CommCare Evidence Base

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EXECUTIVE SUMMARY

This paper summarizes the evidence base for CommCare and closely related mobile applications for frontline workers. We reviewed all published papers and unpublished (gray literature) studies about the CommCare platform, all published papers on pertinent, alternative mobile systems, and several papers on highly relevant topics. This collection of 34 papers offers substantial evidence that CommCare improves access to, quality, experience, and accountability of services provided by frontline workers and directly impacts clients’ knowledge, attitude, and/or practice.

SCOPE

This paper is an informal meta-analysis of published and gray literature available about CommCare and similar mobile systems designed for frontline workers. CommCare is an open source mobile and web platform used by Frontline Workers (FLWs) across a variety of sectors, including community health workers, agricultural extension workers, mobile trainers, supervisors, etc. CommCare replaces cumbersome paper registers, reporting forms, and client education flipcharts with an open source, customizable software application that can run on a wide range of phones. FLWs register clients using customized electronic forms written in their native languages. During visits with clients, CommCare aids FLWs with real-time guidance on service delivery and follow-up. CommCare applications include multimedia elements (audio, images, video) to assist low-literate FLWs and provide powerful educational content to be used with clients. Client visits are logged and submitted in real-time to a central cloud server. Server-side software aggregates data and carries out automated performance analytics to identify strengths and weaknesses of individual FLWs, which enables more effective supervision and mentoring. A video demo of CommCare can be viewed online (http://tinyurl.com/commcaresystemoverview). With over 5,000 registered mobile users across 32 countries, CommCare is one of the most widely adopted and technically advanced mobile platforms for FLWs. Three critical properties of CommCare are:

- **Client tracking**: CommCare allows FLWs to register and track their clients. A client list is maintained on the phone, as is a longitudinal record of information about each client.
- **Decision support during client sessions**: CommCare is designed to be used by FLWs during meetings with their clients, and to improve the quality of those interactions with electronic checklists as well as step-by-step guidance through protocols.
• **Multimedia:** CommCare applications contain images, audio, and video. This makes the application much easier to use by lower-literate FLWs, and provides a powerful behavior change communication aid when multimedia is shown to clients.

Because these are critical properties of CommCare, applications that did not feature all three properties are not included in this review. For example, we are excluding pure data collection systems such as Open Data Kit or Magpi, as well as any applications for FLWs that run on the most basic phones, including pure SMS applications for FLWs such as those developed on RapidSMS. While these applications bring their own set of advantages, they provide a fundamentally different value proposition and were considered separately.

The papers we included that are not about CommCare can be divided into two categories: related systems and alternative systems. Related papers report on systems that are not currently supported by an organization, including early work on PDA-based systems that are considered to be precursors to CommCare [DeRenzi2008, Mitchell2012, Mitchell2013], as well as research that examines how FLWs use video with clients [Ramachandran2010]. Alternative systems are currently supported by other organizations and share the critical properties described above. The alternative applications we examine in this paper are mobile applications developed by D-tree International, Medic Mobile, eMocha, Virtuosos, Vodafone/Mezzanine, and Mobenzi. In an effort to identify all available, published papers, we corresponded directly with several creators of these mobile application systems. Note that D-tree International supports an alternative software application in addition to having contributed to several CommCare-related publications, though there are currently no publications on the alternative systems they support.

Our selected evidence base includes papers within the following four categories:

• **Published CommCare:** All published papers about CommCare (excluding posters).

• **Unpublished CommCare:** Selected unpublished studies about CommCare, also known as gray literature. We selected studies based on our belief that they added particular value to the evidence base.

• **Published Alternative:** All published papers we found about mobile applications for FLWs that are considered to be alternatives to CommCare.

• **Published Related:** Selected published papers that are highly relevant to CommCare. These include a paper about a PDA-based precursor to CommCare that was used in Tanzania, and research that focuses on engaging FLWs’ clients with video.

Additionally, each paper was classified as being in one of the following levels of evidence:

• **Level 1, Conceptual:** Papers discuss the theoretical possibilities and justifications for CommCare, but aren’t tied to any particular intervention or system implementation.

• **Level 2, Implementation Narrative:** Papers describe the process and lessons learned from system implementation, with little or no rigorous evaluation.

• **Level 3, Qualitative interviews:** Papers describe qualitative interviews, most often involving FLWs using a mobile tool.

• **Level 4, FLW Process Improvement:** Papers include quantitative changes to FLW processes or behavior, such as visit rates, data completeness, etc.

• **Level 5, Client Knowledge, Attitude, Practice (KAP):** Papers present evidence that a mobile system directly impacts client knowledge, attitude, and/or practice.
• **Level 6, Outcomes:** Papers present evidence that a mobile system directly impacts client health outcomes.

The levels of evidence are organized by the paper’s rigor in addressing whether CommCare can improve client health outcomes. Note that because CommCare is used across several sectors, only health-related studies could fulfill the Level 6 criteria.

THE EVIDENCE BASE

Table 1 below describes all of the papers included in the evidence base, and is organized by level of evidence. For each paper, we provide the following information:

- **Level:** Indicates the paper’s level of evidence (1-6), as outlined above.
- **Key:** Each paper was assigned a short reference code. This includes the leading author’s last name and date of publication. An asterisk is included if the paper is summarized in the appendix.
- **Highlights:** Provides a short summary of some key study findings.
- **Platform:** Indicates whether the paper focuses on CommCare or an alternative mobile system for FLWs.
- **Published:** Indicates if the selected paper has been published or is gray (not published). Posters are counted as gray literature.
- **Country:** Papers that describe work that took place in one or more countries are listed. “None” is written if the paper is not tied to a specific country. “Many” is listed if the paper describes work from more than three countries.
- **Year:** If published, the year of the publication. If gray, the year of the study.

