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The impacts of contraceptive stock-outs on users, providers, and facilities: A systematic literature review

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Abstract

Contraceptive stock-outs are a world-wide problem, yet published research on the impacts of contraceptive stock-outs have not been comprehensively reviewed and synthesized. This systematic review highlights findings about the impacts of contraceptive stock-outs on users, providers, and facilities and identifies topics that should be explored to ensure everyone can access their preferred method of contraception. We systematically searched PubMed, Embase, Web of Science, Popline, and JSTOR for studies addressing the impacts of contraceptive stock-outs. Of 435 studies, 25 publications addressed the impacts of contraceptive stock-outs. Only two articles focused solely on contraceptive stock-outs; the remaining studies examined stock-outs alongside other factors that may influence contraceptive service provision. Studies discussed how stock-outs limited individuals' ability to use their preferred contraceptive method, influenced where contraceptive methods were obtained and how much they cost, and limited providers' and facilities' abilities to provide contraceptive care. Comparing the impacts of contraceptive stock-outs across studies was challenging, as reliability of stock was sometimes not distinguished from overall method availability, and studies used variable methods to measure stock-outs. Evidence presented in this review can inform efforts to ensure that preferred contraceptive methods are consistently available and accessible to all.

Key words: contraceptive stock-out; contraceptive supply; contraceptive availability; contraceptive access; family planning

Introduction

Increasing access to contraception is a critical, highly cost-effective intervention for improving maternal and newborn health, reducing maternal mortality, and supporting an individual's ability to exercise their reproductive rights. Decades of research have documented the benefits of contraceptive access and use, but significant barriers remain (Agarwal, 2011; Singh S, Darroch J, 2013; Sonfield, 2011). In many developing countries, particularly in sub-Saharan Africa, effective contraceptive method use remains low, myths about the side effects or health risks of contraception are pervasive, and people have access to a limited range of methods (Agarwal, 2011; Darroch et al., 2011; Singh S, Darroch J, 2013).

As of 2017, the most recent year for which data are available, approximately 214 million women in developing countries who want to avoid becoming pregnant have an unmet need for modern contraception. A majority of these women (57%) live in Sub-Saharan Africa and Southern Asia (Guttmacher Institute, 2017). Unintended pregnancies can lead to unplanned births, unsafe abortions where high-quality services are not legally permitted or available, maternal deaths, and the loss of healthy years of life (Guttmacher Institute, 2017).

Lack of contraceptive access is cited among the reasons for contraception nonuse among women with an unmet need in various countries (Sedgh & Hussain, 2014). In several countries in West and Central Africa, about 20% of women report lack of access as a reason for not using contraception (Sedgh & Hussain, 2014). Women need better access–both physical and financial–to a wide range of contraceptive services and supplies so they can choose a method that works best for them (World Health Organization, 2014). However, even if individuals have access to a

facility where contraceptives are routinely provided and can afford their preferred method, they may still be unable to obtain their method simply because it is not in stock.

A contraceptive stock-out occurs when a contraceptive method that, routinely or based on policy, should be available at a health facility is not available due to a lack of supplies of the method itself or other equipment needed to offer the method. Identifying mechanisms for preventing contraceptive stock-outs was listed as one of the top 15 research priorities by a World Health Organization global survey that asked experts to identify and rank research that would be needed to reduce the unmet need for family planning (Ali M, Seuc A, Rahimi A, Festin M, 2014). Despite the global emphasis on addressing stock-outs, there is no comprehensive review of published literature on the effects of stock-outs, and it is unclear if studies have explicitly documented the impacts of contraceptive stock-outs on users, providers, or health facilities. This review synthesizes and highlights existing findings on the impacts of contraceptive stock-outs and identifies key areas where new research is needed.

Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used to conduct this systematic review (Moher et al., 2009; Rethlefsen et al., 2019) (see Supplementary Files 1 and 2). We initially searched the PubMed and JSTOR databases on November 23, 2016 to identify studies that addressed the impacts of contraceptive stock-outs. Search terms included variations of the word “contraception” in conjunction with “supply chain” and various spellings of the term "stock-out". To expand the breadth of our search results, we worked with a medical librarian (JBW) to conduct a search update on July 12, 2019 in PubMed,

Embase, Web of Science, and Popline. No date or language limits were used, and complete search strategy details can be found in Supplementary File 3. A cited reference search of included studies was also used to identify relevant studies. Studies were screened based on title, abstract, and full text to determine if they contained original analysis about the impact of contraceptive stock-outs on users, providers, or the functioning of facilities. Two reviewers (AW and CZ) completed screening, with a third reviewer (KG) available to resolve discrepancies. Studies were excluded if they were not in English, did not contain original analysis on primary or secondary data, did not contain analysis about the impact of contraceptive stock-outs, or focused on stock-outs of emergency contraception. Grey literature was excluded from this analysis. A systematic review protocol was not submitted.

Results

Study selection and characteristics

Of 435 evaluated articles, a total of 25 studies contained original data or data analyses on the impacts of contraceptive stock-outs. Figure 1 displays our selection process.

[Insert Figure 1]

A description of included studies is displayed in Supplementary File 4.

The majority of studies were conducted in sub-Saharan Africa (Akol et al., 2014; Baraka et al., 2015; Burke & Ambasa-Shisanya, 2011; Chen & Guilkey, 2003; Cotten et al., 1992; Cover et al., 2014; Daff et al., 2014; Farmer et al., 2015; Grindlay et al., 2016; Hutchinson et al., 2011; Hyttel et al., 2012; Jalang'O et al., 2017; Lebetkin E, Orr T, Dzasi K, Keyes E, Shelus V, Mensah S,

2014; Mckenna et al., 2014; Mugisha J, 2008; Nakayiza et al., 2014; Nieto-Andrade et al., 2017; Rutenberg & Baek, 2005; Silumbwe et al., 2018; Skiles et al., 2015; Tolley et al., 2014; Tumlinson et al., 2015), and almost a third focused on injectables as a method of contraception (Burke & Ambasa-Shisanya, 2011; Cover et al., 2014; Hyttel et al., 2012; Lebetkin E, Orr T, Dzasi K, Keyes E, Shelus V, Mensah S, 2014; Mckenna et al., 2014; Nakayiza et al., 2014; Skiles et al., 2015; Tolley et al., 2014). Studies varied in the amount of detail they provided on the impacts of contraceptive stock-outs, with stock-outs being the primary topic of two studies (Daff et al., 2014; Grindlay et al., 2016). One study explicitly addressed the impacts of contraceptive stock-outs on women and providers in Uganda (Grindlay et al., 2016), and the other study examined the supply chain before and after an intervention to address stock-outs in Senegal (Daff et al., 2014). In the remaining 23 studies, the topic of contraceptive stock-outs was discussed in passing as one factor related to the quality or accessibility of family planning services.

