International Journal of Gynecology and Obstetrics 130 (2015) E25–E30

Contents lists available at ScienceDirect

International Journal of Gynecology and Obstetrics

journal homepage: www.elsevier.com/locate/ijgo

SUPPLEMENT ARTICLE

Lessons from a geospatial analysis of depot medroxyprogesterone acetate sales by licensed chemical sellers in Ghana

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ARTICLE INFO

Keywords:
Depot medroxyprogesterone acetate
Family planning
Geospatial analysis
Ghana
Geographic information systems
Licensed chemical sellers

ABSTRACT

Objectives: To map access to depot medroxyprogesterone acetate (DMPA) from licensed chemical sellers (LCS); to estimate the proportion of women of reproductive age in areas with access; and to examine affordability and variability of costs. *Methods:* A geospatial analysis was conducted using data collected from 298 women who purchased DMPA from 49 geocoded LCS shops in the Amansie West and Ejisu-Juabeng districts of Ghana from June 4 to August 31, 2012. The women reported on cost and average distance traveled to purchase DMPA. *Results:* In Amansie West, 21.1% of all women of reproductive age lived within average walking distance and 80.4% lived within average driving distance of an LCS. In Ejisu-Juabeng, 41.9% and 60.1% of women lived within average walking and driving distance, respectively. Distribution of affordability varied across each district. *Conclusions:* Access to LCS shops is high, and training LCS to administer DMPA would increase access to family planning in Ghana, with associated time and cost savings.

1. Introduction

Ghana is largely on track to meet the United Nations Millennium Development Goals [1]; however, maternal health indicators, including the use of family planning, are not improving as quickly as other indicators. For example, the proportion of married women using modern contraception increased from 19% in 2003 to just 23% in 2011, while the unmet need for family planning is 26% [2]. In addition, the total fertility rate has remained almost unchanged in the past 10 years, decreasing from 4.4 births per woman in 1998 to 4.0 births per woman in 2008 [3].

An injectable contraceptive, such as depot medroxyprogesterone acetate (DMPA), is the most popular family planning method in Ghana, used by 9% of all married women [2]. Nevertheless, this method cannot be administered outside of health facilities because prescription and administration by a qualified medical professional (doctor, nurse, or midwife) is required.

Ghana has a critical shortage of trained health workers with only 11 per 10 000 population; indeed, this number falls far short of current WHO recommendations of at least 23 per 10 000 [4]. Furthermore, there is an urban–rural disparity in the distribution of health workers who can provide injectable family planning methods. Health facilities where DMPA can be administered are often under-staffed, suffer from lack of stock, and are not always accessible, particularly in rural areas.

Other countries have addressed these barriers by allowing provision of DMPA from community health workers [5–7], and through the use of non-pharmacy private-sector drug shops, where people in many countries receive their first-line health care [8–11].

Licensed chemical seller (LCS) shops are ubiquitous in Ghana, with over 9200 registered nationally (J. Nyoagbe, personal communication, August, 2013), compared with 3217 registered health facilities [12]. As privately owned businesses, LCS shops have incentives to meet the needs of their customers. Consequently, they are open for longer, have shorter waiting times, are perceived to have friendlier staff, and are less likely to experience lack of stock than health facilities [9]. Furthermore, LCS in Ghana previously demonstrated that, with appropriate training, they were capable of selling prescription anti-malarial medications and referring complicated cases to health facilities during the Mobilize Against Malaria project [13].

A previous study implemented by FHI 360 and conducted in the Ejisu-Juabeng and Amansie West districts of the Ashanti region of Ghana found that training LCS to safely sell DMPA and refer women to a qualified provider for the injection could increase access to this contraceptive method [14]. In all, 56% of women purchasing DMPA from LCS were new family planning users, and nearly all of them received the injection at the health facility to which they were referred

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http://dx.doi.org/10.1016/j.ijgo.2015.05.007

[14]. Of note, the coordinates of the LCS shops and health facilities were collected as part of this study, allowing the results to be analyzed geospatially.

The use of geographic information systems (GIS) for geospatial analysis is gaining popularity, and is recognized as a public-health tool with many applications [15]. Nevertheless, this approach remains underutilized. GIS applications allow outcomes to be demonstrated visually, and have frequently been used in disease surveillance and treatment programs [16–18], and to examine issues of equity and access to health facilities [19–22].

Many studies have assessed strategies to improve access to family planning services [23–27]; however, spatial examination of such interventions is lacking. The use of GIS has been limited to broad issues surrounding reproductive and maternal health, such as access to services and facilities [28–30]. Although some studies have examined access to family planning using GIS technologies [31–35], this approach is often used to incorporate spatial statistics into predictive models [31,33], rather than to create visual maps to aid in translating research results to practice. To date, geospatial analysis of access to drug shops has focused on the provision of anti-malarial medication [36,37], and the use of such analysis to measure affordability of family planning interventions is not common practice.

The present study aimed to conduct geospatial analyses of the results obtained in the parent study [14], and thereby aid evaluation of the program's impact and inform stakeholder decisions for future scale-up. The present study had two key objectives: (1) to use GIS to identify and map the geographic areas where women might have access to DMPA from a trained LCS based on the average travel distance, and estimate the proportion of women of reproductive age in those areas; and (2) to examine the affordability of accessing DMPA from LCS shops and model spatial variability of costs.

