Research at Medic Mobile

An overview of our evidence base and research agenda, for scientific collaborators and other partners.

MEDIC MOBILE

This brief was prepared by Medic Mobile’s co-founder and research lead Isaac Holeman, February 2018. For inquiries, please contact isaac@medicmobile.org.
OVERVIEW

Medic Mobile designs, implements and supports open-source software to strengthen community health systems and advance health equity. Our research agenda is bold, optimistic and committed to bringing the latest science and innovation to communities facing the highest burdens of poverty and disease. In the late 2000s we pioneered the use of interactive text messaging to coordinate community health programs and since 2010 we have been a leader in human-centered design for global health equity. Today the Medic Mobile toolkit enables messaging for care coordination, task management, diagnostic decision support and performance analytics across a range of basic to smartphones for over 20,000 community health workers. While ambitious about working at scale, we still take pride in pioneering new models of care. Our team conducts key R&D projects in-house and coordinates strategic research partnerships. This brief is for Medic Mobile staff and partners who want to learn about our research process and the substantial evidence that underpins our work. We discuss three key themes of Medic Mobile’s research agenda, common pathways to impact for the 50+ publications in our research archive, and our infrastructure for collaborating with research partners and scaling up high-impact discoveries.

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Medic Mobile is a non-profit organization, you can read more about our delivery model and key partners at medicmobile.org. This brief was written by Medic Mobile co-founder and research lead Isaac Holeman and version 0.1 was published February 2018. For inquiries, please contact isaac@medicmobile.org.
THE CHALLENGE

In the hard-to-reach communities where Medic Mobile works, as little as one percent of households receive care from a community health worker (CHW) when they are sick. Less than four percent receive a home visit from a health worker during pregnancy and only eight percent receive a newborn care visit [1]. When people go to clinics, they face out-of-pocket travel expenses and the loss of as much as a full day’s wages. As a result, easily curable illnesses such as malaria, pneumonia and diarrheal diseases often go undiagnosed and untreated. Research spanning several decades shows that CHW programs can address these challenges [2]. One of Medic Mobile’s partners in Uganda documented a 27% reduction in child mortality [3]; another in Mali documented an astounding 10x reduction in child mortality over three years [4]. Yet recent studies have shown that inadequately trained, professionalized or supervised CHWs may have little or no impact on child mortality [2,5-7]. The problem is that CHWs are often unpaid, under-managed and under-equipped. Routine operations can make or break efforts to grow beyond a promising study and deliver sustained impact at scale. While there is no easy way to eliminate these challenges, using technology to support new models of data-driven community health shows great promise.

MEDIC MOBILE’S RESEARCH AGENDA

While robust data-systems are vital for any research-intensive global health organization, in general the Medic Mobile software is not simply a research tool; it is not a mere data collection tool. Rather, Medic Mobile’s flexible community health toolkit is integral to the interventions through which we strengthen community health systems and which we document in key research studies. While these studies span a range of technologies and health issues, there are several clear themes: 1) establishing new models of data-driven care that strengthen the role of community health workers; 2) human-centered design as a way of undertaking and studying the complex process of health systems strengthening; and 3) a pragmatic, practice-based approach that integrates inquiry with the hands-on work of building new tools, sustaining implementation at scale, and advocating for equity and rights-based approaches to technology for universal health coverage.

As of February 2018 the Medic Mobile research archive [8] contains over 50 publications, including 32 peer-reviewed articles and over 20 technical reports and white papers. Research methods include scoping, systematic and essay-format literature review, co-design and fieldwork-based design
research, randomized trials, repeated cross-sectional surveys and participatory evaluation methods. Some studies of strategic importance are only documented in research briefs or presented at non-academic conferences (e.g. the Global Digital Health Forum), but this brief emphasizes peer-reviewed publications and rigorous technical reports. This brief does not review the larger collection of studies that inform our work.

Many of the publications in Medic Mobile’s research archive were co-authored by members of our team; in the bibliography we have bolded the names of these authors. Other studies of Medic Mobile projects were led by partners, including independent studies with no Medic Mobile employed co-authors, e.g. [9,10]. In other cases we began supporting a healthcare delivery organization after a study was completed, e.g. [3,4]. We include such studies as part of our research archive only when our tools have become integral to scaling up or sustaining the specific intervention documented in that study.