<table>
<thead>
<tr>
<th>Level</th>
<th>Key</th>
<th>Highlights</th>
<th>Platform</th>
<th>Published</th>
<th>Country</th>
<th>Year</th>
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<tbody>
<tr>
<td>1</td>
<td>Bollinger2011</td>
<td>Describes potential for smart phone applications to empower health workers, and need for evaluation.</td>
<td>eMocha</td>
<td>Published</td>
<td>Many</td>
<td>2011</td>
</tr>
<tr>
<td>1</td>
<td>Braa2010</td>
<td>Presents flexible approach for utilizing DHIS2.0, OpenMRS, and CommCare together.</td>
<td>CommCare</td>
<td>Published</td>
<td>Sierra Leone</td>
<td>2010</td>
</tr>
<tr>
<td>1</td>
<td>DeRenzi2011a*</td>
<td>Presents the case management framework.</td>
<td>CommCare</td>
<td>Published</td>
<td>Unspecific</td>
<td>2011</td>
</tr>
<tr>
<td>1</td>
<td>DeRenzi2011b*</td>
<td>Outlines six key functions for mobile health (mHealth).</td>
<td>CommCare (&amp; others)</td>
<td>Published</td>
<td>Unspecific</td>
<td>2011</td>
</tr>
<tr>
<td>1</td>
<td>Routen2010*</td>
<td>Describes how to use CommCare to support family planning.</td>
<td>CommCare</td>
<td>Published</td>
<td>Unspecific</td>
<td>2010</td>
</tr>
<tr>
<td>2</td>
<td>Bogan2009*</td>
<td>Overview of CommCare applications in Tanzania.</td>
<td>CommCare</td>
<td>Published</td>
<td>Tanzania</td>
<td>2009</td>
</tr>
<tr>
<td>2</td>
<td>Chaiyahati2013*</td>
<td>Five-fold increase in adverse event submission rates using CommCare compared to paper.</td>
<td>CommCare</td>
<td>Published</td>
<td>South Africa</td>
<td>2013</td>
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<tr>
<td>2</td>
<td>Manglima2010</td>
<td>Case study of CommCare in Tanzania.</td>
<td>CommCare</td>
<td>Published</td>
<td>Tanzania</td>
<td>2010</td>
</tr>
<tr>
<td>Page</td>
<td>Author</td>
<td>Title</td>
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<td>Location</td>
<td>Year</td>
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<tr>
<td>2</td>
<td>Mhila2009*</td>
<td>Case study of CommCare in Tanzania.</td>
<td>CommCare Published</td>
<td>Tanzania</td>
<td>2009</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Schuttner2011*</td>
<td>Demonstrates that CommCare helped improve linkages between community and clinic.</td>
<td>CommCare Gray/Poster</td>
<td>Zambia</td>
<td>2011</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Tumwebaze2012</td>
<td>eMocha facilitates a Household-Based HIV Counseling and Testing program.</td>
<td>eMocha Published</td>
<td>Uganda</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Treatman2012a*</td>
<td>Case study of CommCare in India.</td>
<td>CommCare Published</td>
<td>India</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Bhavsar2012</td>
<td>FLWs reported their clients were more attentive and trusted the audio messages in CommCare more than what the FLWs themselves were saying.</td>
<td>CommCare Gray</td>
<td>Guatemala</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Chittamuru2012*</td>
<td>CommCare lent credibility to the message of FLWs. CommCare allowed FLWs to work around cultural and social barriers when discussing sensitive or taboo subjects.</td>
<td>CommCare Published</td>
<td>India</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Mitchell2012b</td>
<td>Electronic protocols well received by clinicians and clients.</td>
<td>Related Published</td>
<td>Tanzania</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Treatman2012b*</td>
<td>Multimedia improves experience for clients and FLWs.</td>
<td>CommCare Published</td>
<td>India</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Vijaykumar2012</td>
<td>Use of CommCare improves FLW credibility.</td>
<td>CommCare Gray</td>
<td>India</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Wise2013</td>
<td>Collected qualitative feedback about CommCare from Village Workers in Maharashtra, India.</td>
<td>CommCare Gray</td>
<td>India</td>
<td>2013</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Birnbaum2012*</td>
<td>Algorithms can detect outliers, and identify FLWs who are submitting false forms.</td>
<td>CommCare Published</td>
<td>Tanzania</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>CRS2013a*</td>
<td>FLWs’ knowledge of high impact MNCH interventions increased by 24% after five months; CommCare improves counseling quality and family’s receptiveness to counseling.</td>
<td>CommCare Gray</td>
<td>India</td>
<td>2013</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>DeRenzi2008*</td>
<td>Electronic guidance increased adherence to clinical protocols by ~20%.</td>
<td>Related Published</td>
<td>Tanzania</td>
<td>2008</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>DeRenzi2012*</td>
<td>Reminders and escalation to supervisor increased timeliness of visits by 85%.</td>
<td>CommCare Published</td>
<td>Tanzania</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>IntraHealth2012*</td>
<td>FLW knowledge of at least 3 of 5 danger signs improved from 48% to 70% after four months of using CommCare.</td>
<td>CommCare Gray/Poster</td>
<td>India</td>
<td>2012</td>
<td></td>
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<td>#</td>
<td>Author1</td>
<td>Author2</td>
<td>Description</td>
<td>Type</td>
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<tr>
<td>4</td>
<td>Medhi2012*</td>
<td>9 of 10 FLWs self-reported improved social respect in community from using CommCare. CommCare reduced average time to get data to program coordinator from 45 days to 8 hours. CommCare improved data completeness from 67% to 84%.</td>
<td>Related</td>
<td>CommCare</td>
<td>Published</td>
<td>India</td>
</tr>
<tr>
<td>4</td>
<td>Mitchell2012a</td>
<td>Counselor using an electronic protocol can effectively screen HIV patients (i.e. task shifting).</td>
<td>Related</td>
<td>Published</td>
<td>South Africa</td>
<td>2012</td>
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<tr>
<td>4</td>
<td>Mitchell2013*</td>
<td>Pre-cursor to CommCare improved the consistency, accuracy, and completeness of IMCI assessments. Study found only 20.7% of children had all ten critical IMCI items assessed using paper-based IMCI protocols, compared to 70.9% with eIMCI.</td>
<td>Related</td>
<td>Published</td>
<td>Tanzania</td>
<td>2013</td>
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<tr>
<td>4</td>
<td>Mohamed2013</td>
<td>CommCare increases the duration of client visits, and engages more decision makers.</td>
<td>CommCare</td>
<td>Gray</td>
<td>India</td>
<td>2013</td>
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<tr>
<td>4</td>
<td>Palazuelos2013*</td>
<td>Medicine dosing accuracy using CommCare was higher than using a paper tool; CommCare enhances FLW credibility within communities.</td>
<td>CommCare</td>
<td>Published</td>
<td>Mexico/Guatemala</td>
<td>2013</td>
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<td>4</td>
<td>Ramachandran2010</td>
<td>Videos on phones engage clients and their families.</td>
<td>Related</td>
<td>Published</td>
<td>India</td>
<td>2010</td>
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<tr>
<td>4</td>
<td>Surka2013</td>
<td>CommCare enhances screening for CVD by enabling faster and easier trainings, more efficient screenings, and by reducing the margin of error in calculating CVD risk scores compared to the paper-based tools.</td>
<td>CommCare</td>
<td>Gray</td>
<td>South Africa</td>
<td>2013</td>
</tr>
<tr>
<td>5</td>
<td>CRS2013b*</td>
<td>Over five months, a CommCare project saw a 33% increase in clients who asked questions during visits (from 24% to 57%).</td>
<td>CommCare</td>
<td>Gray</td>
<td>India</td>
<td>2013</td>
</tr>
<tr>
<td>5</td>
<td>Ollis2012*</td>
<td>An intervention including CommCare improved institutional deliveries to 68% from a baseline of 40% or less.</td>
<td>CommCare</td>
<td>Gray</td>
<td>Tanzania</td>
<td>2012</td>
</tr>
<tr>
<td>5</td>
<td>WorldVision2012a*</td>
<td>Pregnant women that used CommCare had a higher likelihood of accessing antenatal care, have their births assisted by a skilled provider, know pregnancy complication signs, and seek care at a facility. They were more likely to be prepared for birth (64%) than in five similar studies, where rates varied</td>
<td>CommCare</td>
<td>Gray</td>
<td>Mozambique</td>
<td>2012</td>
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between 7% and 48%.

