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**Delivering Sustainable Surgical Care in Rural, Resource-Limited Environments: An Analysis of the Jan Swasthya Sahyog Model in Rural India**

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**Abstract**

Lack of access to life-saving, essential surgical care in rural areas of low- and middle-income countries contributes to a high disease burden and traps many families in cycles of poverty and poor health. Systemic, largely intractable conditions have commonly made it difficult for governmental services to meet the surgical needs of the rural poor. Improving access to essential surgical care has been deprioritized as a public health concern relative to other initiatives because it is argued that surgical capacity building in such environments is an expensive and thus impractical public health intervention. Jan Swasthya Sahyog (JSS) is a community health program that has developed a successful delivery model for high-quality, affordable surgical care in the rural and economically constrained communities of central India. This analysis discusses (1) the conditions in rural Chhattisgarh that have contributed to limited access to surgical care; (2) the components of JSS’ delivery model that have enabled its success; (3) challenges in adapting the JSS model to other communities; and (4) additional novel strategies that can augment the JSS approach.

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# Introduction

It is estimated that approximately 30% of the global burden of disease is surgical in nature (Shrime 2015c). The burden of conditions requiring emergency surgery is particularly high: annually, an estimated 896,000 deaths and 25 million in lost disability-adjusted life-years are attributed to 11 emergency conditions that are treatable by common and well-validated surgical interventions (Stewart 2013). Moreover, the burden of surgical disease disproportionately affects populations in low- and middle-income countries (LMIC): an estimated 80-90% of deaths from surgically-treatable conditions occur in these regions, due largely to significant disparities in access to essential surgical care when compared to high-income countries (HIC) (Ozgediz 2008).

Until recently, lack of access to essential surgical care was not widely viewed as a significant public health concern and improving access to such care remains deprioritized in favor of other public health initiatives; Dr. Paul Farmer has famously described surgery as “the neglected stepchild of global health” (Farmer 2008). One of the key arguments presented to support this viewpoint is the perception that surgery is an expensive and thus impractical intervention, particularly in limited-resource environments (Bae 2011, Farmer 2008). The provision of high-quality surgical care requires physical infrastructure, staffing, materials, and reliable public services (e.g., power, water, and waste management) that present logistical and cost challenges in many LMIC communities (Dare 2015).

Furthermore, the patient populations in rural areas of LMICs are often economically constrained and unable to afford surgical care. Among poor and middle class households within LMICs, nearly 20% of individuals who undergo surgery face resulting catastrophic health expenditures; in contrast, fewer than 4% of poor and middle class households within HICs are at risk for surgically-related catastrophic expenditures (Shrime 2015a).

Both non-governmental and governmental organizations have attempted to address gaps in access to surgical care through temporary platforms such as short-term surgical missions or camps that are often condition-specific; however, these solutions are controversial and widely considered to be inferior to developing local surgical capacity (Ginwalla 2015, McClenaghan 2013, Shrime 2015c). The perception is thus that offering high-quality surgical care on a sustained basis in rural LMIC communities is too expensive for both the provider and the patient.

Despite these concerns, essential surgical care has been shown to be a cost-effective public health intervention, even in limited-resource environments. The majority of common surgical interventions have cost-effectiveness ratios (CER) that are categorized as “very cost-effective” by the WHO (Chao 2014). The CERS for many surgical procedures in LMICs are comparable to or better than the CERs of widely-accepted public health interventions (Chao 2014). For example, the median CER of general surgery ($82.32 per DALY) is similar to the median CER of the BCG vaccine for tuberculosis ($51.86-$220.39 per DALY) (Chao 2014). Additionally, surgical health initiatives in LMICs have been shown to strengthen local health systems and economies (Chao 2014).

