

Appendix B (Additional Supplementary File)

(February 25, 2024)

Table B1. Comparison of Mean Values of Matching Variables Pre- and Post-Matching: Evaluating the Effect of Transition to the Informed Push Model on (a) *Stock-Out*, (b) *Frontline Health Worker Workload*, and (c) *Client Satisfaction*

Matching Variables	Mean Values (Pre-Matching)		Mean Values (Post-Matching)		Bias Reduction
	Control	Treatment	Control	Treatment	
(a) <i>Primary Facility</i>	0.63	0.78	0.78	0.78	100%
<i>Number of Full-time Workers</i>	18.57	22.83	23.65	22.83	81%
<i>Number of Part-time Workers</i>	3.27	2.02	1.72	2.02	76%
(b) <i>Primary Facility</i>	0.51	0.67	0.67	0.67	100%
<i>Number of Full-time Workers</i>	24.62	37.28	31.19	37.28	52%
<i>Number of Part-time Workers</i>	4.10	2.14	2.19	2.14	97%
(c) <i>Primary Facility</i>	0.62	0.54	0.54	0.54	100%
<i>Number of Full-time Workers</i>	26.09	30.46	28.18	30.46	48%
<i>Number of Part-time Workers</i>	3.20	1.62	1.64	1.62	99%

Notes: Treated (i.e., public) and never-treated health facilities (i.e., private) were matched using coarsened exact matching. The cutoff points for categorizing the continuous variables in the coarsened exact matching process are based on the mean values. The unit of analysis is facility-commodity, facility-health worker, and facility-client for the models in parts (a), (b), and (c), respectively.

Table B2. Control Variables: Evaluating the Effect of Transition to the Informed Push Model on Frontline Health Worker Workload

Control Variable	Description	Data Source
<i>Frontline Health Worker Education</i>	Measured in years of cumulative education received by a frontline health worker.	SPA's Health Worker Interview Questionnaire 2012-2013, 2014, 2015
<i>Primary Facility</i>	See Table A3 in Appendix A for a detailed description.	SPA's Inventory Questionnaire 2012-2013, 2014, 2015
<i>Public Facility</i>		
<i>Number of Full-time Workers</i>		
<i>Number of Part-time Workers</i>		
<i>Piped Water</i>		
<i>Management Meetings</i>	Captures the day of the week when the survey was administered to a health worker.	
<i>External Supervision</i>		
<i>Commodity Variety FE</i>		
<i>Day-of-Week FE</i>		
<i>Client Age (mean)</i>		
<i>Client Education (mean)</i>	See Table A3 in Appendix A for a detailed description.	DHS's Women Questionnaire 2012-2013, 2014, 2015
<i>Client Household Size (mean)</i>	See Table A3 in Appendix A for a detailed description.	DHS's Household Questionnaire 2012-2013, 2014, 2015
<i>Client Wealth Index (mean)</i>		

Notes: Unit of analysis is facility-health worker. FE = Fixed Effects. Client Age (mean), Client Education (mean), Client Household Size (mean), and Client Wealth Index mean) were aggregated based on the proximity of clients to a focal health facility (i.e., within a 30 km range).

Table B3. Control Variables: Evaluating the Effect of Transition to the Informed Push Model on Client Satisfaction

Control Variable	Description	Data Source
<i>Client Education</i>	Measured as a binary variable, taking the value of 1 when a client ever attended school, and 0 otherwise.	SPA's Client Exit Interview Questionnaire 2012-2013, 2015
<i>Client Other Satisfaction</i>	A continuous variable measuring client's satisfaction with other elements of the healthcare service besides contraceptive availability (e.g., wait time, facility's cleanliness, hours of service, privacy concerns, facility hours, treatment by staff members, etc.)	
<i>Primary Facility</i>	See Table A3 in Appendix A for a detailed description.	SPA's Inventory Questionnaire 2012-2013, 2015
<i>Public Facility</i>		
<i>Number of Full-time Workers</i>		
<i>Number of Part-time Workers</i>		
<i>Piped Water</i>		
<i>Management Meetings</i>		
<i>External Supervision</i>		
<i>Commodity Variety FE</i>		
<i>Day-of-Week FE</i>	Captures the day of the week when the survey was administered to a client.	
<i>Client Age (mean)</i>	See Table A3 in Appendix A for a detailed description.	DHS's Women Questionnaire 2012-2013, 2015
<i>Client Education (mean)</i>		
<i>Client Household Size (mean)</i>	See Table A3 in Appendix A for a detailed description.	DHS's Household Questionnaire 2012-2013, 2015
<i>Client Wealth Index (mean)</i>		

Notes: Unit of analysis is facility-client. FE = Fixed Effects. Client Age (mean), Client Education (mean), Client Household Size (mean), and Client Wealth Index mean) were aggregated based on the proximity of clients to a focal health facility (i.e., within a 30 km range).

