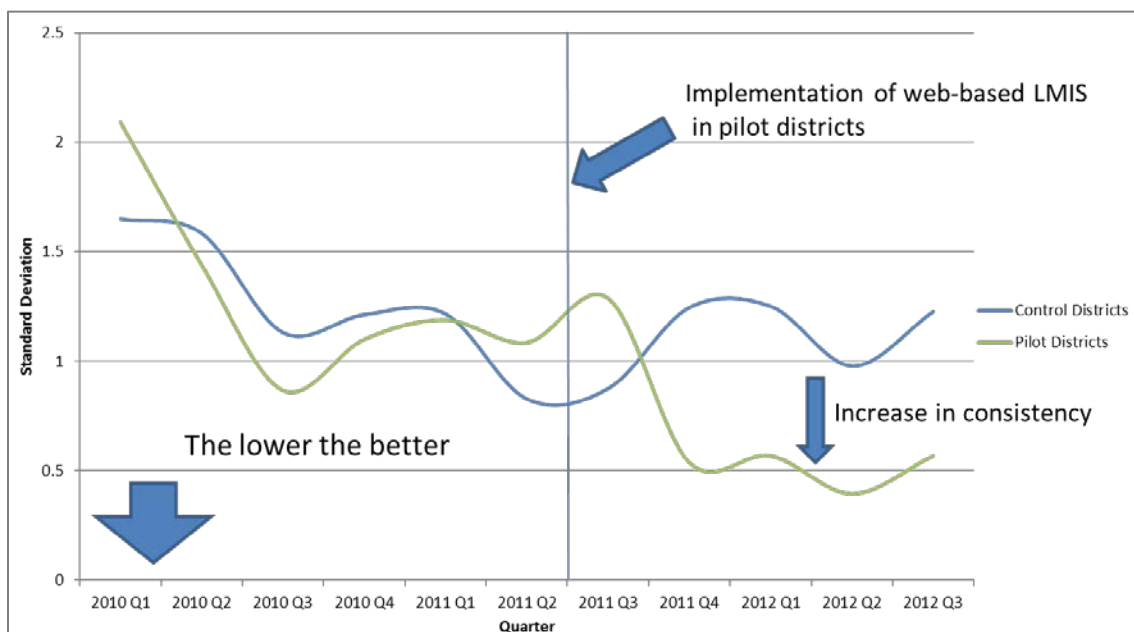
above. District warehouses are now holding more stock. Average inventory holdings have increased while the amounts dispensed remain unchanged, resulting in lower inventory turnover at district warehouses.

**Figure 1. 2010–2012 Male Condom Inventory Turnover at the District Level**



Since both the pilot and control district demonstrated a downward trend, the impact of the web-based LMIS was not seen in the average inventory turnover. However, there was an impact on the variance of the inventory turnover (measured by standard deviation). One of the key outputs of the web-based LMIS is more timely access to accurate lower-level data, which allows for orders to better match the needs of the lower-level sites. In turn, this allows stock level to equate with actual inventory movements. In other words, better access to lower-level information smooths out the peaks and troughs in stock levels showing that the system is better able to respond to demand.