To investigate the question of whether the delivery of high quality, affordable surgical care is both feasible and sustainable in rural, limited-resource environments, this essay presents an analysis of Jan Swasthya Sahyog (JSS), a community health program that provides medical and surgical care to economically constrained rural patients in Chhattisgarh, India. This analysis seeks to (1) present the local conditions in Chhattisgarh that have historically impeded surgical capacity building; (2) identify the factors and replicable components of the JSS model that are key to its success in delivering surgical care; and (3) discuss potential challenges to and opportunities for adapting these components to surgical capacity building in other resource-constrained environments.

# Region Profile: Chhattisgarh, India

Chhattisgarh, a landlocked state in India’s central eastern region (see *Figure 1*), has a population of 32.2 million residents, 78% of whom live in rural areas and 65.5% of whom are classified as belonging to tribal groups (a historically disadvantaged segment of the local population) (Galhotra 2014). It has the highest poverty rate in the country: 40% of its population lives below the national poverty line, compared to 22% of the Indian population nationally (World Bank 2016c). More than half of its districts are classified by the federal government as remote, tribal, or extremist-affected areas (Galhotra 2014). Basic public infrastructure in this region is severely constrained. While the majority of households (87%) have access to electricity, only 27% of households (concentrated mainly in urban areas) have access to clean drinking water. Road density is significantly below that of the national average (2,915 km. vs. 3,231 km. per million people) (World Bank 2016b).



*Source: https://www.mapsofindia.com/chhattisgarh/*

Figure 1. Map of Chhattisgarh, India

The location of JSS’ core facilities is outlined in red.

# General State of Healthcare in Rural Chhattisgarh

Presently, the healthcare needs of Chhattisgarh are serviced primarily by a network of government-operated facilities. However, due to poor oversight, institutional corruption, and budget constraints, the public health system has largely failed the rural population; thus, most residents lack access to basic medical care (Rajshekhar 2010). Many facilities, established under poorly-planned central planning initiatives, are plagued by dilapidated infrastructure and chronic shortages of medical supplies (Panagariya 2008).

The public healthcare system is further crippled by severe understaffing. Despite aggressive government initiatives, nationally, fewer than 20% of the surgical workforce practices in rural areas, where 70% of the population resides (Belle 2015). State-wide, Chhattisgarh’s residents have at most 30-43% of the number of estimated physicians required to adequately staff healthcare facilities (Galhotra 2014, Rao 2013); access to physicians is widely perceived to be significantly lower in rural areas and for most of the state’s economically disadvantaged residents (Galhotra 2014, Nandi 2018). In rural areas of Chhattisgarh, physician density is estimated at 4 physicians per 100,000 residents (Bajpai 2014).

Efforts to recruit physicians to rural areas with incentives like higher pay have been largely ineffective (Ghosh 2018). Due to difficult working conditions and low accountability, employee absenteeism is rampant (Panagariya 2008). Of those providers who report to work, a significant proportion have not received any formal medical training and reports have emerged of providers illegally charging patients for services that are supposed to be provided for free (Bawaskar 2015). A test of medical knowledge on regionally common health conditions that was taken by both physician and non-physician clinical providers (i.e., rural medical assistants, ayurvedic medicine and yoga practitioners, and pharmacists) practicing in Chhattisgarh found that diagnostic accuracy ranged from 54% to 86% and appropriate treatment prescriptions ranged from 33 to 61% (Rao 2013).

The majority of Chhattisgarh’s rural poor are also unable to afford medical care. Although all residents living below the national poverty line are eligible for Rashtriya Swasthya Bima Yjana (RSBY), a state-funded universal health insurance program, the availability of hospitals that accept RSBY within a given district has been found to be inversely correlated with RSBY enrollment rates in that district (Nandi 2018). In other words, affordable health care is the least available to those residents of the state who need it the most. Given the significant lack of healthcare resources in the region, it is unsurprising that Chhattisgarh ranks in the bottom quartile of multiple health metrics among India’s 30 states (Galhotra 2014, World Bank 2016a).