Table B4. Costs of the Pull Distribution Model and the Informed Push Distribution Model at Different Supply Chain Levels in Senegal (Source: Lynch et al. 2020)

Informed Push Distribution Model	Value
<i>National Cost (Total)</i>	\$1,810,595
<i>Regional Cost (Average Cost per Region)</i>	\$100,022
<i>District Cost (Average Cost per District)</i>	\$2,540
<i>Primary Health Facility Cost (Average Cost per Primary Facility)</i>	\$609
<i>Secondary Health Facility Cost (Average Cost per Secondary Facility)</i>	\$1,639
<p><i>Notes:</i> Start-up costs are annualized over the period of 2012 through 2015, and recurrent costs reflect the annual costs incurred to run the supply chain over this period. The national costs include all funds distributed by IntraHealth, the implementing organization, including annualized start-up costs and annual recurrent costs. The regional costs include costs incurred by IntraHealth staff, payments and training of external logistics providers, training and supervision of staff, vehicle operating costs such as maintenance, fuel, and per diems. The district costs include the costs of training and supervision of staff, vehicle operating costs such as maintenance, fuel, and per diems. The health facility costs include overhead costs and the cost to purchase new storage equipment for the health facilities' stock rooms. Note that the procurement costs of contraceptive methods were identical across pull and push distribution models and, therefore, were not included in the cost tables (Lynch et al. 2020). All cost numbers are reported in US Dollar.</p>	
Pull Distribution Model	Value
<i>National Cost (Total)</i>	—
<i>Regional Cost (Average Cost per Region)</i>	\$14,593
<i>District Cost (Average Cost per District)</i>	\$3,077
<i>Primary Health Facility Cost (Average Cost per Primary Facility)</i>	\$250
<i>Secondary Health Facility Cost (Average Cost per Secondary Facility)</i>	\$1,130
<p><i>Notes:</i> Recurrent costs reflect the annual costs incurred to run the supply chain over the period of 2012 through 2015. There are no national costs documented for operating the pull distribution model in Senegal as the pull model was managed at the sub-national level. The regional costs include the costs of training and supervision of staff, purchasing new storage equipment, vehicle operating costs such as maintenance, fuel, and per diems. The district costs include the costs of training and supervision of staff, vehicle operating costs such as maintenance and fuel, and per diems., and costs to purchase new equipment for storage. The health facility costs include overhead costs and the cost to purchase new storage equipment for the health facilities' stock rooms. Note that the procurement costs of contraceptive methods were identical across pull and push distribution models and, therefore, were not included in the cost tables (Lynch et al. 2020). All cost numbers are reported in US Dollar.</p>	

Table B5. Cost-Benefit Ratios for *Stock-Outs* using an Alternative Costing Approach by Burns et al. (1985): Transition from the Pull Model to the Informed Push Model

Cost Per Percentage Point Decrease in <i>Stock-Out</i>		
More Mature LMIS Practices	\$240	\$366
Less Mature LMIS Practices	\$150	\$191
	Less Developed Road Infrastructure	More Developed Road Infrastructure

Notes: All cost numbers are reported in US Dollar.

Table B6. Difference-in-Differences Estimation on Coarsened Exact Matched Samples: Placebo Falsification Effects of Transition from the Pull Model to the Informed Push Model on *Basic Supply Unavailability*

DV: <i>Basic Supply Unavailability</i>	All	LMIS Only		Road Infrastructure Only		LMIS and Road Infrastructure	
		Less Mature	More Mature	Less Developed	More Developed	Less Mature and Less Developed	More Mature and More Developed
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Informed Push Model</i>	0.12 (0.17)	-0.67** (0.33)	0.20 (0.20)	0.08 (0.21)	0.34 (0.26)	-0.89 (0.67)	0.32 (0.35)
<i>Control Variables</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Month FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Day-of-Week FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Region FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Catch. Pop. Proxy</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Commodity Variety FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Commodity Type FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Pseudo R-Squared</i>	0.22	0.24	0.23	0.25	0.24	0.28	0.25
<i>Log Likelihood</i>	-3619	-1007	-2557	-1770	-1743	-544	-1289
<i>Observations</i>	8,570	2,460	6,110	4,400	4,170	1,390	3,100

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Notes: FE = Fixed Effects. Robust standard errors clustered at the district level in parentheses. In addition to the listed covariates, the model in Column 1 also controls for LMIS practices and road infrastructure.