**PATHWAYS TO IMPACT**

Studies that emerge from our ongoing work have pursued practical questions related to the design or cost-effectiveness of particular interventions, as well as basic inquiry concerning for example natural language processing algorithms for not widely spoken bantu languages [11] or how the interweaving of technology and work activities shapes the emergence and contextual embeddedness of ICT4D interventions [12]. Recognizing that these studies can be relevant to our mission in different ways, over time we have become more proactive about clarifying potential research outputs and pathways to impact early in the planning process. The UK Medical Research Council’s guidance on pathways to impact statements [13] is a helpful point of reference:

- be project specific with clear deliverables
- describe societal and economic deliverables
- focus on non-academic beneficiaries where possible
- focus on knowledge exchange and impact generation where possible
- acknowledge that research is likely to have impacts over a range of timescales.
- ensure that planned activities are appropriate to the research undertaken, feasible in terms of resource, and deliverable over the lifetime of the project

Pathways to impact vary not only from project to project but also from publication to publication within larger projects, and they often evolve as inquiry proceeds. Yet over time we have observed that most studies amplify Medic Mobile’s impact in one of four general ways: landscape analysis or literature
review, human-centered design research, evidence in the form of evaluations or field experiments, and commentary or position papers relevant to advocacy.

**Landscape Analysis and Literature Reviews**

Although the field of global digital health is still young, new trials are proliferating and there is a vast body of relevant literature. While we draw important concepts from a variety of fields, public health and ICT4D are the disciplinary homes for this work. Our aim in these projects is to draw on and contribute to this literature in ways that inform and influence key internal projects at Medic Mobile. Example projects include literature reviews on mHealth for cancer care [14], digital technology for good governance in the health sector [15], SMS for immunization programs [16] and human-centered design for global health equity [17]. This work also results in concise evidence briefs that increase our staff’s exposure to research without necessarily resulting in a peer-reviewed publication.

**Human-Centered Design Research**

Human-centered design is a n approach to innovation that puts people at the center of activity, prioritizing their needs, desires and behaviors in the design of complex systems. Emphasizing a hands-on approach to learning by doing, such studies feature patient fieldwork and iterative cycles of design, implementation and evaluation of stakeholder experiences. The term human-centered also invokes stakeholder participation or co-design, orienting to human skills and attention to values such as human dignity or humanitarian concerns. In our view, design research is not limited to building technologies or solving purely technical problems so much as it is a way of making sense of the complex challenge of health systems strengthening in a digital age. Design in this sense is not synonymous with ‘formative research;’ ongoing redesign remains important as interventions are scaled up and services integrated across the health system. For this reason, human-centered design is a way of answering calls for renewed focus on global health implementation research and practice [18].

Grounded in the disciplines of engineering, ICT4D and the broader multidisciplinary human-centered design research

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i Medic Mobile’s literature review paper, Human-Centered Design for Global Health Equity, emphasizes that this multi-disciplinary field of research and practice draws influence from engineering and human-computer interaction, computer supported cooperative work, organizational information systems research, the more craft-oriented design professions, participatory design, action research and the social sciences [17].
community, this stream of research takes inspiration from the R&D arms of global technology firms, such as Microsoft Research, Xerox Parc, Intel and Nokia Research. Such studies typically involve interviews, extended observation, and participation in the design process with Medic Mobile’s model building partners. These studies also involve Medic Mobile’s staff designers, with the aim of contributing to their expertise and the working knowledge of the organization as a whole.

In some cases this research gives rise to and documents new technologies. For example, field research presented at conferences in 2010 paved the way for Medic Mobile’s development of SIM card applications, which we subsequently documented in a paper for the ACM Symposium on Computing and Development [18]. Design research grounded in extensive fieldwork has also enabled our team to make practical contributions to vaccine cold chain monitoring technology, alongside conceptual contributions to the information systems design literature [12]. In other cases design research has lead to new methodological tools or process innovation, for example when extended design research in Kenya and Nepal led to the development of Medic Mobile’s deck of design cards [20].

Program Evaluations and Field Experiments
Medic Mobile projects have been evaluated using a range of methods, including 2 completed and 6 ongoing randomized controlled trials, baseline control studies, participatory evaluation methods and more descriptive program evaluations. Today, most of these evaluations are led by independent partners. This research helps us to understand where we need to pivot and redesign or invest in scaling up interventions. Evidence that our interventions make a difference is also necessary for securing resources to strengthen health systems and advance new models of community health.

While we value rigorous evaluation methods, we also recognize that the innovativeness of the interventions being studied has a decisive influence on the ultimate impact of a study. For example, perhaps the most influential publication in the Medic Mobile research archive is the largely descriptive program evaluation of our first project at St. Gabriel’s Hospital in Malawi [21], which showed that a new approach to interactive open text chat via SMS could be used to coordinate community health workers and strengthen health systems. It is widely credited as one of the first interventions of its kind and since 2010 it has been cited by 125 other scientific
publications. This insight undergirds the commitment we discuss below to conducting research with strategic focus.

**Commentary, Position Papers and Advocacy**

Making the case for replication and scale begins with measuring our impact and documenting our approach in enough detail that other organizations can learn from our struggles and replicate our successes. Beyond celebrating promising results, this means thoughtfully documenting failures [22] and making sense of why our work is so complex [23].