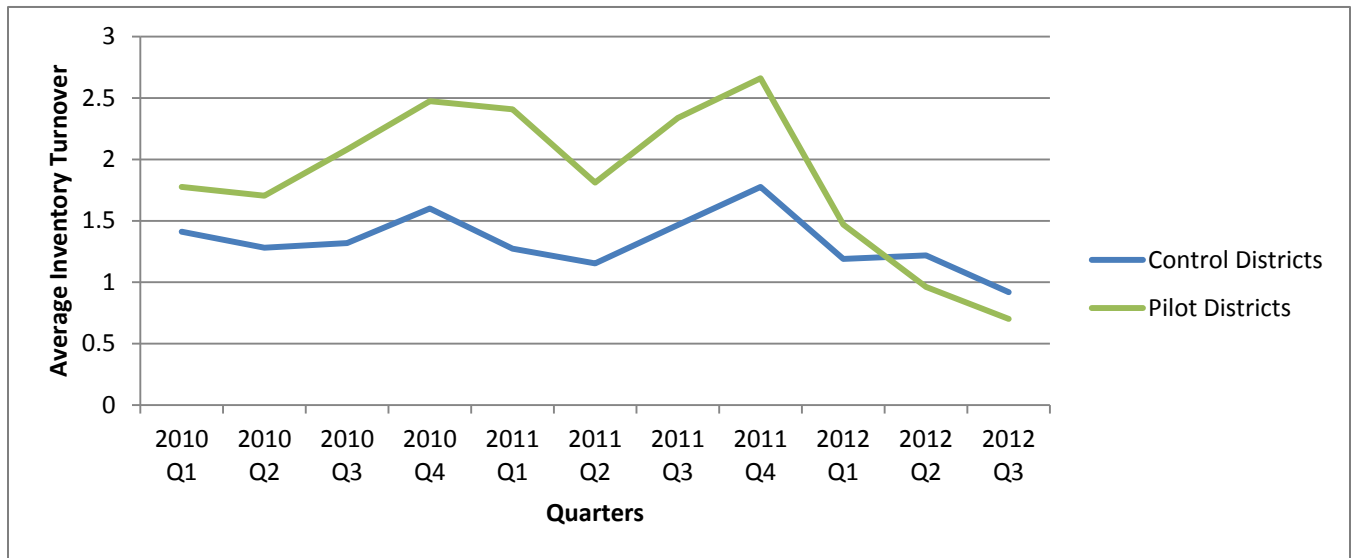
**Figure 2. Variation in Inventory Turnover at District Warehouses, Male Condoms, 2010–2012**



## Average Inventory Turnover

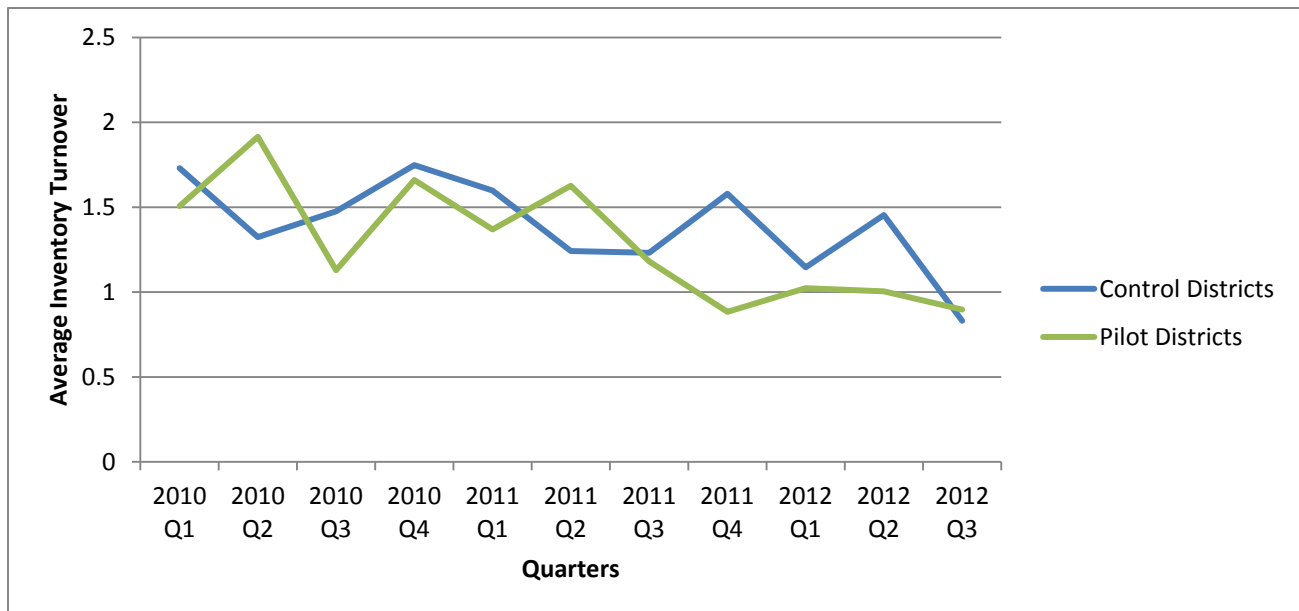
The pattern for three-month injectables shows a clear drop in inventory turnover at the beginning of 2012 which coincides with the change in inventory policy (December 2011) from one to three months of stock on hand. The inventory turnover has a rapid decline in pilot districts, as compared to the control districts, though the ability to determine the cause of this change based on the average in inventory turnover alone is limited.