Table B7. Two-staged Least Squares Endogeneity-Corrected Event Study Estimation on Coarsened Exact Matched Samples to Relax the Parallel Trends Assumption: Effects of Transition from the Pull Model to the Informed Push Model on *Stock-Out*

DV: <i>Stock-Out</i>	All	LMIS Only		Road Infrastructure Only		LMIS and Road Infrastructure	
		Less Mature	More Mature	Less Developed	More Developed	Less Mature and Less Developed	More Mature and More Developed
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Informed Push Model</i> $t-3$	0.08	—	0.36	—	-0.35	—	-0.03
× <i>Contraceptive</i>	(0.78)	—	(0.80)	—	(0.25)	—	(0.23)
<i>Informed Push Model</i> $t-2$	0.45	0.45	0.47	-0.03	0.96***	0.12	0.97***
× <i>Contraceptive</i>	(0.32)	(0.63)	(0.32)	(0.39)	(0.37)	(0.76)	(0.34)
<i>Informed Push Model</i> t	-1.23***	-2.64***	-0.79***	-2.17***	-0.54	-3.88***	-0.21
× <i>Contraceptive</i>	(0.30)	(0.58)	(0.30)	(0.37)	(0.40)	(1.05)	(0.42)
<i>Informed Push Model</i> $t+1$	-2.15***	-2.51***	-2.29***	-2.61***	-1.89***	-3.08***	-2.17**
× <i>Contraceptive</i>	(0.44)	(0.79)	(0.63)	(0.50)	(0.63)	(0.86)	(0.85)
<i>Informed Push Model</i> $t+2$	-2.07***	-2.98***	-1.99***	-2.60***	-1.57***	-4.91***	-2.44***
× <i>Contraceptive</i>	(0.39)	(0.80)	(0.46)	(0.38)	(0.57)	(1.10)	(0.94)
<i>Control Variables</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Month FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Day-of-Week FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Region FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Catch. Pop. Proxy</i> ^{2SLS Instrumented}	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Commodity Variety FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Pseudo R-Squared</i>	0.16	0.20	0.18	0.19	0.18	0.29	0.22
<i>Log Likelihood</i>	-2396	-636	-1687	-1188	-1134	-320	-809
<i>Observations</i>	8,105	2,228	5,877	4,050	4,053	1,215	3,043

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Notes: FE = Fixed Effects. Robust standard errors clustered at the district level in parentheses. Consistent with standard practice, the year prior to the rollout of the informed push model serves as the baseline group. In addition to the listed covariates, the model in Column 1 also controls for LMIS practices and road infrastructure.

Table B8. Instrument-free Gaussian Copula Estimation on Coarsened Exact Matched Samples: Effects of Transition from the Pull Model to the Informed Push Model on *Stock-Out*

DV: <i>Stock-Out</i>	All	LMIS Only		Road Infrastructure Only		LMIS and Road Infrastructure	
		Less Mature	More Mature	Less Developed	More Developed	Less Mature and Less Developed	More Mature and More Developed
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Informed Push Model</i>	-1.02***	-1.54***	-0.85***	-1.19***	-0.84***	-1.81***	-0.80***
× <i>Contraceptive</i>	(0.13)	(0.25)	(0.12)	(0.13)	(0.21)	(0.22)	(0.17)
<i>Gaussian Copula Correction</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Control Variables</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Month FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Day-of-Week FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Region FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Catch. Pop. Proxy</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Commodity Variety FE</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Pseudo R-Squared</i>	0.16	0.20	0.18	0.19	0.17	0.29	0.22
<i>Log Likelihood</i>	-2396	-633	-1689	-1194	-1138	-321	-813
<i>Observations</i>	8,104	2,227	5,877	4,052	4,052	1,215	3,043

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Notes: FE = Fixed Effects. Robust standard errors clustered at the district level in parentheses. In addition to the listed covariates, the model in Column 1 also controls for LMIS practices and road infrastructure.

References

Lynch C, Faye A, Cavallaro F, Cresswell J, Bradley J, Wong K, Gasparini A, et al. (2020) *The informed push model for contraceptives in Senegal: How did it function, was it effective, in what context and at what cost?* (London, UK and Dakar, Senegal).