Inadequate infrastructure; endemic poverty; and a chronic staffing shortage made worse by low accountability and variable professional competence combine to chronically hamper governmental efforts to improve access to healthcare for Chhattisgarh’s rural communities.

# Access to Surgical Care in Rural Chhattisgarh

Presently, the overwhelming majority of Chhattisgarh’s rural poor lack access to essential surgical care (Dutta 2020, Nandi 2018, Rao 2016). Due to the lack of published data, precise figures are not available to define the magnitude of this problem; however, recent studies on common conditions requiring surgical intervention provide some insights. Acute abdominal conditions (AAC) are the major cause of premature mortality in India; 87% of these deaths occur in rural areas, outside of hospitals (Dare 2015). Patients who seek medical care typically present in the late stages of the disease, when life-saving treatment necessitates an exploratory laparotomy (i.e., emergency abdominal surgery) (Dare 2015). In a nationwide study, Chhattisgarh was identified as having some of the highest mortality rates due to AACs in the country, along with poor geographic access to appropriate surgical facilities (see *Figure 2*) (Dare 2015). Among individuals 15-39 years old, traumatic injuries, many of which typically require surgical intervention, accounted for 35.8% of all deaths. (IHME 2016). It is believed that these figures significantly under-represent the true number of trauma-related and AAC cases requiring surgical treatment (Dare 2015). Despite improvements in maternal care, maternal mortality rates remain high in part because many women do not have access to obstetric surgical care: only 35.4% of women in rural areas of Chhattisgarh deliver in a healthcare facility (Vital Statistics Division 2013).



*Source: Dare, et al. (2015)*

Figure 2. Geographical Variations in Death Due to Acute Abdominal Conditions (AAC) in India, 2007-08

(A) displays age-standardized death rates. (B) displays high- and low-mortality clusters; Z scores reflect the number of standard deviations away from the mean national mortality rate due to AACs. Chhattisgarh (identified in the maps as *CG*) contains some of the highest mortality rates due to AACs across the country, with mean mortality rates in the state significantly above the national average.

Morbidity and mortality due to lack of access to surgical care in Chhattisgarh disproportionately affects the rural poor (Dare 2015). This group is also more likely to develop conditions that require surgical intervention. For example, inguinal hernia repairs, which constitute 45% of all surgical procedures performed in rural areas of India, occur most commonly in adult men who engage in heavy physical labor (a known risk factor for developing hernias) (Belle 2015, Rao 2016). In neighboring southern Odisha, where residents share similar economic and sociocultural demographics with residents of Chhattisgarh, 75% of adults are laborers or farmers; most households are so poor that farmers perform ploughing work typically done by oxen (Meher 2007).

Short-term mass surgery camps have periodically been organized by state health officials to address the surgical needs of rural communities where permanent health facilities are unavailable. However, these camps are controversial due to reports of poor oversight, emphasis on high surgical volume and quick operative case turnover at the expense of patient outcome, the absence of post-operative patient support or follow-up, and high complication rates (Dutta 2020). In one tragic incident, a state-run surgical camp that performed laparoscopic tubectomies on rural Chhattisgarh women resulted in the deaths of 13 women and over 70 critically ill post-operative patients (Dutta 2020). Unsurprisingly, these incidents as well as the chronic shortcomings of public services have fostered distrust of government-provided healthcare among India’s rural and tribal poor (Meher 2007, Balgir 2011, Contractor 2018).

The impact of limited access to affordable, essential surgical care in these communities extends beyond the health of affected individuals. India’s rural poor are significantly more likely to incur financially catastrophic medical costs, higher out-of-pocket expenditures relative to their assets, and high interest rates for medically-related loans (Meher 2007, Ravi 2016). Moreover, common surgically treatable conditions such as AACs and trauma injuries all predominantly affect married, adult rural men in their prime productive years (Meher 2007, Rao 2016). As such, for the rural poor, lack of access to surgical care is financially catastrophic in part because many conditions requiring surgical intervention can debilitate or kill the family’s primary income provider. In addition to generating a high burden of disease, lack of access to affordable surgical care in Chhattisgarh undermines economic progress in the region.