Thirteen studies provided qualitative evidence on the impacts of contraceptive stock-outs through interviews and focus group discussions with contraceptive users, providers, and policy makers (Baraka et al., 2015; Burke & Ambasa-Shisanya, 2011; Cover et al., 2014; Dansereau et al., 2017; Farmer et al., 2015; Grindlay et al., 2016; Hyttel et al., 2012; Jalang'O et al., 2017; Mckenna et al., 2014; Mugisha J, 2008; Rutenberg & Baek, 2005; Silumbwe et al., 2018; Tolley et al., 2014). Twelve studies provided quantitative data on the impact of stock-outs, with six studies reporting descriptive statistics by analyzing survey data (Akol et al., 2014; Cotten et al., 1992; Daff et al., 2014; Gribble et al., 2007; Lebetkin E, Orr T, Dzasi K, Keyes E, Shelus V, Mensah S, 2014; Nieto-Andrade et al., 2017), and six including a measure of stock-out as a variable in regression models (Chen & Guilkey, 2003; Hutchinson et al., 2011; Magnani et al.,

1999; Nakayiza et al., 2014; Skiles et al., 2015; Tumlinson et al., 2015). Only one of the six studies assessing survey data provided a definition of a contraceptive stock-out, defining this as "zero units available for sale at the facility on a day when the facility was open"(Daff et al., 2014). In addition, each of the six studies using a measure of contraceptive stock in regression models defined and measured this variable differently. Four of these studies scored health facilities on how well they stocked contraceptives based on a different set of criteria. For example, one paper examined if a method had been out of stock in the previous year and scored facilities on a continuous scale from 0-8 (Tumlinson et al., 2015), while another scored facilities on a scale of 0-2 depending on if the method was available the day data was collected and if there had been a stock-out in the past six months (Magnani et al., 1999). Among the two studies that did not score facilities, one defined their stock-out variable as the number of times a method was in stock at a facility within 5 kilometers from a woman (Chen & Guilkey, 2003), and the second specified their stock-out variable as whether women had ever experienced a stock-out of a particular brand of an injectable contraceptive (Nakayiza et al., 2014).

Impacts on users

Eighteen studies reported on how stock-outs impacted use of contraception (Baraka et al., 2015; Burke & Ambasa-Shisanya, 2011; Chen & Guilkey, 2003; Cotten et al., 1992; Daff et al., 2014; Farmer et al., 2015; Gribble et al., 2007; Grindlay et al., 2016; Hyttel et al., 2012; Jalang'O et al., 2017; Magnani et al., 1999; Mckenna et al., 2014; Mugisha J, 2008; Nieto-Andrade et al., 2017; Rutenberg & Baek, 2005; Silumbwe et al., 2018; Skiles et al., 2015; Tumlinson et al., 2015). Twelve studies that explored this topic through interviews or descriptive statistics reported that stock-outs led to, or were associated with, discontinuation of the preferred method or a switch to a less effective method, both of which increased the risk of unwanted and unplanned pregnancies

(Burke & Ambasa-Shisanya, 2011; Cotten et al., 1992; Daff et al., 2014; Farmer et al., 2015; Gribble et al., 2007; Grindlay et al., 2016; Jalang'O et al., 2017; Mckenna et al., 2014; Mugisha J, 2008; Nieto-Andrade et al., 2017; Rutenberg & Baek, 2005; Silumbwe et al., 2018). Reasons for discontinuation included negative side effects from methods prescribed in lieu of the preferred method, prohibitively high financial or time costs involved in obtaining the method from another location, and difficulty or the inability to acquire the preferred method at all (Burke & Ambasa-Shisanya, 2011; Farmer et al., 2015; Gribble et al., 2007; Grindlay et al., 2016; Mugisha J, 2008; Nieto-Andrade et al., 2017; Silumbwe et al., 2018). Contraceptive stock-outs may also impact demand for certain types of methods. Authors of a study conducted in Angola hypothesized that stock-outs of long acting reversible contraceptive methods in public facilities were likely a contributing factor to why condoms and oral contraceptives were the most widely used methods (Nieto-Andrade et al., 2017).

Four studies identified determinants of contraceptive use by constructing multivariate models (Chen & Guilkey, 2003; Magnani et al., 1999; Skiles et al., 2015; Tumlinson et al., 2015). Although each study defined and measured stock-outs differently, results from these papers point to the potential impact of reliability of contraceptive stock on utilization, especially for more effective methods. In a study exploring quality of care and contraceptive use in five urban areas of Kenya, a consistent stock of a mix of contraceptive methods was associated with current use of a modern contraceptive method in high volume facilities (adjusted prevalence ratio 1.15; CI (0.99, 1.34)) (Tumlinson et al., 2015). Similarly, a study in rural Tanzania found that an increase in the number of methods in stock within five kilometers of where a woman lived increased the probability of using a contraceptive method over no method (Chen & Guilkey, 2003). This variable had the largest effect on the use of modern methods (excluding pills and condoms)

compared to no method (coefficient .090, p = 0) in a multinomial logit model (Chen & Guilkey, 2003). A study conducted in Malawi found that the probability of using injectables for women with the most access to a reliable, nearby stock of injectables was 5.2 percentage points higher compared to women with the least access, with a stronger effect among rural residents ($p < .001$; no CI reported) (Skiles et al., 2015). This study operationalized the concept of a reliable supply of contraceptives through constructing a monthly index of method availability (no stock-outs) and combining this measure with distance to the nearest facility, using kernel density estimation (Skiles et al., 2015). Another paper using data from household surveys in Morocco included information on the availability of methods in their model as an index, with availability summed over six months of data for methods mandated to be offered at public clinics. When examining the interaction between prior intention and the availability of methods, women with no intention of using contraception had an increased probability of use when methods were more readily stocked at the nearest public health clinic, compared to women who intended to use contraception within 12 months (Magnani et al., 1999). The researchers found that stock-outs may have the biggest impact on the actual use of contraceptives among women who did not intend to use a method (coefficient 1.20; $p < .001$) (Magnani et al., 1999).

Nine studies addressed how contraceptive stock-outs impacted where individuals chose to obtain their preferred method of contraception (Akol et al., 2014; Daff et al., 2014; Dansereau et al., 2017; Gribble et al., 2007; Grindlay et al., 2016; Jalang'O et al., 2017; Lebetkin E, Orr T, Dzasi K, Keyes E, Shelus V, Mensah S, 2014; Nakayiza et al., 2014; Tolley et al., 2014). In instances where one's preferred method was out of stock in the public sector, some would seek their method in the private sector (Daff et al., 2014; Dansereau et al., 2017; Grindlay et al., 2016; Tolley et al., 2014). In many cases, this increased the price one had to pay for contraception, as

private facilities charged more for methods and services that were provided for free or for a lower cost at public facilities (Burke & Ambasa-Shisanya, 2011; Daff et al., 2014; Grindlay et al., 2016; Tolley et al., 2014). In a study conducted in Senegal, contraceptive users who bought their preferred method in the private sector after experiencing a stock-out at a public facility, paid three to nine times the price they would have paid at a public facility (Daff et al., 2014). A study in Ghana found that, among users of injectables who had purchased their method from a chemical shop, 16% chose to buy the method at a chemical shop due to it being in stock (Lebetkin E, Orr T, Dzasi K, Keyes E, Shelus V, Mensah S, 2014). Among women who could name other locations where injectables were sold, 22% reported not visiting these locations because of stock-outs (Lebetkin E, Orr T, Dzasi K, Keyes E, Shelus V, Mensah S, 2014). Similar findings were reported in Uganda, with 10% of contraceptive users who had switched their source of contraception from a public facility to a private drug shop citing stock-outs among the reasons they switched (Akol et al., 2014). One study exploring the determinants of preference for sources of a particular brand of injectable contraceptive in a district in Uganda found that the majority of women preferred private sources over public ones (Nakayiza et al., 2014). The authors reported that women who had never experienced a stock-out of this brand were more likely to prefer private sources than their counterparts who had experienced stock-outs (Nakayiza et al., 2014). Although the authors suggest that consistent supplies at private sources may explain this preference, this result may also be capturing effects of socioeconomic status. Women able to afford private sources would be less likely to experience a stock-out in the first place, while women who experienced stock-outs most likely experienced them at public facilities and may not have the financial resources to visit a private provider. Relatedly, one paper found that client satisfaction with family planning services was higher in private facilities than in public ones in

Kenya and Tanzania, and the authors partly attribute this to their finding that private facilities in both countries experience fewer contraceptive stock-outs (Hutchinson et al., 2011).