<table>
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<tr>
<th>Evidence Level</th>
<th># Published CommCare</th>
<th># Unpublished CommCare</th>
<th># Published Alternative</th>
<th># Published Related</th>
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<td>Conceptual</td>
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<td>1</td>
<td></td>
<td></td>
<td>5</td>
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<tr>
<td>Implementation narratives</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
<td>7</td>
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<td>Qualitative FLW interviews</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td></td>
<td>6</td>
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<tr>
<td>FLW Process improvements</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
<td>12</td>
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<tr>
<td>Client KAP</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
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<tr>
<td>Total</td>
<td>16</td>
<td>11</td>
<td>2</td>
<td>5</td>
<td>34</td>
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</tbody>
</table>

* Paper or study is summarized in the Appendix.

Of the 34 studies described in Table 1, ten were conducted in India and another nine were conducted in Tanzania. These are the two countries that Dimagi and D-tree International have most widely implemented CommCare. Fifteen of the studies were conducted or published in 2012. Table 2 shows a breakdown of the papers in Table 1 by evidence level and category. There are a total of 16 published papers on CommCare, 11 unpublished papers on CommCare, 2 papers on alternative systems, and 5 on related systems (4 of which are a PDA-based precursor to CommCare). Note that this review did not include unpublished studies on alternative or related systems to CommCare.

**TABLE 2: OVERVIEW BY EVIDENCE LEVEL**

**FINDINGS**

Although there is no definitive study showing an improvement in health outcomes from adopting CommCare, the collective evidence base shown in Table 1 makes a convincing case that, when used correctly, CommCare’s system can improve community programs, both in the health and non-health domains.

**Acceptability and Feasibility**

Several published case studies about CommCare provide clear evidence that the system is well received by FLWs and clients across different geographical regions and types of community programs [Mhila2009, Bogan2009, Mangilima2010, Treatman2012a]. It is clear that CommCare can be introduced into FLW programs successfully, although a program’s ability to maintain enthusiasm for the system is a separate question. This is validated by
several studies that have conducted qualitative interviews with FLWs using CommCare [Mhila2009, Bhavasar2012, Chittamuru2012, Treatman2012b, Vijaykumar2012] in Tanzania, India, and Guatemala. A study of FLWs in Mexico and Guatemala found that FLWs were more likely to choose CommCare over a paper-based tool, and 93% of FLWs found CommCare to be easy to use while 56% of FLWs who found paper-based tools easy to use [Palazuelos2013].

Overall, FLWs have reported that CommCare makes their job easier and has helped them gain more respect from clients. While these results are partially biased due to the fact that interviewees typically want to speak favorably about CommCare, they are still highly encouraging.

**Access to Care**

We define access to services as how often and for how long a client meets with a FLW. Common barriers to access include high FLW turnover rates, FLWs not enrolling all eligible clients in their catchment areas, FLWs not conducting necessary visits after enrolling eligible clients, and FLWs spending limited time with clients during visits.

A randomized controlled study in Tanzania found that feedback generated from data collected by CommCare increased FLW visit frequency [DeRenzi2012]. The approach hinges on the fact that FLWs’ visits are reported in near real-time to a central server, CommCareHQ. FLWs can be encouraged to perform a visit until visit data is reported. The study found that SMS reminders that were escalated to a supervisor in the case of a missed visit improved FLW visit timeliness by 86%, compared to CommCare-using FLWs who did not receive SMS reminders. CommCare has also been deployed in Zambia to help FLWs improve follow-up rates at clinics. The preliminary investigation showed that “the system widely penetrated into the pilot communities, and showed functioning linkages between community and clinic” [Schuttner2011].