# Jan Swasthya Sahyog Improves Access to Surgical Care

Across rural India, access to surgical care has been improved through various physician-driven, local non-profit initiatives (Belle 2015, Gawande 2015, Rao 2016, Sethuraman 2016). Despite the controversies surrounding short-term surgical camps as discussed in previous sections, surgical success rates in some of these programs are high. In one study of general surgeries performed in a surgeon-run, rural surgical camp in Maharashtra State, 92.2% of surgical procedures performed were considered fully effective (Belle 2015). Rather than competing with government healthcare resources, these initiatives provide surgical care to individuals who otherwise would not have access to treatment (Gawande 2015, Rao 2016, Sethuraman 2016). They have also helped to improve existing public healthcare systems by serving as models of efficient healthcare delivery and occasionally advising local governments on how to implement similar initiatives in public hospitals (Sethuraman 2016). One critical component to the success of these programs is their ability to create highly-localized, cost-effective systems tailored to the unique needs of the rural communities they serve (Thomas 2015).

Jan Swasthya Sahyog (JSS), a non-profit healthcare delivery system, is one such success story. It was established in 1997 by a team of Indian physicians in the Bilaspur district of Chhattisgarh to serve a rural, economically destitute region with a large population of tribal and disadvantaged subgroups (Sethuraman 2016). Beginning with a 15-bed clinic, the organization has gradually expanded to a 100-bed hospital that offers on-site radiologic, laboratory, equipment sterilization, and blood bank services (Jain 2020, Sethuraman 2016).

Presently, it provides high-quality, accessible, and affordable surgical care to many of the area’s poorest residents. Because JSS’ patients span over 10 districts across Chhattisgarh and the neighboring state of Madhya Pradesh, the organization has also expanded to offer primary care through mobile clinics and village health centers that operate in a hub-and-spoke system to refer complex cases back to the main clinic or other tertiary centers (Jain 2020, Sethuraman 2016). In addition to surgery, the hospital also offers non-surgical, complex medical care such as oncologic treatments and an ICU within its emergency ward equipped with five ventilators available for use in critically ill patients. Its patient volume is estimated at approximately 50,000 annually and 300-400 daily (Jain 2020).

While non-governmental healthcare facilities are not uncommon in rural India, JSS is novel in its ability to provide high-quality, low-cost surgical care to the rural poor on a sustained basis (Sethuraman 2016). Since its inception, JSS has performed more than 25,000 essential and emergency surgical procedures in the areas of general surgery, orthopedics, trauma, pediatrics, gynecology, and obstetric care (JSS n.d.). These procedures are offered at JSS for a fraction of the practice charged by area hospitals or without charge for patients who cannot afford to pay (JSS n.d., Sethuraman 2016). *Table 1* provides a comparison of prices charged at JSS and the nearest comparable public hospital for three common surgical procedures.

Table 1. Comparison of Patient Fees for Common Surgical Procedures

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*Data Source: Sethuraman, et al. (2016)*

Shri Ram Care (SRC) Hospital is the nearest hospital in Bilaspur District, Chhattisgarh that offers a comparable standard of surgical care. RSBY-approved rates are amounts that the central government will cover for each procedure under the subsidized health insurance plan for the poor. For many procedures, JSS’ fees are a fraction of what other facilities offer.

The clinic’s successes have yielded measurable improvements in health outcomes within the communities served by JSS. For example, from 2000-2013, the infant mortality rate dropped from 119 to 22.5 deaths per 1,000 live births in areas served by JSS, compared to a current rate of 59 deaths in the rest of Chhattisgarh (JSS n.d.).

# Key Replicable Components of the JSS Model

JSS’ success in establishing a sustainable delivery model for surgical care in rural Chhattisgarh can be attributed to its implementation of three key principles.