Three papers evaluated the impacts of contraceptive stock-outs on users more broadly, describing results from interviews with patients and providers (Burke & Ambasa-Shisanya, 2011; Cover et al., 2014; Grindlay et al., 2016). Stock-outs can potentially impact users' privacy or ability to discreetly utilize contraception (Cover et al., 2014), as women may need to visit a different provider or facility, or use an alternative method that is less discreet (Grindlay et al., 2016). Stock-outs can also cause contraceptive users to become discouraged about finding their preferred method (Burke & Ambasa-Shisanya, 2011) and users may experience stress from worrying about unwanted or unplanned pregnancies (Grindlay et al., 2016). Study participants also reported domestic violence brought on by attempting to abstain from sex, requesting their partner use a condom, or experiencing unwanted pregnancies (Grindlay et al., 2016). Among young individuals, consequences of a stock-out were magnified by the potential implications of an unwanted pregnancy, including the possibility of dropping out of school, marrying early, or undergoing an unsafe abortion (Grindlay et al., 2016).

Impacts on healthcare providers and facilities

Six studies discussed the impacts of contraceptive stock-outs on providers or the functioning of facilities (Baraka et al., 2015; Cover et al., 2014; Gribble et al., 2007; Grindlay et al., 2016; Hyttel et al., 2012; Mugisha J, 2008). These studies were primarily qualitative or presented basic characterizations of how providers altered clinical and administrative practices when faced with contraceptive stock-outs. In Senegal, Tanzania, and Uganda, facilities reported having to interrupt their family planning services or turn patients away due to stock-outs (Baraka et al.,

2015; Cover et al., 2014; Grindlay et al., 2016). Providers in Uganda also reported that the most common barriers to providing quality family planning services were contraceptive stock-outs and a lack of supplies (Mugisha J, 2008), and that stock-outs made providers feel emotionally distressed and decreased their ability to provide long-term methods due to a lack of practice (Grindlay et al., 2016). The latter study also reported that providers believed stock-outs negatively impacted the performance of the facility itself because of a loss of trust among clients who frequently experienced stock-outs (Grindlay et al., 2016). In rural Tanzania, providers described having to reallocate funds for other services or charge for services that were usually free in order to buy basic contraceptive supplies and equipment (Baraka et al., 2015). However, even after taking these measures, stock-outs would interfere with the provision of contraceptive care. A survey among family providers in Ministry of Health facilities in Peru revealed that stock-outs led providers to advise their patients to temporarily use a different contraceptive method (Gribble et al., 2007). The majority of these providers wrote a prescription for an alternate method to be filled at a commercial pharmacy or outlet where the method would likely be more expensive, whereas others changed the patient's method to one in stock at the public facility. Table 1 summarizes the impacts of contraceptive stock-outs on users, providers, and facilities.

[Insert Table 1]

Discussion

Although all 25 studies reported on an at least one impact of a contraceptive stock-out, only two studies focused primarily on stock-outs. The majority of studies in our review only addressed the impacts of contraceptive stock-outs in passing, and did not include careful analyses of their

impacts. The dearth of comprehensive analyses on the impacts of contraceptive stock-outs suggests that quantitative research is needed to explicitly document the wide-ranging effects stock-outs can have on users, providers, and facilities.

Our results also indicate a need to standardize how contraceptive stock-outs are measured. Stock-outs were defined and measured in a variety of ways, making it difficult to compare and evaluate the reported impacts of contraceptive stock-outs across studies. In 2015, organizations working in the global reproductive health community published a stock-out indicator guide, which aims to standardize how contraceptive stock-outs are reported across organizations and countries (Reproductive Health Supplies Coalition, 2015). The guide recommends one global stock-out indicator for all organizations to use, as well as an array of clearly-defined indicators organizations can choose from based on their needs and capacities (Reproductive Health Supplies Coalition, 2015). A stock-out indicator (Indicator 10) has also been included in the list of core indicators used to assess the progress of countries that have joined the the Family Planning 2020 global movement and that are committed to expanding contraceptive access (2020, n.d.; Track2020, n.d.). Efforts to increase education and adoption of standardized stock-out indicators will help researchers better understand the prevalence and impact of contraceptive stock-outs, and assist facilities with maintaining a consistent supply of contraceptives (Reproductive Health Supplies Coalition, 2015).

Since only a handful of studies discussed the impacts of contraceptive stock-outs on providers and facilities (Baraka et al., 2015; Cover et al., 2014; Gribble et al., 2007; Grindlay et al., 2016; Hyttel et al., 2012; Mugisha J, 2008), more data are needed to understand how providers cope with stock-outs on a personal level, as well as how stock-outs affect provision of contraceptive care. Future studies could investigate the extent to which stock-outs impact a facility's reputation

and overall performance in the provision of other types of health services in both the short- and long-term. Existing literature on stock-outs of drugs for antenatal care and human immunodeficiency virus have shown that stock-outs of these medications increased staff workload, negatively influenced the quality of care provided, caused health facility staff to feel blamed by the community for a lack of medicines and supplies, and negatively impacted staff morale and confidence in providing care (Medley & Kennedy, 2010; Penfold et al., 2013).

One reason there may be limited literature on stock-outs as a key issue in quality of family planning services is because stock-outs are not specifically a part of the Bruce-Jain framework, which is considered a central framework for understanding the quality of family planning care (Bruce, 1990). Although the framework encourages facilities to be well-prepared to offer family planning services, it does not explicitly mention stock-outs or provide details on how to track stocks of contraceptive supplies. As a result, the framework does not distinguish between availability of methods and reliability of stock, both of which are critical to the provision of services, and these factors must be examined separately due to their different causes and impacts on facilities and users. Availability can be limited for reasons other than stock-outs, such as a shortage of staff trained to provide certain contraceptives (Baraka et al., 2015) or by provider bias about appropriate methods for a client based on her age or marital status (Speizer I, Hotchkiss D, Magnani R, Hubbard B, 2000). Limited availability could also be due to the fact that not all facilities carry all contraceptive methods, and it is possible for a facility to have never carried a method in the first place. In contrast, reliability of stock can only be measured if a method is expected to be consistently available, and there are many potential reasons a facility may experience a stock-out. For instance, providers in Uganda reported that although mechanisms were in place to report discrepancies between the stock required to be in drug kits

and those that are actually received, stock-outs occurred because the forms used to request family planning supplies from national distribution facilities were not honored by these facilities (Grindlay et al., 2016). Various factors can limit the supply of contraceptive methods, including unreliable suppliers (Baraka et al., 2015), burdensome administrative barriers (Grindlay et al., 2016), reallocation of funding (Mckenna et al., 2014), or a lack of trained staff to track and order supplies (Daff et al., 2014; Hancock et al., 2015), all of which would require different solutions. Identifying the reasons for method unavailability will allow interventions to carefully target the cause of the limited methods offered to contraceptive users.