A study in Mozambique found that pregnant women whose CHVs used CommCare had a higher likelihood of accessing antenatal care and have their births assisted by a skilled provider than women in the control group [WorldVision2012a]. Study results from Afghanistan showed a 20% improvement in antenatal attendance and a 22.3% improvement in the number of women receiving skilled deliveries at a health facility. The same study also noted that equipping non-literate CHVs with mobile phones allowed them to “better access and deliver medical supplies during the winter months,” in addition to making referrals to health facilities. [WorldVision2012b]

A poll of 23 FLWs using CommCare and 17 not using CommCare in Kaushambi, Uttar Pradesh investigated how long FLWs spent with their clients and who attended the counseling sessions. The results showed that sessions lead by FLWs using CommCare are on average 1.7 times longer, 2.6 times more likely to include the client’s husband, and 1.6 times more likely to include the client’s mother-in-law than counseling sessions lead by FLWs that don’t use CommCare [Mohamed2013].

A recurring theme in the CommCare literature is whether CommCare reduces the time it takes FLWs to participate in trainings or complete job-related tasks, which could possibly enable them to see more or spent more time with clients. A study in South Africa found that FLWs that used paper-based tools during trainings for cardiovascular diseases screenings took four times as long to complete the trainings as FLWs that used CommCare (12.25 hours compared to 3 hours). When it came to the actual screening, it took FLWs with paper tools an average of 36 minutes to complete one screening compared to 21 minutes for a FLW with CommCare [Sukra2013].
Quality of Care

We define quality of care in terms of whether a client receives complete and accurate information, and if their FLWs make the necessary assessments and decisions and propose well-informed recommendations and follow-up steps. Common barriers to delivering high quality services include a lack of training for new or replacement FLWs, FLWs failing to administer all counseling information due to sensitive topics or limited time, and inaccurate clinical assessments that are the result of measurement tools or a lack of motivation to act upon the assessment.

The quality of services an FLW provides is based on them knowing and being comfortable delivering correct information to clients. A study in India showed that, after a period of four months of use, FLWs had increased their knowledge retention of at least three to five danger signs across all key health categories from 48% at baseline to 70% [IntraHealth2012]. A separate pilot project of 111 ASHAs in Kaushambi, India found a 24% improvement in ASHAs’ knowledge of high impact maternal and newborn care interventions since first using CommCare five months earlier [CRS2013]. Other FLWs in India have self-reported better knowledge retention as a result of using CommCare, which has been helpful in presenting complex and sensitive topics [Chittamuru2012].

A prominent trend in this evidence base is that CommCare can supplement FLW training. A controlled trial in 2008 in Tanzania tested a PDA-based precursor to CommCare (eIMCI) that contained an electronic version of the Integrated Management of Childhood Illness (IMCI) protocol for classifying and treating common causes of child mortality. The trial results indicated that clinicians using electronic guidance completed on average 20% more of the required steps than clinicians that did not use electronic guidance [DeRenzi2008]. A study of 17 FLWs in Mexico and Guatemala found use of CommCare consistently resulted in higher medicine dosing accuracy compared to a paper-based tool during a dosing practice test [Palazuelos2013].

At the clinical level, CommCare has been shown to improve the consistency, accuracy, and completeness of clinical assessments. In the same Tanzania study, it was discovered that the proportion of completed assessments for each of the ten critical IMCI items ranged from 61-98% using paper-based protocols, compared to 92-100% with the CommCare pre-cursor. Only 20.7% of children of the 1,221 children in the study had all ten IMCI items assessed with paper protocols, compared to 70.9% that had electronic guidance. The CommCare pre-cursor also resulted in more accurate disease classification (90.9%) compared to paper (82.7%), and clinical assessments that use CommCare are more consistent across clinics. [Mitchell2013].

Experience of Care

We define experience of care by a client’s level of engagement during a FLW visit and the degree to which the client finds their FLW persuasive. Common barriers to high experience of care include if a FLW doesn’t carry or misuses promotional materials and if they have low credibility in their community.

CommCare applications typically make extensive use of multimedia, especially images and audio clips that are recorded locally by native speakers. CommCare also support videos, although these are less common due to production expenses. The literature indicates that multimedia usage in CommCare increases client engagement [Treatman2012b]. These findings corroborate with earlier work that shows that videos played by FLWs on phones helped engage clients and other decision makers in the client’s family [Ramachandran2010].

Several studies have shown that CommCare improves FLWs’ personal credibility and the credibility of the health messages they deliver [Chittamuru2012, Vijaykumar2012, Bhavsar2012, Medhi2012]. These findings have emerged
from qualitative interviews with FLWs, who have reported that CommCare has enhanced their credibility in their community and that their clients and clients’ families perceive recorded messages played on CommCare as more trustworthy. CommCare is widely viewed as an independent, objective source of information, which greatly benefits FLWs’ ability to deliver sensitive information, such as information about family planning methods. In utilizing CommCare to communicate sensitive health messages, an FLW can act more as a trusted mediator in addressing the listeners’ questions and concerns about the phone’s messages. On the other hand, concerns are noted that use of CommCare to play health messages to the client can reduce interaction if the FLW simply plays the audio clips without initiating a follow-up discussion.

CommCare has also been shown to improve clients’ visit experiences and FLWs’ ability to deliver counseling messages. As part of the study in Tanzania, parents of ill children were interviewed after a clinician using the PDA-based precursor to CommCare (e-IMCI) examined their child. The caretakers had positive views of the electronic system, and specifically noted that the system prompted providers to conduct more thorough examinations and ask more questions about their children [Mitchell2012b]. A study in India found that FLWs’ counseling techniques improved after five months of using CommCare. This included a 34% increase in FLWs who encouraged clients to use a health service, a 22% increase in FLWs who encouraged clients to ask questions or speak during visits, and a 25% increase in FLWs who waited for clients to respond to a question [CRS2013b].

**Accountability of Care**

We define accountability of care as providing more visibility into FLWs’ job-related activities. Common barriers to high accountability of care include redundant and misused paper registers, data that is filled out solely for reporting purposes, and delays in compiling and reporting data. CommCare has the potential to dramatically improve accountability of care by providing near real-time reports about each interaction between an FLW and a client—with a level of detail and speed that is far beyond what even the best paper reporting systems can accomplish.