1. **Make surgical care affordable for the rural poor by realizing cost savings without compromising high quality of care or patient safety.**

These savings are achieved through:

1. Infrastructure planning that prioritizes long-term over short-term savings and improves quality of care. In some instances this principle has led JSS staff to purchase equipment such as generators that are less technologically advanced or reliable than newer alternatives but that are serviceable by local technicians. In other instances this principle has led to higher initial capital investments such as the purchase of high-grade sterilization equipment that yield greater cost savings over time by reducing the clinic’s reliance on single-use, disposable sterile materials (Sethuraman 2016).
2. Cross-training of healthcare staff to perform a wide variety of tasks and procedures. All physicians on staff, for example, are expected to interpret radiologic findings without the assistance or confirmation of a consultant radiologist and to provide cross-coverage for medical services that in a traditionally-run tertiary center would be staffed by specialists (Sethuraman 2016).
3. Pragmatic surgical innovations to lower the variable costs of surgery, including (1) novel adaptation of inexpensive, locally available materials for surgical use; and (2) modification of surgical techniques to minimize waste.
4. Recycling and reuse of disposable supplies. For example, disposable examination gloves are washed and repurposed for non-sterile reuses (Sethuraman 2016). While such approaches for the handling of disposable medical supplies are uncommon and possibly not cost-effective in HICs, they present a practical solution to supply logistics in rural Chhattisgarh, where even basic items are often difficult or unavailable to re-stock.
5. **Address chronic provider shortages by establishing a teaching environment for healthcare trainees.**

Administrators at JSS report that a high-volume, clinically rich training program has attracted motivated medical and nursing trainees who volunteer to provide care under the supervision of attending physicians. While these training commitments are typically short-term and not an optimal solution to staffing, they are a pragmatic approach given the difficulties of attracting medical staff to rural areas. Trainees enable the organization to serve more patients and raise public awareness for the clinic’s initiatives, all at lower staffing cost to the facility.

This teaching-focused culture has also resulted in the publication of epidemiologic and medical findings from studies of JSS’ patient population (Chowdhury 2019, Kole 2019, Vikram 2020). The published research yields multiple benefits, including contributing to the medical and public health literature and raising public awareness of the organization’s activities.

1. **Overcome community distrust of healthcare providers by building a patient-centered approach to the delivery of care.**

This strategy includes low-cost, high-impact initiatives such as (a) partnering with current village health workers to strengthen referrals to JSS; (b) providing free on-campus camping and cooking facilities for families during post-operative inpatient admissions; and (c) training staff in patient engagement and communications skill building.

# Challenges and Opportunities in Adapting the JSS Model

In addition to realizing cost savings in its surgical operations, organizations seeking to replicate JSS’ success must also address staffing challenges; secure funding to cover operational costs that frequently exceed payments received for services; and achieve buy-in from local community stakeholders.

Staff recruitment and retention are common hurdles to clinical capacity building in many rural areas (Ghosh 2018, Van Essen 2019). Since the majority of trainees who rotate through JSS’ facilities agree can only commit to short-term engagements during their initial visits, the organization views its teaching arm as both a pragmatic staffing solution and a recruitment tool (JSS n.d., Sethuraman 2016). As discussed in previous sections, financial incentives alone are not sufficient to recruit and retain personnel; as such, JSS has partially addressed the challenges presented by its lean staffing structure through heavy cross-training and appeal to providers who desire to work with medically underserved patient populations. Long-term retainment of highly-trained medical professionals in rural areas remains a significant challenge, particularly in LMICs (Van Essen 2019).

Despite JSS’ many cost-saving measures, funding will also likely present a major challenge to establishing surgical capacity in any limited-resource environment. JSS has historically received significant financial support from private and non-profit organizations since the low fees charged for procedures do not cover many fixed operational costs (Sethuraman 2016). In its fiscal year ending 2019, grants constituted 55.8% of JSS’ total income while receipts from activities constituted 32.2% of total income (JSS 2019). Some community health programs have successfully secured financial support from governmental sources; however, in LMICs, where even public facilities are chronically underfunded, this is likely at best a supplemental source of income. It is reasonable to anticipate that any new community surgical program will similarly have to rely heavily on institutional funding, which may be particularly difficult for a new organization to secure in a pilot year.