**Figure 3. 2010–2012 Three-Month Injectable Inventory Turnover at the District level**



For combined oral contraceptives we find the same decreasing pattern for inventory turnover as seen in the other commodities assessed following the change in inventory policy.

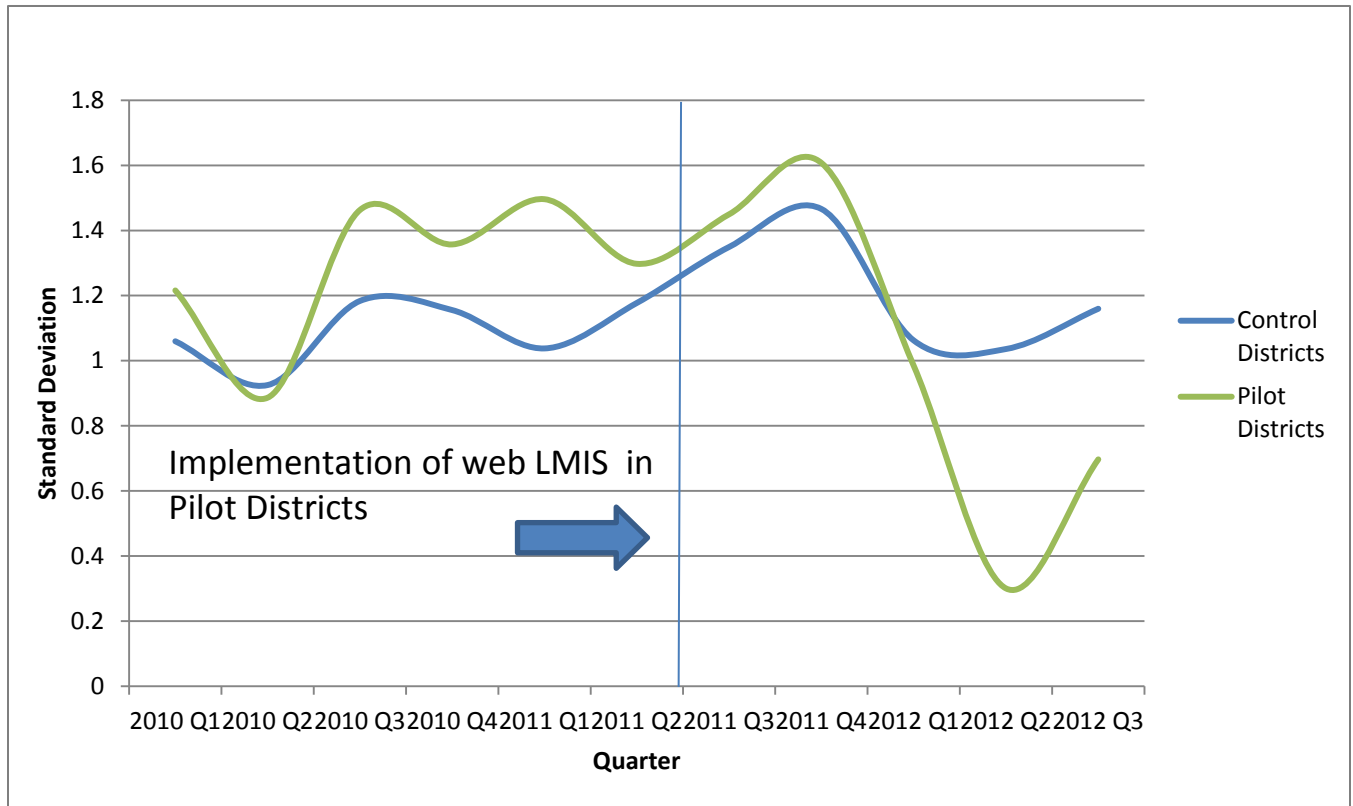
**Figure 4. 2010–2012 Combined Oral Contraceptives Inventory Turnover at the District Level**