A crosscutting trend from the evidence base is that CommCare improves monitoring and communication. In one project in India, the introduction of CommCare improved data completeness from 67% with the paper-based system to an average of 84% with CommCare. CommCare also reduced the average time it took to submit data to a program coordinator from 45 days to 8 hours [Medhi2012]. In qualitative interviews, FLWs in Bihar and Uttar Pradesh, India reported that community members felt greater social pressure to comply with recommended behaviors when they knew that their knowledge, attitudes, and practices were being recorded [Chittamuru2012].

Another promising aspect of mobile data capture is its ability to conduct real-time quality control. Research on CommCare has included the development of algorithms to detect anomalous data from FLWs. After testing data generated by FLWs who were asked to submit false yet realistic data, the algorithms were able to identify the false data with 80% sensitivity and 90% specificity [Birnbaum2012].

CommCare has also been shown to improve form submission rates. A study in South Africa found that CommCare increased Healthcare Workers’ (HCWs) submission rates of adverse event forms from 5% at baseline using paper forms to 27% using CommCare. The study also found a disconnect between HCWs’ expressed enthusiasm for using CommCare and actual practice (which was lower than expected). The study concluded that programs should carefully explore FLW motivations and technologic enhancements prior to scaling new mobile health initiatives [Chaiyachati2013].
Client Knowledge, Attitude, or Practice

There are a few examples in the literature where CommCare has helped improve client knowledge, attitude, and/or practice. A study in India found that after interacting for five months with FLWs who used CommCare, clients were 33% more likely to ask questions than when they interacted with FLWs who didn’t use CommCare [CRS2013b]. CommCare was used in Zanzibar to increase institutional delivery rates, especially in cases of complicated pregnancies. Traditional birth attendants were equipped with CommCare to identify danger signs, refer clients, record family members’ permission to transport the women in case of emergencies, and facilitate payment to local vehicle owners to transport women to a facility. The intervention reported a 68% facility delivery rate, compared to the baseline of 40% and 23% recorded in the two control areas [Ollis2012].

A World Vision study found that pregnant women in Mozambique who interacted with a CommCare pregnancy and postpartum module were more likely to know about pregnancy danger signs (20%) and seek facility care in case of complications. They were also more likely to be prepared for birth (64%) than in five similar studies where rates varied between 7% and 48%. Study results also indicated that there is an association between birth preparedness and referral completion rates (91% during prenatal period and 47% during postpartum period) [WorldVision2012b]. Another World Vision in Afghanistan study reported similar findings. In addition to being attributed to increasing the likelihood that a woman receives antenatal care (20%) or has a skilled delivery (22.3%), CommCare was attributed to increasing pregnant women’s knowledge of 2+ pregnancy danger signs (12.9%), the likelihood that a pregnant woman would have a birth plan (12.6%), and the number of pregnant women who took iron supplements (14.4%) [WorldVision2012b].

Alternative Systems

While there are many papers on mobile systems for community programs, we found few published papers on comparable mobile systems for use by FLWs (designed primarily for health workers) that have the key properties described above of supporting client tracking, decision support during client sessions, and embedded multimedia. The papers on alternative systems in Table 1 reinforce the themes described above, showing the general acceptability and feasibility of deploying mobile systems for FLWs, and their potential to facilitate other programmatic goals.

There are several systems with client tracking, decision support, and multimedia including applications being deployed by D-tree International, Mobenzi, Mezzanine, Medic Mobile, Virtuosos, and eMocha. There are important differentiators among these applications and CommCare such as whether they are open source, have application builders which allow non-programmers to create and adapt the applications, and what types of phones are supported. However, given the similarities among these applications, the evidence on one is relevant to all of them, and as more papers emerge we will be including them as we update this document.

Conclusion

Over the last ten years, Dimagi has participated in research initiatives for ICT platforms and healthcare delivery in under-served populations, both domestically and abroad. We have partnered with research firms, non-profit organizations, governments, and academic institutions to conduct research about CommCare. While many of the studies involved people from Dimagi or D-tree, the majority of studies was led by academic researchers from
organizations including University of Pennsylvania, Nanyang Technological University, Microsoft Research, and University of Washington.

The result is an extensive evidence base. There are 16 published papers about CommCare, compared to two published papers about alternative mobile systems. Available evidence about CommCare is further bolstered by important gray literature studies and five papers on closely related systems, including four that are about the PDA-based precursor to CommCare. These papers reflect what was available at the time of this literature review, which was concluded in November of 2013. We will update this document periodically as more papers are published on CommCare and similar systems.

The collective findings from the 41 papers in Table 1 are encouraging. They demonstrate the potential for organizations to use CommCare to improve a wide range of aspects within their community program(s). The findings also support the hypothesis that CommCare can be used to increase the timeliness, accuracy, and relevance of essential information delivered to clients. It is, however, important to note that CommCare by itself will not improve the behavior of FLWs, but can only amplify an organization’s efforts to improve their community program. Organizations must continually support their FLWs and utilize the information delivered by CommCare in order to realize the potential benefits of introducing a mobile system to their FLWs.

It is also encouraging that there is preliminary evidence, in unpublished studies, that CommCare can create changes in client behavior, including knowledge, attitude, and practice. As we think about our next steps in expanding CommCare’s evidence base, one area we’d like to further evaluate is CommCare’s impact on client’s knowledge, attitude, and practice. We hope to also see rigorous studies demonstrating health benefits in the long run, but acknowledge that that these studies will be expensive and time consuming. These intermediate studies play an important role of providing insight into the potential benefit of CommCare and other mobile systems for FLWs, as well as guidance on how to improve CommCare to best reach its potential.

References


[CRS2013a] Internal report shared through personal correspondence with authors.

[CRS2013b] Internal report shared through personal correspondence with authors.


Appendix: Summaries of Selected Papers

Project: Guatemala; maternal health
Category: Qualitative interviews
Published/Gray: G
Hypothesis: CommCare is a more effective platform than Magpi for case management by community health workers (CHWs).
Key findings: Localized audio messages incited trust and influence. Data collection with CommCare was more effective than Magpi because patient data was always available on the phone and only required updates. CommCare’s usability results were also better than Magpi’s for this task.
Key challenges: This piece is a substantive poster, but lacks the full details of a report.