The historical conditions surrounding access to medical care in a community can also engender wariness among that community’s stakeholders towards new healthcare initiatives. Establishing a program that offers high-quality, affordable surgical care in a resource-limited environment is a multi-phase process that can benefit from behavioral and community health science approaches to engage various community stakeholders. One key starting point is to execute a community needs assessment. The goals of the assessment should be to (1) identify the surgically-treatable conditions with the largest public health burdens as well as the services and concerns that are most important to the community’s residents; (2) gain buy-in from local leaders and other stakeholders; (3) guide optimal site location; and (4) increase community awareness and begin outreach efforts to build trust and improve engagement across multiple stakeholders.

Although not explored in detail in this paper, technological innovation and improved global supply chain logistics have also presented opportunities for lowering the costs of surgical equipment and materials. Some recent notable examples include low-cost versions of surgical equipment such as external fixation devices (for fractures) and laparoscopes; pulse oximeters and other anesthesia monitoring equipment designed specifically for low-resource settings; and the use of telemedicine for live, perioperative surgical consultant guidance (Bolton 2019). The combined utilization of cost-saving measures developed in high-income countries and innovations sourced from the local environment where surgical care will be provided will help to maximize the potential for economic efficiency.

Another promising model for sustainability can be found in community health programs that integrate access to medical care with non-medical community initiatives such as environmental conservation and economic development. Alam Sehat Lestari (ASRI), one such organization established on the outskirts of an environmentally threatened national park in rural Indonesia, runs a primary care clinic where local villagers can pay for services in non-cash payments such as seedlings, manure, and locally-produced crafts. These materials, which are codified in a pre-set cash equivalency list, are then used to support local reforestation and environmentally sustainable economic development efforts (ASRI 2018, HIH 2013). While patients’ non-cash payments do not directly address the organization’s financial needs, ASRI’s novel integration of environmental conservation and economic development efforts with the provision of essential medical care has attracted significant external donor funding and bolstered local governmental and community support of the clinic and its activities (HIH 2013). Additionally, because environmentally disastrous activities such as illegal logging in the national parks are most often undertaken by local villagers to pay for catastrophic medical expenses (Webb 2016), aligning conservation and economic development efforts with affordable medical care is an approach that has yielded profound symbiotic benefits for both ASRI and the communities it serves. Integrating access to medical care with other major, non-medical needs of local communities is a promising healthcare delivery model that warrants further investigation.

# The Public Health Relevance of the JSS Model

The Centers for Disease Control and Prevention (CDC) has specified several key factors to guide the identification of public health concerns. The CDC defines a public health problem as one that (1) affects a large number of individuals; (2) has the potential to cause serious disability or death to those affected; (3) carries significant economic and/or social costs; and (4) can be addressed by evidence-based, easily implemented interventions (CDC 2013).

As demonstrated in this essay, the burden of surgical disease in limited-resource environments such as rural India is an issue that meets all four criteria. However, recognition and acceptance of essential surgery as a public health concern has only recently begun to gain widespread acceptance (Gawande 2015). Relatedly, the literature on community-focused surgical initiatives in LMICs remains limited; for instance, a recent systematic review of studies on the quality of surgical care in LMICs found that fewer than 6% of studies evaluated issues surrounding equity in access to surgical interventions (Saluja 2019). While LMICs face heterogeneous obstacles in improving surgical capacity, many of the broader challenges – e.g., funding, infrastructure, and community acceptance – are nearly universal. Studies of organizations such as JSS that have been successful in addressing these challenges can thus provide valuable insights into the approaches that are likely to be useful in establishing surgical care for other resource-constrained communities.

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