There are several limitations to this study. First, reports by government agencies or non-governmental organizations on contraceptive stock-outs were not included in our review, so we may have missed some data on the impact of stock-outs included in these reports. The second limitation is that we cannot generalize the impacts of contraceptive stock-outs based on the studies reviewed, as qualitative and quantitative data on stock-outs were limited and often applied to a certain method or set of facilities within a small geographical area. Studies extracting information about stock-out impacts from other sources offered little information about secondary data sources, making it difficult to clarify how questions on stock-outs were presented in surveys (Gribble et al., 2007) or how variables that included stock-outs were defined (Nakayiza et al., 2014). Considerable variation in how stock-outs were defined and measured also made it challenging to compare the impacts of contraceptive stock-outs within and across studies. Qualitative data on the impacts of stock-outs were limited by geography and sample size, and perspectives of participants cannot be considered representative of the total population or generalizable to regions beyond where the study took place. Despite these limitations, our review consistently found that contraceptives stock-outs limit an individual's ability to use their

preferred method; influence where contraception is obtained and how much it costs, limit facilities' and providers' ability to provide contraceptive care, and can have broad, negative repercussions on users and communities, possibly leading to unintended pregnancies and household violence.

Conclusion

Although there is increasing global interest among private, public, and non-governmental organizations in addressing supply chain and stock-out issues (*Reproductive Health Supplies Coalition*, 2018), quantitative data and comprehensive analyses on the direct and indirect impacts of stock-outs on users are still needed. In addition, more data are needed on how providers cope with stock-outs on a personal-level, how stock-outs affect provision of contraceptive care and other types of health services in the short- and long-term, and how contraceptive stock-outs impact the reputation of facilities. Research is also needed to tease apart the reasons for, and effects of, overall availability of family planning methods and the reliability of stocks of these methods. The synthesized evidence presented in this review can inform policy and advocacy efforts to increase awareness about and adoption of global contraceptive stock-out indicators, as well as inform interventions to address the consequences of stock-outs when facilities or communities are faced with limited supplies.

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Declaration of Interest

The authors declare that they have no competing interests.

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Author contributions

This review was conceptualized and designed by KB and KG. The literature search was performed by CZ in 2016 and by JBW in 2019. Data screening and extraction, as well as data analyses and interpretation were performed by AW and CZ. A first draft of the manuscript was written by AW and CZ, and CZ prepared subsequent drafts of the paper. The paper was edited and reviewed by AW, CZ, EDD, JBW, KB, KG, and SH.

Supplementary Files

Supplementary File 1. - Completed PRISMA Checklist

Supplementary File 2 - Completed PRISMA-S Chart

Supplementary File 3 - Search Strategy Details

Supplementary File 4 - Description of Studies Table

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546 **Table 1. The impacts of contraceptive stock-outs on users, providers, and facilities.**

Authors	Users	Providers and Facilities
Silumbwe et al. (2018)	Contraceptive Use • Stock-outs of preferred methods negatively impacted contraceptive use and one woman described losing interest in trying to access contraceptives at a clinic experiencing frequent stock-outs	
Dansereau et al. (2017)	Source and Cost of Method • Some women were forced to purchase implants or injectables from a private provider or pharmacy because their local health facility experienced a stock-out of these methods • The cost of purchasing contraceptives from a pharmacy or private provider was a barrier for one focus group participant	
Jalang'o et al. (2017)	Contraceptive Use • Women identified frequent stock-outs as a major challenge to accessing contraceptives, with at least one woman becoming pregnant while waiting to obtain her method Source of Method • Frequent stock-outs at public facilities forced women to go to private pharmacies for contraceptive supplies, even though many thought chemists were less qualified to provide care	
Nieto-Andrade et al. (2017)	Contraceptive Use • Almost one-fifth of female contraceptive users reported not using their preferred method, with the most common reasons being that their preferred method was difficult to obtain or not available • The authors note that stock-outs of IUDs or implants at public	

	facilities are likely a contributing factor for why condoms and oral contraceptives are the most widely used method, while LARCs are the least known and used in Luanda	
Grindlay et al. (2016)	<u>Contraceptive Use</u> • Stock-outs led women to try new methods, and negative side effects caused women to discontinue use. • Older women were less flexible in terms of changing methods, and were likely to stop using a new method if they experienced any negative side effects. <u>Source and Cost of Method</u> • After facing stock-outs in public facilities, some women paid out-of-pocket for a method at private facility. • Women who visited multiple sources to access a method were concerned about high travel costs. Travelling to different facilities was more challenging for younger women. • Young women expressed confidentiality concerns when visiting a different provider, and not all providers were willing to offer them family planning methods. <u>Other</u> • Women reported stress from worrying about the potential of an unwanted pregnancy, or from having to abstain from sex due to their inability to obtain their preferred method. • Some women experienced domestic violence spurred on by their attempts to abstain from sex or requests for their partner to use a condom. • Women reported abandonment or	<u>Provider Morale</u> • Providers felt stressed and demoralized at not being able to meet their patients' needs and were often blamed for a lack of supplies. <u>Provision of Services</u> • Stock-outs of long-term methods made it difficult for providers to maintain the skill level to provide these methods. <u>Facility Performance</u> • Stock-outs were perceived to impact the performance of the facility itself with loss of trust among clients who had experienced persistent stock-outs.

	divorce if they experienced an unintended pregnancy due to a stock-out. • Some women believed that unmarried women were most impacted by stock-outs, as unwanted pregnancies could force them to drop out of school, marry a partner earlier, or undergo unsafe abortions.	
Baraka et al. (2015)	<u>Contraceptive Use</u> • Stock-outs were identified as one of the reasons clients did not receive method counseling at facilities.	<u>Cost and Provision of Services</u> • Providers reported using funds allocated for other primary health care activities to procure essential supplies locally, or charging fees for services that were supposed to be free. • Frequently, provision of family planning care was interrupted by stock-outs.
Farmer et al. (2015)	<u>Contraceptive Use</u> • Providers believed stock-outs caused women to stop using contraception, resulting in unwanted pregnancies.	
Skiles et al. (2015)	<u>Contraceptive Use</u> • The authors found an increase in injectable use and demand for birth spacing if a nearby facility had a reliable stock of that method. • The probability of using injectables was 3.3 - 5.2 percentage points higher for women with the most access to stocked facilities compared to women with the least access. • Among rural women, those with the best access to consistently stocked facilities were more likely to use injectables than those with least access (a 7.5 percentage point increase). • Among urban women, distance to a facility with a reliable supply of contraceptive injectables had a	

	significant effect on demand for birth spacing.	
Tumlinson et al. (2015)	Contraceptive Use • A consistent stock of a mix of contraceptive methods was marginally associated with current modern method use in all facilities, and in higher-volume facilities.	
Akol et al. (2014)	Source of Method • Of clients who had switched providers from their last contraceptive method (50% of drug shop clients), 10% of the clients who had switched from a government clinic/health center cited fewer stock-outs at drug-shops among their reasons for switching sources.	
Cover et al. (2014)	Other • According to clinic providers and community health workers, turning clients away due to stock-outs was costly, inconvenient, and less discreet for women.	Provision of Services • Clinic providers and community health workers discussed how stock-outs cause them to have to turn women away.
Daff et al. (2014)	Contraceptive Use, Source, and Cost Among current users of contraception who had experienced a stock-out: • 55% switched methods, often to a less effective method. • 45% either discontinued use or went to the private sector, where they paid 3 to 9 times the price they would have paid at a public facility.	
Lebetkin et al. (2014)	Source of Method • 16% percent of women interviewed purchased the injectable from chemical shops because the method was in stock. • 30% women who knew of other facilities that provided injectables, and of these women, 22% reported	