Project: Tanzania; maternal and neonatal health
Category: Improvements to health system process
Published/Gray: P
**Hypothesis:** Tools for automated data quality control make health systems more efficient and detect fabricated data better than in paper records, thus enhancing accountability.

**Key findings:** Active data management by health service providers makes it easier for them to respond to clients more quickly, monitor field workers more effectively, and follow-up with patients more easily.

**Key challenges:** The data management capabilities of CommCare are only useful in managing high-quality data and cannot detect unintentional fabrications that might result from lack of expertise, low training, high turnover, or mismatched incentives. Efforts to eradicate low-quality data could be successful, or could compound fabricators’ efforts.

*Bogan et al. (2009) Improving Standards of Care with Mobile Applications in Tanzania.*

**Project:** Tanzania  
**Category:** Implementation narratives  
**Published/Gray:** P  
**Hypothesis:** There are multiple lessons gained from developing and testing CommCare in Tanzania.  
**Key findings:** Initial findings show that users and clients positively view the phone-based system as more discreet and private than the paper-based system. Simplicity and flexibility are paramount aspects of the system. Participatory design was useful in anticipating problems.  
**Key challenges:** Running out of battery, switching models of phone resulting in trust issues with community.

*Catholic Relief Services (2013a) ASHA Facilitation: Lessons Learned from the Remind Pilot Project*

**Project:** India; maternal health  
**Category:** FLW Process Improvement  
**Published/Gray:** G  
**Hypothesis:** Technology can help CHWs provide higher quality care to clients through assessing, counseling, and follow-up; data generated by CommCare can help supervisors better manage and monitor CHWs.  
**Key findings:** CommCare helps CHWs better manager their workload, improves counseling message quality, and improves families’ receptiveness of MNCH messages. Pregnant women also reported that CommCare’s multimedia is more engaging than paper-based tools and helps them better retain key messages. Quantitative results show a 24% improvement in CHWs’ knowledge of high impact MNCH interventions since first using CommCare.  
**Key challenges:** N/A

*Catholic Relief Services (2013b) ASHA Facilitation: Lessons Learned from the Remind Pilot Project*

**Project:** India; maternal health  
**Category:** Client KAP  
**Published/Gray:** G  
**Hypothesis:** N/A  
**Key findings:** Over the course of five months, facilitators saw several improvements in CHW counseling. This includes a 13% increase in CHWs who greeted clients, a 22% increase in CHWs who encouraged clients to speak or ask questions, and a 25% increase in CHWs who waited for clients to respond before moving on. Additionally, there was a 28% increase in CHWs who expanded on CommCare messages, a 34% increase in CHWs who encouraged women to use a health service, and a 33% increase in clients who asked questions.  
**Key challenges:** N/A

*Chaiyachati et al. (2013) A Pilot Study of an mHealth Application for Healthcare Workers: Poor Uptake Despite High Reported Acceptability at a Rural South African Community-Based MDR-TB Treatment Program.*

**Project:** South Africa; MDR-TB
**Category:** Implementation Narrative  
**Published/Gray:** P  
**Hypothesis:** N/A  
**Key findings:** Mobile healthcare workers submitted 27% of expected adverse event forms using CommCare, compared to a 5% submission rate at baseline using paper forms. Although a significant increase, this conflicted with qualitative results in which Healthcare Workers expressed greater enthusiasm for using CommCare to improve adverse events communication, help with their daily workflow, and the potential to expand this to other health interventions. Based on these qualitative findings, study leaders expected the submission rate to be higher.

**Key challenges:** The results of the study should be interpreted cautiously due to its small size (only 5 Healthcare Workers participated in the study). Furthermore, Healthcare Workers occasionally faced technical issues with using the application and wanted increased technical support.

*Chittamuru et al. (2012) CommCare: Evaluation of a Mobile Application for Maternal Health in Rural India.*

**Project:** India; maternal health  
**Category:** Qualitative interviews  
**Published/Gray:** P  
**Hypothesis:** CommCare's user-centered design is an effective tool for improving maternal health care service delivery.

**Key findings:** CommCare is perceived as credible and trustworthy by pregnant women and their families, is a useful tool when introducing sensitive/controversial topics, and often becomes the primary agent, while the CHW functions as a mediator between phone and client. The phone is engaging in that it facilitates communication and is inclusive of varied audiences, including husbands or mothers-in-law, and facilitates flexible audience size. CHWs feel they have better knowledge retention and enhanced social capital. Monitoring capacity of phone exerts social pressure on clients to comply with behavior change communication.

**Key challenges:** Trade-off between platform as a job-aid and as primary agent.

*DeRenzi et al. (2008) e-IMCI: improving pediatric health care in low-income countries.*

**Project:** Tanzania; child health  
**Category:** Improvements to health system process  
**Published/Gray:** P  
**Hypothesis:** e-IMCI unblocks barriers to compliance with the Integrated Management of Childhood Illness protocols, such as training expenses, insufficient supervision, time costs, and reduced rigor in protocol compliance.

**Key findings:** e-IMCI is an accessible tool for Tanzanian health workers that can reduce errors like unintentional deviations from IMCI. It is also acceptable to clinicians.

**Key challenges:** Balance between a fast and flexible system that simultaneously encourages protocol adherence; how to use the PDA to address other gaps other than protocol adherence.

*DeRenzi et al. (2011a) A Framework for Case-based Community Health Information Systems.*

**Project:** Overview  
**Category:** Conceptual  
**Published/Gray:** P  
**Hypothesis:** CommCare is a community health information system that has the potential to address critical gaps in healthcare service delivery.

**Key findings:** Flexible case management tools are applicable for a wide variety of community health programs. These tools support community health program effectiveness and reduce duplicated efforts.