## Variation in Inventory Turnover

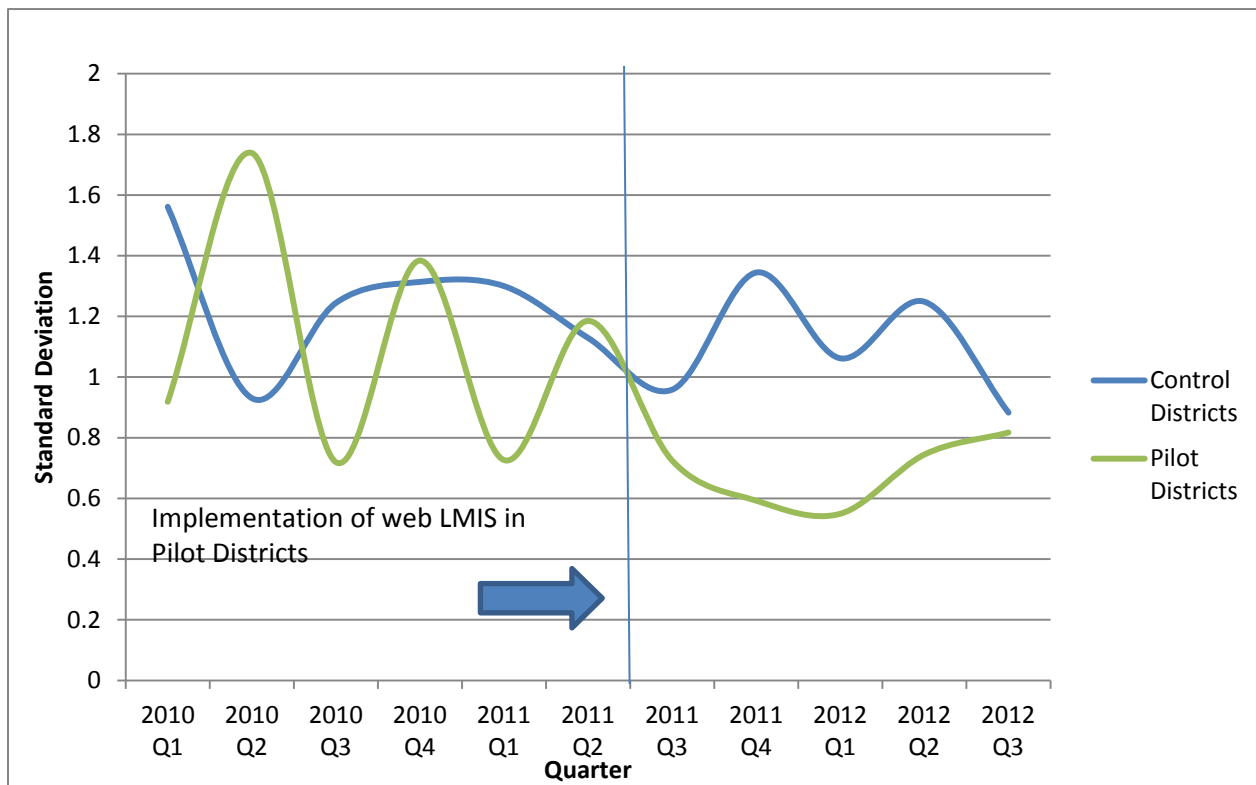
In three-month injectables, the change in variation matches the pattern seen in male condoms. Again, this is an indicator of the system being more responsive to fluctuations in demand.

**Figure 5. Variation in Inventory Turnover at District Warehouses, Three-Month Injectables, 2010-2012**



For Combined Oral Contraceptives the variation within the pilot districts also shows the same decreasing pattern as seen in the other commodities.