	they did not visit these locations because of stock-outs.	
McKenna et al. (2014)	Contraceptive Use • Policy makers and service providers explained that stock-outs limited access to effective methods of contraception, forcing women to use condoms or other less-effective methods as a stop-gap to prevent pregnancy.	
Nakayiza et al. (2014)	Source of Method • Among other determinants, evidence of a stock-out was significantly related to preference of source for DMPA. • Women who had never experienced a stock-out of DMPA were more likely to prefer private to public sources compared to those who had experienced a stock-out (RR=-2.77). The authors largely attributed this to the fact that supply at private sources was continuous and women appreciated this quality.	
Hyttel, M (2012)	Contraceptive Use • Policymakers were concerned that without a wide mix of contraceptive methods, women experiencing negative side effects would have very limited options for an alternative method.	Provision of Services • Policymakers mentioned that stock-outs and other factors negatively impacted the provision of family planning services, as providers were unable offer women a wide range of affordable contraceptive methods.
Tolley et al. (2012)	Source of Method • Although injectables were free at public facilities, stock-outs at these facilities led some women to buy injectables from the private sector.	
Burke and Ambasa-Shisanya (2011)	Contraceptive Use • Stock-outs were identified as a logistical reason for discontinuing use of a contraceptive. • When clinics run out of	

	injectables, women were asked to buy the method at a pharmacy and then return to the clinic for the injection. The time and financial resources needed to do this prevented women from returning to the clinic. <u>Other</u> • Stock-outs also caused users to become discouraged because there was not an affordable place to access their preferred method.	
Hutchinson et al. (2011)	<u>Other</u> • Client satisfaction with family planning services is higher in private rather than public facilities, and the authors partly attribute this to their finding that private facilities were less likely to experience a stock-out of contraceptive methods and supplies. • Clients were significant more likely to report that "availability of medicines or methods" was not a problem at private health centers and clinics in Tanzania and Kenya, compared to private facilities. • In bivariate analysis, availability of contraceptive methods was reported as a problem more frequently in public facilities in Tanzania and Kenya. Two indicators of quality of care, "stock inventory, organization, and quality" and "number of family planning methods offered" were significantly different between public and private facilities in these two countries. • In multivariate analysis, "Quality stock inventory" was a significant factor of client satisfaction in hospitals in Ghana	

Gribble et al. (2007)	Source of Method • Stock-outs caused women to obtain their contraceptive method at a commercial outlet or pharmacy at a higher cost, rather than at a public facility. Contraceptive Use • Women whose preferred contraceptive method was out-of-stock were sometimes prescribed a different method. Other Authors hypothesize that commodity stock-outs in facilities played a role in the increase in the number of abortions.	Provision of Services 83% of providers advised their patients to use another method temporarily when facing a contraceptive stock-out, particularly of oral contraceptives and injectables: • 60% provided a prescription to be filled at a commercial outlet or pharmacy. • 23% changed the patient's contraceptive method to one in stock.
Mugisha and Reynolds (2007)	Contraceptive Use • Stock-outs were reported to lead to discontinuation of methods and unwanted pregnancies. • Discontinuation was common according to providers, as some stock-outs reportedly lasted 3 to 6 months and women had strong preferences for certain methods.	Provision of Services • Lack of supplies and stock-outs were reported as a common barrier to quality services for family planning. • Providers reported longer wait-times as a result of stock-outs.
Rutenberg and Baek (2005)	Contraceptive Use • Providers attributed stock-outs at PMTCT sites to a decline in the prevalence of women's use of certain methods and an increase in the number of pregnancies among HIV-positive women.	
Chen and Guilkey (2003)	Contraceptive Use • The multivariate results suggested that an increase in the number of methods in stock increased the probability of using a contraceptive method versus using none. •The largest effect sizes were observed for "other modern method" versus no method, followed by condom versus no	

	method, and oral contraceptive use versus no method. •The only statistically significant relationship was found for “other modern method” versus no method. • In simulating the impact of the results, an increase in the number of methods found to be in stock within 5 km was associated with a decrease in a simulated percentage of nonuse and an increase in simulated use for all other methods. • The largest increases were observed for "other modern methods" and oral contraceptives.	
Magnani et al. (1999)	<u>Contraceptive Use</u> • Method availability at the nearest public health clinic was associated with contraceptive intentions and use. • Results suggested that women with no intention to use contraception were influenced to a greater extent by the availability of methods than those women who had already intended to use a method. • The authors noted that causality may be reversed; services may be allocated in response to demand.	
Cotten et al. (1992)	<u>Contraceptive Use</u> • Among users of injectables, stock-outs were identified a major reason for discontinuation. • In Niger, 13% of women who discontinued a method reported stock-outs as a major reason for stopping use. • Among users of other methods, and among all users in the Gambia, stock-outs were not one of the top four reasons for discontinuation.	

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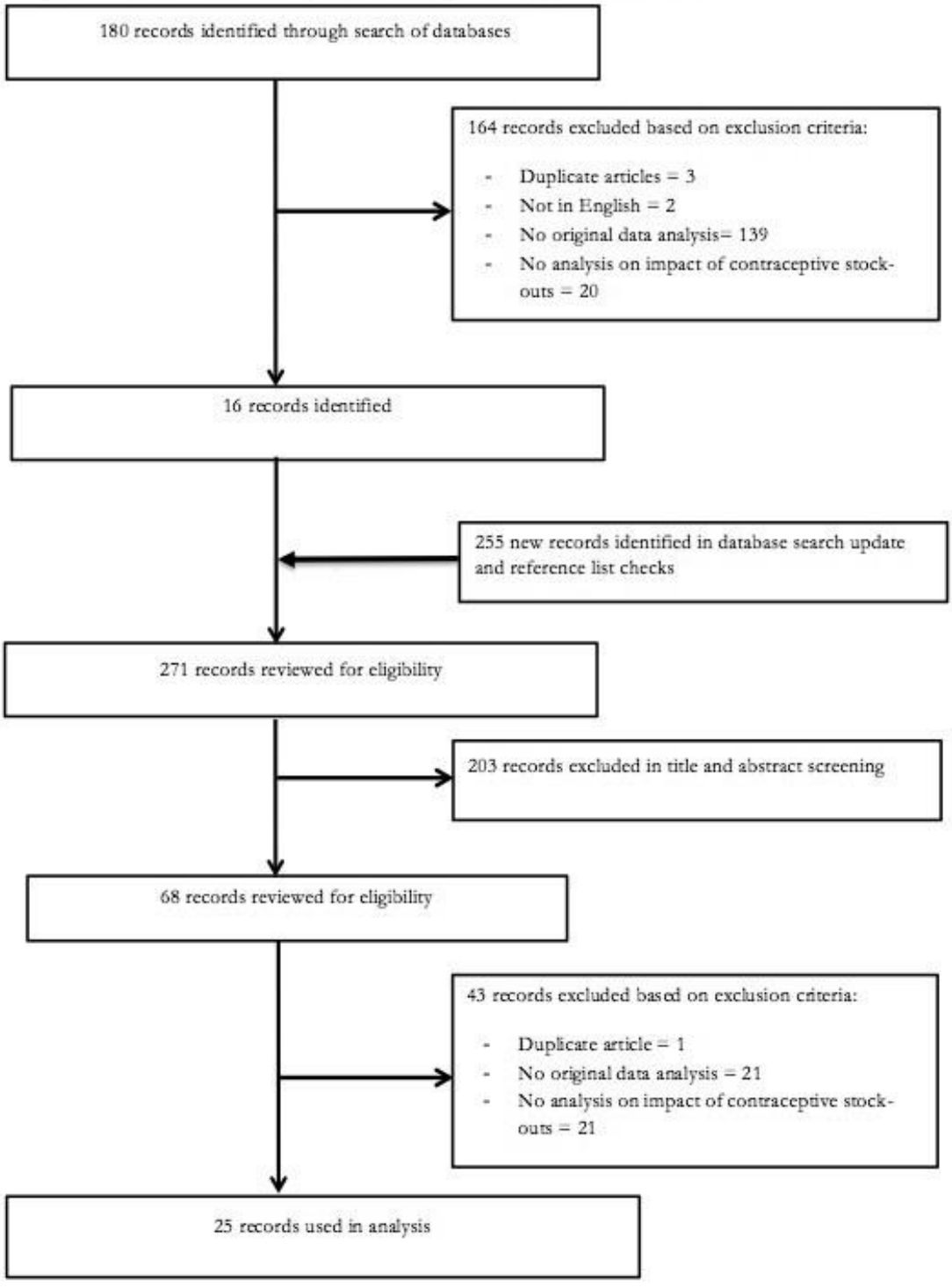
Fig 1. Flow chart of the selection process to identify articles eligible for this review.