**Key challenges:**
DeRenzi et al. (2011b) Mobile Phone Tools for Field-Based Health care Workers in Low-Income Countries.
Project: Overview
Category: Conceptual
Published/Gray: P
Hypothesis: Mobile health platforms’ effectiveness can be evaluated based on a six-point health function framework: data collection, training and access to reference material, facilitating communication among health workers, providing job aids and decision support, supervision of health workers, and promoting healthy behaviors in the population.
Key findings: Inclusion of multimedia elements to reinforce each step in the forms, including audio, icons, or images, helps low-literate CHWs and turns the application into a powerful educational and behavior change communication tool that facilitates discussion.
Key challenges: N/A

DeRenzi et al. (2012) Improving Community Health Worker Performance Through Automated SMS.
Project: Tanzania; HIV management
Category: Improvements to health system process
Published/Gray: P
Hypothesis: SMS messaging capabilities enable CHWs to perform better by improving the regularity and timeliness of their visits, two critical elements to building trust with clients and delivering health services effectively.
Key findings: Escalating SMS reminders to CHWs and, when necessary, their supervisors makes CHWs’ performance more transparent and accountable. Regular visits can be important medically (e.g. neonatal check-up) and psychosocially (e.g. reducing stigma). Buy-in from CHWs in Tanzania was achieved in part because they were allowed to use phones for personal reasons.
Key challenges: Lack of two-way communication between health system and CHWs, in addition to supervisors’ limited ability to aggregate reminders.

IntraHealth (2012) mSakhi: Putting Information into the Hands of Community Health Workers.
Project: Uttar Pradesh, India; maternal and neo-natal health
Category: Qualitative interviews
Published/Gray:
Hypothesis: mSakhi is the most cost-effective and sustainable method of supplementing CHW training.
Key findings: mSakhi was used to increase CHWs’ access to reliable information and as a tool for positive interpersonal communication with clients in support of broader CHW training under India’s National Rural Health Mission (NRHM). Participatory design yielded key adjustments prior to scale. CHW usage was high, knowledge retention increased, and CHWs reported gains in confidence and credibility.
Key challenges: N/A

Medhi et al. (2012) Combating rural child malnutrition through inexpensive mobile phones.
Project: Madhya Pradesh, India; child health
Category: Improvements to health system process
Published/Gray: P
Hypothesis: CommCare improves data management by improving data quality, completeness, and timeliness, and is acceptable to users and clients.
Key findings: CommCare cuts down the time it takes data to reach health system and improves data quality. Users are motivated by CommCare due to its ability to enhance social capital and ability to be used for non-work related
activities (unlike single-use PDAs). CommCare accessibility was high, even for illiterate CHWs. Clients were engaged by phone’s ability to act as an extension of authority. Gains were made to health system process through active data management.

**Key challenges:** Allowing for positive or non-harmful non-work related usage of the phone, e.g. taking pictures of malnourished children to hold other CHWs accountable, talking to friends, from problematic unsupervised use. Referenced ongoing transportation/portability issues, despite device’s robustness.

*Mhila et al. (2009) Using mobile applications for community-based social support for chronic patients.*

**Project:** Tanzania; HIV management  
**Category:** Implementation narratives  
**Published/Gray:** P

**Hypothesis:** The initial stages of implementing CommCare yielded learning that can be used for product improvement.

**Key findings:** Make the product simple, in that all aspects of it are relevant and can be adjusted easily. Prioritize privacy when refining the product so that patient confidentiality is maintained. Partner with users in the design process and incorporate their feedback for optimal future use.

**Key challenges:** Charging the phone and training, re-training requirements for optimum usage.


**Project:** Tanzania; IMCI  
**Category:** FLW Process Improvement  
**Published/Gray:** P

**Hypothesis:** Sought to answer if mobile technology can improve the quality of care of child health, particularly in delivering IMCI. The study observed 1,221 children in 18 clinics in Tanzania. Anticipated 65% adherence under pIMCI and 80% adherence under eIMCI.

**Key findings:** For all ten critical IMCI items, adherence to the protocol was greater for electronic IMCI than for paper-based IMCI. The proportion of complete assessments for each of the ten selected IMCI items under pIMCI ranged from 61% to 98%, compared to 92% to 100% under eIMCI. Only 20.7% of the children had ten selected IMCI items assessed under pIMCI, compared to 70.9% of children under eIMCI. eIMCI also resulted in more accurate disease classification for the four primary classification areas (90.9%), compared to pIMCI (82.7%). Clinical assessments that use CommCare are more consistent across clinics, as seen by the fact that pIMCI’s ICC values were a lot higher than eIMCI’s. Finally, the difference in visit lengths with pIMCI and eIMCI is not significant.

**Key challenges:** Due to a limited number of cases, this study wasn’t able to show mobile technology’s impact on the classification of severe diseases. The study also only observed 10 of IMCI’s 15 assessment areas. Finally, the study evaluated assessment and disease classification, even though treatment and counseling are also two critical components of IMCI.

*Ollis2012 Using mHealth for Safer Deliveries.*

**Project:** Tanzania; institutional delivery  
**Category:** Client KAP  
**Published/Gray:** G

**Hypothesis:** Maternal deaths can be reduced by providing a safety net for women who would normally deliver at home through the use of technology, specifically by addressing the three delays in seeking care.
**Key findings:** The phone’s multi-faceted nature goes beyond presenting and recording information. It also includes having phone numbers of local vehicle owners available, recorded permissions from family, and the ability to call hospitals directly. Replacing traditional birth attendants’ financial incentives towards using this system. Improved traditional birth attendant knowledge levels and institutional delivery rates increased in target areas. In the pilot districts in Unguja and Pemba, the baseline facility delivery rate was 40% for North A and 23% for Pemba. Following a CommCare training, 25 TBAs registered nearly 700 women. 211 of those delivered, and 143 delivered at the facility, representing a facility delivery rate of 68%.

**Key challenges:**

*Palazuelos (2013) User Perceptions of an mHealth Medicine Dosing Tool for Community Health Workers*

**Project:** Mexico and Guatemala; dosing analysis

**Category:** Improvements to health system process

**Published:** P

**Hypothesis:** The objective of this study was to collect and compare 17 CHWs’ perceptions and impressions of a customized, CommCare tool compared to an existing paper-based medicine dosing tool.