2. Materials and methods

2.1. Survey data

A geospatial analysis was conducted using data previously reported by Lebetkin et al. [14]. Approval for the parent study was obtained from the Protection of Human Subjects Committee, FHI 360, Durham, NC, USA, and the Ghana Health Services Health and Research Development Division, Ethical Review Committee, Accra, Ghana. All participants provided written informed consent at the time of purchasing DMPA. Consent was confirmed verbally at interview, which was conducted approximately 2–4 weeks after purchase to allow time to receive the injection. Participants were compensated with mobile phone credit valued at 2.00 Ghanaian cedis (approximately US $1.00).

Full details of the original methods are available elsewhere [14]. Briefly, from June to January, 2013, LCS from the Amansie West (n = 75) and Ejisu-Juabeng (n = 29) districts were trained to sell DMPA (Depo-Provera; Pfizer, New York, NY, USA) and refer users to health facilities to receive the injection. These 104 LCS were recruited from the group of 144 LCS who had participated in the Mobilize Against Malaria program [13], and so did not represent a census of all LCS in these two districts. A subset of LCS (n = 49) was randomly selected to consent family planning users (up to 10 per LCS) to participate in structured phone interviews about their experience purchasing DMPA and receiving the injection. Eligible users of these services were aged 18–49 years and had access to a telephone. Interviews were conducted among 237 women who had purchased DMPA from LCS shops in Amansie West (n = 40) and 61 women who had purchased DMPA from LCS shops in Ejisu-Juabeng (n = 9) during the period June 4 to August 31, 2012. The sample size was based on numbers that are meaningful to local decision makers; there was no formal hypothesis tested for the parent study.

Questions posed to users relevant to the present geospatial analysis related to distance traveled and costs associated with the purchase of DMPA from the LCS. Users self-reported distance traveled and mode of transport to the LCS shop where they purchased DMPA, and to the health facility where they received the injection. They also reported total costs associated with receiving DMPA, which included traveling to the LCS shop and the health facility, purchasing DMPA, and receiving the injection. Owing to unknown response or non-response to relevant interview questions, the sample size was reduced from 298 to 291 users for the distance analysis, and from 298 to 296 users for the cost analysis.

User responses were linked to the LCS shops where DMPA was purchased. No home addresses were collected. All participating LCS shops and referral health facilities were geocoded. Hand-held global positioning system devices were used to collect longitude and latitude in decimal degrees at these locations with accuracy within 5 m.

2.2. Geospatial analysis

Global positioning system data were combined with the interview data and displayed on maps. Additional external data was used for the analysis and creation of these maps. The spatial distribution of women of reproductive age was accessed from AfriPop, a project with datasets licensed under Creative Commons Attribution 4.0 International License, which used Ghana Statistical Service 2000 census data and a combination of growth rates to estimate the 2010 distribution at a spatial resolution of 100 m [29]. Administrative boundaries were downloaded from the Centre for Remote Sensing and Geographic Information Services, University of Ghana-Legon, Accra. Owing to redistricting that had occurred in 2008, some LCS shops fell outside of the current district boundaries. The road network dataset was produced with data from OpenStreetMap (www.openstreetmap.org). Spatial layers were projected into WGS 1984, UTM Zone 30S, and all geospatial analysis was completed using ArcGIS version 10.0 (Esri, Redlands, CA, USA).

The proportion of women of reproductive age within the mean distance traveled to the LCS shop to purchase DMPA, as well as within a range of distances (1–5 km) to both LCS shops and health facilities, was calculated. The mean distance traveled to the LCS shop was stratified based on mode of transport (walking or motorized) and district. Buffers were created around the LCS shops and health facilities to create zones within a range of specified distances traveled. Buffers were overlaid with the distribution of women of reproductive age to estimate the proportion in each district who might have access to LCS and health facilities. Although some LCS shops were located outside district boundaries, and women from nearby districts might be served by an LCS within the present study area, the analysis was restricted to district boundaries.

The cost for women traveling to LCS shops to purchase DMPA from any location in Amansie West was estimated by user self-report. A cost analysis was not performed in Ejisu-Juabeng owing to the small sample size. The analysis was conducted using inverse distance weighted interpolation, a geostatistical method that models costs at other locations using up to five known costs within a 10-km buffer, with the closest known costs given the greatest weight [38]. In addition to total costs, the model estimated 'potential' costs that might be incurred if women could receive the DMPA injection from the LCS. For this scenario, the cost of traveling to the health facility was removed, and the cost of receiving the injection at the LCS shop was assumed to be the same as at the health facility.

3. Results

The distribution of health facilities and LCS shops in the two districts is shown in Fig. 1. Users could purchase DMPA from 75 LCS shops in Amansie West, with injections available at 22 health facilities. Likewise, DMPA was available at 29 LCS shops in Ejisu-Juabeng, with 13 health facilities providing injections. The proportion of women of reproductive age within a given radius of an LCS shop was nearly always higher than the proportion within the same radius of a health facility (Table 1). For example, while 83.8% of women of reproductive age in