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PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3-4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	4-5
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	4-5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	4-5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplementary File 3
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Figure 1; 4-5
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	5
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	5, Supplementary File 4 & Table 1
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	N/A
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	5

PRISMA 2009 Checklist

Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	N/A

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	N/A
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	N/A
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Figure 1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Supplementary File 4
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Supplementary File 4
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	5-12, Table 1
Synthesis of results	21	Present the main results of the review. If meta-analyses are done, include for each, confidence intervals and measures of consistency	5-12
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	N/A
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	N/A
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	12-16
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	15-16
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	16
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	17

PRISMA 2009 Checklist

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: **www.prisma-statement.org**.

Section/topic	#	Checklist item	Reported on page #	Reported in abstract	Reported in Suppl.
DATABASES					
Databases	1	Describe fully all databases searched.	4	x	
Database name	1A	Name each individual database searched.	4	x	
Interface	1B	State the platform, interface, provider, vendor, or host system for each database searched.	n/a		
Dates of Coverage	1C	List the dates of coverage for each database searched.			x
Multidatabase Searching	1D	If databases were searched simultaneously through a single interface, state the name of the interface and list all of the databases included and their dates of coverage individually.	n/a		
ADDITIONAL INFORMATION SOURCES					
Additional information sources	2	Describe all other information sources and methods used as part of the search process.	4-5		
Online resources	2A	List any trials registries, web search engines, specific web sites, conference proceedings, or other resource searched, including their dates of coverage.	n/a		
Manual searching	2B	If manual searching or handsearching was conducted, list the names of all handsearched sources, including the dates of coverage.	n/a		
Citation searching	2C	Indicate whether cited references or citing references were examined, and describe any methods used for locating cited/citing references (e.g., manual search; name, platform, and dates of coverage for any citation index used; email alerts).	5		
Text analysis methods	2D	Describe or cite pre-defined individual or sets of records and/or software or applications used for textual analysis to derive search terms or for other automated text-mining techniques.	n/a		
Contacts	2E	Indicate whether additional studies or data were sought by contacting authors, experts, manufacturers, or other contacts.	n/a		
Other methods	2F	Describe any additional supplementary search methods used.	n/a		
LIMITS AND RESTRICTIONS					
Limits and restrictions	3	Specify that no limits were used or describe any limits or restrictions applied to each search and provide justification for their use, including: a. Date or time period; b. Language; c. Publication status; d. Human or Organism; e. Study design; f. Database subsets; g. Pre-specified cut-off points for inclusion of search results (e.g. from internet searches); h. Other restriction	4-5		x
FILTERS AND PRIOR WORK					
Search filters	4	Indicate and cite when published search filters or hedges were used for any search, and whether they were modified or adapted from their published versions.	n/a		
Prior work	5	Indicate and cite when search strategies from other literature reviews were adapted or reused for part or all of the search.	n/a		
FULL SEARCH STRATEGIES					
Full search strategies	6	Include the search strategies for each database and resource, copied and pasted exactly as run, including any updates.			x
DATES OF SEARCHES					
Dates of searches	7	For each source, provide the date when the search and any subsequent update(s) occurred.	4		x
UPDATES					
Updates	8	Report the methods used to update the search(es).	4		x
SEARCH DESIGNER(S)					
Search designer(s)	9	Describe who designed and/or executed the search.	4		
PEER REVIEW					
Peer review	10	Describe any search peer review process.	n/a		
MANAGING RECORDS					
Total records	11	Document the total number of references identified from each database and additional information source.			x
Deduplication	12	Describe the processes and any software used to deduplicate records from multiple database or other resource searches.			
Records screened	13	Document the number of records for screening after duplicates removed.			x

Preferred Reporting Items for Systematic review and Meta-Analysis Searches (PRISMA-S) 2019 statement
Rethlefsen ML, Koffel JB, Kirtley S, Waffenschmidt S, Ayala AP, PRISMA-S Group.
Version 1.0, released March 20, 2019.

Supplementary File 3. Search strategy details.

The initial search was conducted on November 23, 2016.

Database	Search strategy	Number of results
PubMed	("contraceptive" OR "contraception" OR "contraceptives") AND ("stockout" OR "stockouts" OR "stock-out" OR "stock-outs" OR "stock out" OR "stock outs" OR "supply chain")	31
JSTOR	("contraceptive" OR "contraception" OR "contraceptives") AND ("stockout" OR "stockouts" OR "stock-out" OR "stock-outs" OR "stock out" OR "stock outs" OR "supply chain")	149
Total		**180**

The search update was run on July 12, 2019. No date or language limits were used.

Database	**Search strategy**	**Number of results**
PubMed (1966-)	(("contraceptive agents"[Pharmacological Action] OR "contraceptive devices"[MeSH Terms] OR ("contraceptive"[All Fields] AND "devices"[All Fields]) OR "contraceptive devices"[All Fields] OR "contraceptive"[All Fields] OR "contraceptive agents"[MeSH Terms] OR ("contraceptive"[All Fields] AND "agents"[All Fields]) OR "contraceptive agents"[All Fields]) OR ("contraception"[MeSH Terms] OR "contraception"[All Fields]) OR ("contraceptive agents"[Pharmacological Action] OR "contraceptive agents"[MeSH Terms] OR ("contraceptive"[All Fields]	58

	AND "agents"[All Fields]) OR "contraceptive agents"[All Fields] OR "contraceptives"[All Fields])) AND (stockout[All Fields] OR stockouts[All Fields] OR "stock out"[All Fields] OR "stock outs"[All Fields] OR stock-out[All Fields] OR stock-outs[All Fields] OR "supply chain"[All Fields])	
Embase (1947-)	('contraceptive'/exp OR contraceptive OR 'contraception'/exp OR contraception OR 'contraceptives'/exp OR contraceptives) AND (stockout OR stockouts OR 'stock out' OR 'stock outs' OR 'supply chain'/exp OR 'supply chain')	83
Web of Science (1900-)	((contraceptive OR contraception OR contraceptives) AND (stockout OR stockouts OR “stock out” OR “stock outs” OR stock-out OR stock-outs OR “supply chain”))	42
Popline (1970-)	(contraceptive OR contraception OR contraceptives) AND (stockout OR stockouts OR "supply chain")	197
Total		380
Number of duplicates		130
Total after de-duplication		**251**