**Figure 6. Variation in Inventory Turnover at District Warehouses Combined Oral Contraceptives, 2010-2012**

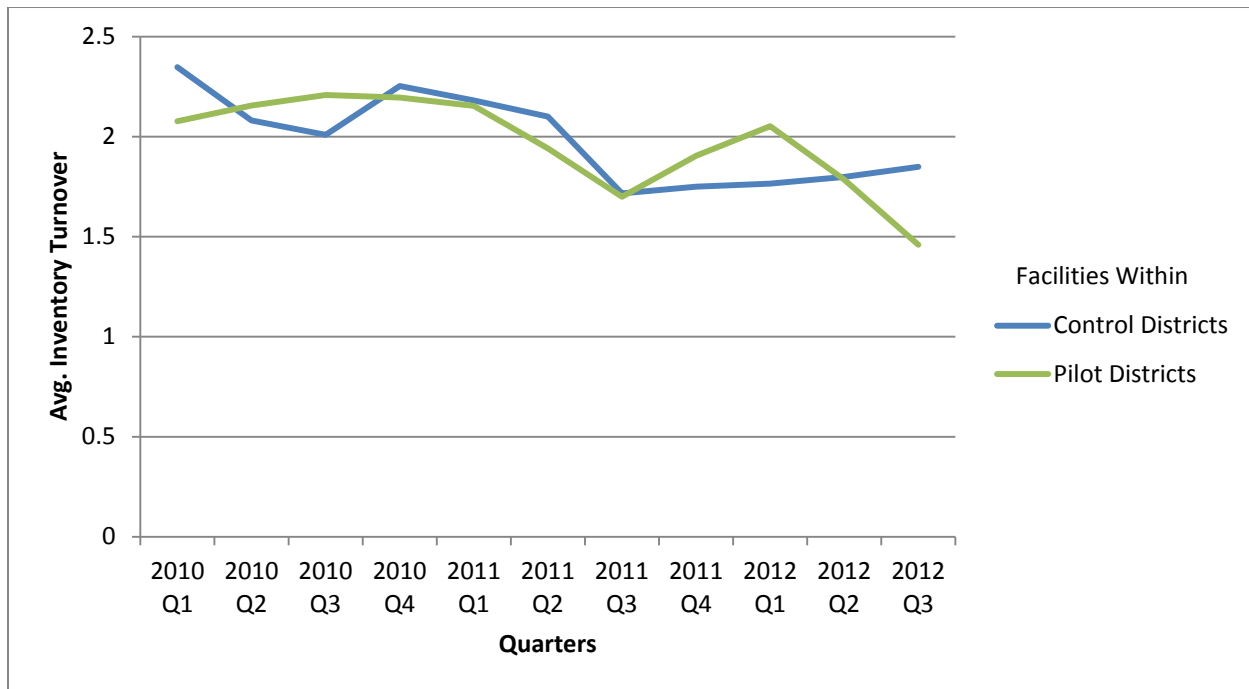


### Facility Level Results

Facility level data is only available aggregated at the district level not at individual facility level which limits the possible analysis and interpretation. In general, the average inventory turnover has either remained the same or decreased. For example, average inventory turnover for male condoms decreased from 2.25 to 1.75. There are 2 possible causes for an inventory turnover decrease—decrease in issuances, or maintaining issuance levels while increasing stock on hand. For male condoms the issuances has shown a trend of increasing on average from 85,000 to 125,000 units per district. If we assume the increase in issuances is true, the decrease in inventory turnover cannot be the result of a reduction in dispensed inventory. Thus the facilities are both increasing dispensed to clients as well as increasing stock on hand. This indicates that the system is responding to the signal to increase stock on hand as a result of increased client demand. However, proving this particular hypothesis would require greater disaggregated data at the facility level.



**Figure 7. Avg. Inventory Turnover and Issuances at Facility Level, Male Condoms, 2010-2012**



In general, other commodities analyzed had similar inventory turnover patterns. The only difference was that issuances were increasing, except for combined oral contraceptives in the pilot districts, which showed a decrease. For three-month injectables in the pilot districts, it remained constant. In these cases, further analysis is needed to determine what is occurring.