**Key findings:** 29% more of CHWs chose CommCare over the paper-based tool, and 93% of CHWs found CommCare to be easy to use compared to 56% of CHWs who found paper-based tools easy to use. Doing accuracy was also higher with CommCare than a paper-based tool. Qualitative analysis found that CHWs found CommCare to be quick and easy to use, had complete information, and increased their own credibility.

**Key challenges:** The CommCare application could benefit from additional safety confirmation screens and CHWs would benefit from additional simulated clinical encounters with implementers to master CommCare’s interface. Finally, the study size (17 CHWs) is too small to draw formal, statistical comparisons between CommCare and paper-based tool.

*Routen et al. (2010) Using Mobile Technology to Support Family Planning Counseling in the Community.*

**Project:** Overview

**Category:** Conceptual

**Published/Gray:** G

**Hypothesis:** The Balanced Counseling Strategy can be used via an mHealth platform to increase access to and demand for family planning services.

**Key findings:**

**Key challenges:**

*Schuttner et al. (2011) Use of mobile phone-guided community outreach for integrated primary health care and HIV services in Zambia.*

**Project:** Tanzania; primary health and HIV management

**Category:** Improvements to health system process

**Published/Gray:** P

**Hypothesis:** Providing CHWs with mobile phones improves service outreach, referral, and follow-up between clinic and community.

**Key findings:** Follow-ups facilitated through the mobile application resolved 91% of patients’ chief complaints, expanding access without necessitating clinic visits.

**Key challenges:** Clinic attendance following home visits can be improved; more work needs to go into identifying access barriers and optimizing clinical/operational entry points.

*Treatman et al. (2012a) Mobile phones for community health workers of Bihar empower adolescent girls.*
**Project**: Bihar, India; adolescent girl’s health  
**Category**: Implementation narratives  
**Published/Gray**: P  
**Hypothesis**: Communicating health messages through mobile phones can have an empowering effect on adolescent girls.

**Key findings**: Short, structured health messages delivered privately through mobile phones can positively impact adolescents’ knowledge and attitudes about their bodies and health, prompting them to pass information along to their peers.

**Key challenges**: No data in terms of how increased knowledge and positive attitudes influence practice, e.g. contraceptives uptake. This study highlights one girl and thus is an isolated example.

*Treatman et al. (2012b) Strengthening Community Health Systems with Localized Multimedia.*

**Project**: India  
**Category**: Qualitative interviews  
**Published/Gray**: P  
**Hypothesis**: The multimedia component of CommCare, in comparison to text-based ICTs, increases client engagement and enhances CHW credibility.

**Key findings**: Multimedia can improve CHW performance by improving adherence to processes, serving as a third-party agent in introducing sensitive and controversial topics, advocating for CHWs and enhancing their credibility, and improving engagement through attractiveness of platform. It is also sustainable and scalable.

**Key challenges**: 

**Project**: India;  
**Category**: Qualitative Interviews  
**Published/Gray**: G  
**Hypothesis**: The objective of this field study is to examine the influence and use of mobile health technology on health care in Jamkhed, Maharashtra, including barriers and benefits.

**Key findings**: One of the most prominent findings from this study was the “sense of empowerment that Village Health Workers expressed during and after using the mobile technology...this empowerment has major implications for health and the provision of healthcare.” The study also cited increased capacity for project monitoring and improvements in support and data collection process as benefits to CommCare.

**Key challenges**: Despite the fact that CommCare is designed for low-literate users, limited typing (e.g. registering clients) is challenging for Village Health Workers. Other potential challenges for this particular project included ensuring capacity exists to monitor the program and Village Health Workers’ concerns about privacy.

*World Vision (2012a) Use of Mobile Phones for Improvement of MNCH Care*  
**Project**: Mozambique; pre-natal and post-partum care.  
**Category**: Client KAP  
**Published/Gray**: G  
**Hypothesis**: To determine whether CommCare improves CHV performance in diagnosing and referring pregnancy complications, communicating with facilities during emergencies, and motivate and enable pregnant/postpartum women access health services.

**Key findings**: CommCare usage was associated with an improvement in quality of services delivered, specifically regarding CHVs’ higher rate of danger sign recognition, a higher rate of birth preparedness compared to previous
studies, and by association, a higher referral completion rate. CommCare also is associated with increased CHV credibility, strengthened linkages with the health facilities, and rapid mobile technology usage uptake. The prevalence of birth preparedness (64%) in association to danger sign recognition is higher than what has been reported previously in studies. Technical support via mobile technology from health facility personnel to CHVs was reported above 95% when danger sign was identified during both prenatal and postpartum period.

**Key challenges:** Implementation challenges were related to mobile phones (finding suitable phones, recharging phones), participants (low literacy levels, phone misusage), limited supervision and M&E, and varying languages.

*World Vision (2012b) Application of mobile technology to improve maternal and newborn health outcomes*

**Project:** Afghanistan; maternal and newborn care

**Category:** Client KAP

**Published/Gray:** G

**Hypothesis:** World Vision sought to measure CommCare’s ability to increase uptake of healthy actions and knowledge of information, while also improving communication and coordination of health workers and pregnancy and newborn outcomes.

**Key findings:** At the end of 20 months, there were significant change between intervention and control groups in any antenatal attendance (20%), skilled delivery at a health facility (22.3%), having a birth plan that included improved coordination with the health facility as well as saved money and arranged transport (12.6%), and knowledge of 2+ pregnancy danger signs (12.9%). Findings from focus groups also indicated that CommCare increased mothers’ enthusiasm to listen and learn about health topics.

**Key challenges:** CHWs in Afghanistan work in close-knit pairs of one male and one female. In these pairs, female CHWs are more likely to be illiterate, less adapt to using phones, and provide the majority of prenatal and newborn care. While CommCare usage among illiterate, female CHWs was high, they often required assistance from male CHWs for complex tasks like patient registration and patient removal.