Description of Included Studies Table

Authors	Geography	Study Objective	Sample Size	Methods and Measures of Stock-out Impact [a]
Silumbwe et al. (2018)	Kabwe District, Zambia	To explore barriers and facilitators to provision and use of family planning services	• 12 focus group discussions (FGDs) were conducted with 114 community members of reproductive age	Qualitative Measure of Impact • In FGDs, participants discussed barriers and facilitators to contraceptive use
Dansereau et al. (2017)	Chiapas, Mexico	To understand the views of and barriers to family planning services in the poorest regions of Chiapas, Mexico in order to design interventions that are effective and culturally appropriate	• 44 FGDs with 292 women, adolescent women, and men	Qualitative Measure of Impact • In FGDs, participants discussed family planning topics, including their ability to access contraceptives
Jalang'o et al. (2017)	Rural Kenya	To establish determinants of contraceptive uptake among postpartum women	• 2 FGDs with a total of 20 postpartum women	Qualitative Measure of Impact In FGDs, mothers were asked about their views on family planning methods, use, availability, access, and barriers to access
Nieto-Andrade et al. (2017)	Luanda, Angola	To assess the link between women's choice of contraceptive methods and availability of these methods	• Original analyses from three surveys: a 2012 family planning survey, a 2014 retail survey, and a 2015 retail survey	Quantitative Measure of Impact • Descriptive statistics of the 2012 survey include the unmet need for preferred contraception, which is defined as the percentage of sexually active women who are currently using contraception but are not

				using their preferred method. •For both retail surveys, availability of contraceptive methods on the market was calculated for each year and was defined as the percentage of public and private sector facilities that reported distributing or selling different types of contraceptive methods
Grindlay et al (2016)	Kamuli and Mbarara districts, Uganda	To explore the impacts of contraceptive stock-outs on women and providers, as well as to examine how policymakers perceived and managed stock-outs	• 8 FGDs with a total of 50 women • 24 in-depth interviews (IDIs) with providers and health facility managers • 11 IDIs with policymakers and decision makers	<u>Qualitative Measure of Impact</u> • In FGDs, women who had ever used or tried to use a method of contraception discussed their experiences obtaining contraceptives and mechanisms for coping with stock-outs, as well as the impacts of stock-outs on themselves and others • IDIs covered mechanisms to deal with stock-outs and perceptions of the impacts of stock-outs
Baraka et al (2015)	Kilombero district, Morogoro Region, Tanzania	To identify providers' perspectives on the challenges of addressing unmet need for contraception	• 22 key informant interviews (medical officers, district health coordinators, nurses, and clinical officers) • 4 FGDs with 6-8 providers each	<u>Qualitative Measure of Impact</u> • In IDIs and FGDs, providers discussed societal, cultural, and economic factors that influence their ability to provide services, as well as logistical and operational challenges

Farmer et al (2015)	Kayonza district, Rwanda	To identify factors contributing to and hindering use of family planning services, and to understand community perspectives on the quality of services	• 96 IDIs with male and female community members • 48 IDIs with community health workers • 15 IDIs with health facility nurses representing all 8 health centers in the catchment area of the district's Rwinkwavu Hospital	<u>Qualitative Measure of Impact</u> • IDIs covered a range of topics related to reproductive health, including experiences using or promoting contraceptive methods
Skiles et al (2015)	Malawi	To link individual-level data on women's use of injectable contraceptives with logistics data from service delivery points to better understand how facilities and product supply impact contraceptive use and demand for services	• 423 injectable contraceptive service delivery sites • 22,480 women aged 15-49 years	<u>Quantitative Measure of Impact</u> • Linear probability models were used to understand associations between access to services, reliability of supplies on injectable use, and demand for birth spacing • The variable capturing contraceptive stock-outs was defined as a woman's distance to a facility with a reliable stock of injectable contraceptives; the reliability component was measured using an index composed of monthly data on availability of injectables; this operationalization of the variable makes it hard to isolate the effect of stock-outs independent of distance • The analysis excluded private sites *a priori* and

				excluded any public site with missing facility geographic coordinates, potentially introducing omitted variable bias, although >90% of women in urban areas accessed injectables at public facilities • Women could not be matched to individual facilities they actually used, so women were linked to all facilities in a cluster that offered injectables
Tumlinson et al (2015)	5 urban areas of Kenya	To investigate the relationship between the quality of family planning services and contraceptive use among women living in urban areas of Kenya	• Individual survey data from 3,990 women • Facility audits of 260 facilities in 5 urban areas of Kenya	<u>Quantitative Measure of Impact</u> • A multivariate model aimed to identify the aspects of family planning service quality that influenced contraceptive use, with contraceptive stock-outs included as a covariate • The measure of stock-outs included in this model was defined as the number of methods provided at a facility that have not been stocked out in the previous year (measured on a scale from 0-8)
Akol et al. (2014)	Lowero, Nakasongol, Mayuge, and Bugiri districts, Uganada	To assess family planning services provided at private-sector drug shops after training staff to provide contraceptive methods.	• 585 structured questionnaire for clients of 54 drug-shops.	<u>Quantitative Measure of Impact</u> • Questionnaires asked users if they had received their last contraceptive method elsewhere. Those that had switched providers selected their reason(s) for doing so. • Results were limited to understanding the choice

				of a drug-shop as a source of family planning services over other sources.
Cover et al (2014)	Three districts in Senegal and two districts in Uganda	The study assessed the brand Sayana Press compared to traditional intramuscular Depo-Provera or DMPA (brand of depot medroxyprogesterone acetate) injectables	• 58 semi-structured IDIs with clinic providers and community health workers	<u>Qualitative Measure of Impact</u> • IDIs discussed supply management challenges with DMPA injectables • Limited focus on the impact of contraceptive stock-outs as study was primarily about the introduction of Sayana Press
Daff et al (2014)	Pikine and Guediawaye districts, Dakar Region, Senegal	To review the results of a supply-chain study in order to better understand the magnitude and reasons for contraceptive stock-outs and to explain the effects of the designed intervention to address the identified root causes	• Surveys of 156 contraceptive users	<u>Quantitative Measure of Impact</u> • Contraceptive user surveys asked consumers who had experienced stock-outs how stock-outs impacted their use of contraception
Lebetkin et al (2014)	Amansie West and Ejisu-Juabeng Districts, Ghana	To assess if allowing licensed chemical shops to sell injectables would increase access to and use of the method	• 298 telephone surveys with women who purchased an injectable from chemical seller shop. Open-ended questions about reasons for purchasing the injectable at a chemical shop rather than a	<u>Quantitative Measure of Impact</u> • Clients were asked to name reasons they purchased the injectable from chemical shops, as well as reasons why they did not obtain the method from other locations if they could name other locations • Data were collected via mobile telephones, potentially excluding