## Conclusion

Analyzing the inventory turnover indicator in Pakistan has provided decisionmakers with insight into the impact of changes they are making both in terms of policy (changing from 1 month to 3 month distribution) as well as implementation of improved information systems (web-based LMIS).

Use of supply chain performance indicators can demonstrate improved availability of family planning commodities in the public sector supply chain. Using this indicator we are able to show—

- decreasing trend in average inventory turnover at district warehouses due to the change in policy from monthly to quarterly deliveries from central warehouse to the districts
- reduced variability in inventory turnover in web-based LMIS pilot districts resulting from more timely access to accurate data from the districts
- increasing issuances and stock at the field level indicating that system is robust and is responding to increased demand for commodity.

The availability of timely and reliable information from the web-based LMIS enables decisionmakers to see the impact of interventions on performance and to target future interventions to better meet client needs, by making critical health products available where and when they are needed.

The LMIS is now established within the federal, provincial, and regional governments of Pakistan and will be streamlined for potential automation from the central to the district level. For 2013, the project has planned key activities to strengthen sub-district level demand, supply, and reporting systems for



contraceptives. With the availability of private sector data also disaggregated at the district level, stakeholders may be able to identify total market supply constraints.

Additional analysis of the system data over time may further show increased responsiveness to stock challenges in districts using the web-based LMIS. Since the system is being rolled out to all districts within the next year, analysis can also be done to show the impact of increased visibility into the lower levels of the system (district to facilities), enabling program managers to target and respond more quickly to stock challenges at lower levels, and ultimately to more efficiently connect the supply and demand for family planning products in Pakistan.

## Commitment to Family Planning Logistics in Pakistan

The healthy timing and spacing of pregnancy is an important component of the GoP's strategic goal to improve reproductive and maternal and child health. Critical to achieving this goal is the increased availability of reproductive health commodities. During the devolution of vertical health programs to the provinces, which impacted the ability of the government of Pakistan to fund contraceptive procurement in 2010 and 2011, the GoP has worked with the project to ensure data visibility and an uninterrupted supply of contraceptives to lower levels of the system. Based on USAID | DELIVER PROJECT quantification and forecasting of contraceptive needs for public and private sectors, the USAID Mission in Pakistan provided \$12 million and \$19 million for commodities in 2010 and 2011, respectively. Throughout this time period, a number of interventions have supported increased commodity security in Pakistan, including contraceptive quantification and resource allocation, warehouse rehabilitation, bar-coding and automated inventory control systems, improved procurement capacity, and the introduction of a web-based LMIS.

### Key Technical Interventions

- warehouse rehabilitation
- improved procurement capacity
- strengthened LMIS
- increased commodity security
- supportive supervision and monitoring

## References

Bowersox, Donald J. 2007 *Supply Chain Logistics Management*. New York: McGraw-Hill Irwin.

Website for the Pakistan Logistics Management Information System: <http://www.lmis.pc.gov.pk>

*The USAID | DELIVER PROJECT, Task Order 4, is funded by the U.S. Agency for International Development, and implemented by John Snow, Inc. The project improves essential health commodity supply chains by strengthening logistics management information systems, streamlining distribution systems, identifying financial resources for procurement and supply chain operations, and enhancing forecasting and procurement planning. The project also encourages policymakers and donors to support logistics as a critical factor in the overall success of their health care mandates.*

---

The authors' views expressed in this publication do not necessarily reflect the views of the U.S. Agency for International Development or the United States Government.

**USAID | DELIVER PROJECT**

John Snow, Inc.  
1616 Fort Myer Drive, 16th Floor  
Arlington, VA 22209 USA  
Phone: 703-528-7474  
Fax: 703-528-7480  
Email: [askdeliver@jsi.com](mailto:askdeliver@jsi.com)  
Internet: [deliver.jsi.com](http://deliver.jsi.com)

**USAID | DELIVER PROJECT**

John Snow, Inc.  
House 231, Street 13, Sector E-7  
Islamabad, Pakistan  
Phone: 051.2655425-6  
Fax: 051. 2655427  
Email: [Info@deliver-pk.org](mailto:Info@deliver-pk.org)