			health facility were also asked.	populations without access to a phone and biasing the sample toward a higher socioeconomic group • Results were limited to understanding the choice of a chemical shop as a source of injectables
McKenna et al (2014)	Kenya and Rwanda	To understand barriers and facilitators to delivering a novel longer-acting injectable (LAI) services in Kenya and Rwanda	• IDIs with27 service providers and19 policymakers and program implementers	<u>Qualitative Measure of Impact</u> • IDIs discussed factors around introducing a potential LAI, including distribution approaches, although the focus was primarily on considerations for a novel LAI versus how the current supply environment impacted contraceptive use
Nakayiza et al (2014)	Nakasongola Ditrict, Uganda	To identify the determinants of preferred source of Depo-Provera (DMPA) among rural women in Uganda	• Survey data from 642 adult women who began using Depo-Provera three years prior to the evaluation	<u>Quantitative Measure of Impact</u> • A variable representing experiences of DMPA stock-outs was included in the multivariate regression, measured from the users' perspective; the outcome of interest in the model was preference for private source of DMPA over a public source • Authors offered little explanation of the variable "Ever experienced a stock-out;" we assumed the variable included experiences of stock-outs in public or private facilities
Hyttel, M (2012)	Uganda	To understand the physiological and social experiences of using	• Interviews with 10 male and five female policymakers	<u>Qualitative Measure of Impact</u> • During interviews, policymakers discussed

		injectables and how these experiences impact daily life and the development of community-based knowledge about side effects		how limited availability, accessibility and affordability of contraceptive methods negatively affected the delivery of family planning services • Limited exploration on the topic of stock-outs in this paper
Tolley et al (2012)	Kenya and Rwanda	To better understand the experiences, attitudes, and perspectives of women, providers, and policymakers on injectables and potential LAI products	• 19 FGDs with a total of 177 women • 27 IDIs with service providers • 19 IDIs with policy makers	<u>Qualitative Measure of Impact</u> • FGDs and IDIs discussed knowledge and experience related to DMPA, new approaches to long-acting injectables, and characteristics of potential users, although the focus on stock-outs was limited • Population of women was drawn from health facilities and excluded women who did not access family planning services through clinics or who do not use contraception at all
Burke and Ambasa-Shisanya (2011)	Nyando District, Kenya	To understand reasons women discontinue injectable contraceptives	• 14 FGDs were conducted: 4 with current contraceptive injectable users, and 2 with each of the following groups: husbands, mothers-in-law, community leaders, and service providers	<u>Qualitative Measure of Impact</u> • FGDs were conducted to identify reasons for discontinuation of contraceptives among women using services from Ministry of Health clinics

Hutchinson et al. (2011)	Tanzania, Kenya, and Ghana	To quantify differences in the quality of family planning services at public and private providers, and assess how these differences impact client satisfaction	•Data was collected from 386 facilities in Ghana, 323 in Kenya, and 482 in Tanzania •611 interviews with family planning clients were conducted in Ghana, 628 in Kenya, and 1,005 in Tanzania	<u>Quantitative Measure of Impact</u> • A facility inventory questionnaire was used to obtain data on family planning medicines and supplies offered. The indicator related to stock-outs was "stock inventory, organization, and quality." This variable included inventory of contraceptive supply present at the facility, stock organized by expiration date, and contraceptives protected from heat, water, and pests. Multivariate regression was used to examine the relationship between client satisfaction and quality measures, including facility inventory and total number of contraceptive methods offered. • Exit interviews were conducted with clients after their visit with a provider to determine their satisfaction with the services provided. Clients were asked if they encountered any problems that day during their visit, including "availability of medicines or methods at this facility". If a problem was identified, clients were asked if the problem was large or small for them. A binary measure of client satisfaction was created to compare clients that reported "no

				problem" versus those reporting any problem.
Gribble et al (2007)	Peru	To provide insight on how family planning policies changed and affected access to services in Peru	• Survey of 243 family planning providers operating in Ministry of Health facilities between 2002 and 2004	<u>Quantitative Measure of Impact</u> • The evidence addressing the impacts of stock-outs came from the survey of family planning providers; this survey asked providers how they responded when facing stock-outs of contraceptive commodities • The paper offered limited information on the how stock-outs were measured in the survey.
Mugisha and Reynolds (2007)	Bushenyi, Iganga, Lira and Mpigi districts, Uganda	To document providers' perspectives on societal and organizational factors influencing the quality of care and services they offer	•4 FGDs with 38 female nurses and midwives •16 IDIs with female nurses and midwives •9 IDIs with family planning managers	<u>Qualitative Measure of Impact</u> • FGD and IDI topics included providers' perceptions of quality of care and barriers to providing services
Rutenberg and Baek (2005)	Cameroon, Kenya, Namibia, South Africa, Uganda, Brazil, the Dominican Republic, India and Thailand	To evaluate the availability of family planning services for HIV-positive women during antenatal and postpartum care as well as the demand and use of these services	• 27 interviews with national program managers and stakeholders • Visits to 13 Prevention of Mother to Child Transmission	<u>Qualitative Measure of Impact</u> • Providers discussed the topic of stock-outs including the impacts of stock-outs on women's use of the stocked-out method and the PMTCT program

			(PMTCT) program sites in Kenya, Uganda, the Dominican Republic, India, and Thailand and 32 interviews with site managers and providers (2-3 per site)	
Chen and Guilkey (2003)	Rural Tanzania	To examine how three major components of Tanzania's family planning program (logistical support, trained providers, and communications programs) impact method choice	• 12,816 women pooled from 4 years of Demographic and Health Survey (DHS) data	<u>Quantitative Measure of Impact</u> • This study used multiple datasets from DHS, as well as facility surveys conducted in the same communities; women were linked to the closest facility of each type (hospital, health center, and dispensary) within 5 km of the community surveyed through the Tanzania Service Availability Survey and the Tanzania Reproductive and Child Health Facility survey • A multinomial logit was constructed, with both individual level covariates and covariates measuring exposure to family planning messages and supply-side variables • The variable in the model on contraceptive stock was the number of times a method was in stock at a facility within 5 km from a woman; this variable is an index of whether 5 different

				methods are in stock at 3 different facility types; this measure potentially included the effect of overall availability of contraceptive methods because some facility types may not offer all methods • Not all facilities could be matched between surveys, potentially biasing the sample
Magnani et al (1999)	Morocco	To quantify the effects of family planning programs on contraceptive use and intention by using data collected from household surveys in 1992 and 1995	• 910 married women who were not using a contraceptive method in 1992 answered questions in the 1992 and 1995 DHS surveys	<u>Quantitative Measure of Impact</u> • A two-equation bivariate model was constructed to understand determinants of intentions of contraceptive use and actual use, incorporating the effects of contraceptive intention on actual use in the second equation; data on supply side factors were included from a service availability module accompanying the household survey • A method availability index for public clinics was constructed by summing scores assigned to methods mandated to be offered at public clinics, factoring in availability on the date of data collection and stock-outs during the previous 6 months • The sample was limited to women who were interviewed included in both survey rounds, potentially introducing non-response bias

				• Although method availability was included as an independent variable in the model, the casual direction was not clear; the authors suggested having available stock of contraceptive methods may influence intention; services may be allocated in response to demand
Cotten et al (1992)	Clinic site in Niger and two rural clinics in the Gambia	To identify the extent of, and reasons for, contraceptive discontinuation among new users	• 650 women surveyed in Niger • 570 women surveyed in The Gambia	<u>Quantitative Measure of Impact</u> • New family planning clients were followed for 6-8 months and asked to participate in 3 surveys at study admission, at the end of the study, and a home-visit questionnaire for women at least one month late for a scheduled follow-up visit; the exit survey asked women to identify the reasons they discontinued a method • The authors only listed the top four reasons named for discontinuation by method type and country

* Sample size and methods described in Table 1 only pertain to the portion of the study that addressed the impact of contraceptive stock-outs. Study limitations influencing data on the impacts of contraceptive stock-outs are noted in the methods and measures column.