Often this entails producing more rigorous and comprehensive versions of internal documents that we are already using to share strategies and lessons learned across branches of our team. We then turn to teaching and advocacy that draws on our accumulated experiences and distinctive point of view. Ultimately we gauge our success in terms of how these activities inspire changes in the broader global health ecosystem. Our open and collaborative approach draws inspiration from the open source software movement, as well as global health organizations such as Partners in Health that have built new models of care, documented successes with unimpeachable rigor, and then tirelessly advocated for the field of global health to re-imagine its opportunities.

Our commitment to open collaboration began with blog posts and a peer-reviewed case study documenting lessons learned during our first pilot program [21] and early calls for a more human-centered perspective on scaling mHealth interventions [24]. It continues with open sourcing our software [25], delivering TEDx talks [23,26-29], and developing an online masters level mHealth course in partnership with the University of Edinburgh’s Global Health Academy [30]. Today these efforts are particularly integral to our work with model building partners (see below), with whom we work to ground breaking new models of data-driven community health is a priority.

**INFRASTRUCTURE FOR IMPACTFUL RESEARCH**

For each of these general ‘pathways to impact’ we can cite successful example studies that have been influential in Medic Mobile’s work and, as a result, have had real-world impact at a greater scale than most peer-reviewed research. At the same time, many of our research efforts have proven less fruitful. Some projects went poorly because a team lacked appropriate resources, time or key research skills. Other studies were more rigorous, but poorly integrated with our organization and as a result have proven irrelevant to our ongoing work.

These problems are not unique to Medic Mobile—a recent survey of ICT4D researchers concluded that, “while ICT4D researchers are interested in influencing both practice and
policy, they are less inclined toward the activities that would make this happen” [31]. On at least two occasions, independent evaluators of Medic Mobile projects failed to even mention in their manuscripts that the toolkit is open source, or that a non-profit organization exists to help governments and NGOs scale up their use of these freely available tools [9,32]. Developing in-house research infrastructure has enabled us to pursue internal R&D projects with greater rigor, and also to be more discerning in how we form research projects and partnerships with external collaborators. The following paragraphs outline our current understanding of the expectations and concrete activities that can foster research impact in and through Medic Mobile’s ongoing advocacy work and existing user base of nearly 20,000 health workers.

A Pragmatic, Organizationally Embedded Agenda

In addition to contributing to the scientific community, research can and should contribute to Medic’s organizational infrastructure so that each initiative has broad support across Medic and an appropriately cross-functional team including designers, implementers, tech leads, developers and data analysts. Some past research has taken place in siloes, separated from our regional teams and product team. Separate silos are convenient for initial studies but this approach scales poorly because our design, implementation, partnerships and strategy teams are unfamiliar with the process and outcomes. Addressing this challenge means recognizing that scientific aims are secondary and instrumental to caring for communities and sustainably improving health systems and health outcomes—what we call a practice-based, care-first agenda that is well aligned with Medic Mobile’s delivery model.

Medic Mobile’s delivery model includes ongoing development of the core community health toolkit, systems design efforts with model building partners, national scale up in partnership with Ministries of Health, and hosting the simple Standard version of our toolkit free-of-charge with remote support for smaller organizations. Read more at medicmobile.org.
Practically speaking this often means co-design sessions, co-presenting at conferences and co-authoring with Medic Mobile staff, most of whom are not trained as researchers and may see this as a professional development opportunity. Our editorial in the European Journal of Cancer Care is relevant to this point:

*We urge journal editors and agencies commissioning research and development in this area to favor for funding, review and publication, research that reflects long-term and meaningful engagement with designers, implementers, managers, and community members. Such interdisciplinary collaborations should not begin and end with a single demonstration project or clinical trial; at best they will begin with initial prototyping in a specific national health care system and proceed to robust evaluation and implementation at scale in the same setting... Research generated in this manner is most likely to address the needs and constraints of mHealth programs in settings of poverty and high burdens of disease. Similarly, technologies developed through such collaborations are more likely to be meaningfully user-informed, fit for context, and of demonstrated value [14].*

**Strategic Focus**

Strategic focus begins with a frank understanding that we are co-designing a model Medic Mobile could scale. Generally this means focusing on technology supported community health interventions with potential to significantly influence burden of disease and human suffering for large numbers of people.

Such research opportunities do not present themselves in the form of obvious questions amenable to technical solution. Before we can ask substantive research questions we need to make sense of ambiguous situations and identify what is already known, what we are in a position to learn, what the impacts of research might be, who will be involved and how. This involves *curating a pipeline of ideas*, constantly scanning the community health innovation landscape and drawing insights from people’s experiences with our toolkit. Filtering this pipeline of ideas, identifying and coordinating external partners and matching learning initiatives to implementation sites requires making complex and holistic strategic bets about potential for impact. To identify the most promising research opportunities, we rank every proposal according to **three general, multi-dimensional criteria**: technical feasibility, organizational viability and sustainability, and human values including health, dignity and usability.

While rigorously applying these general criteria is deeply important, it is also necessary to account for Medic Mobile’s **strategic position** as one toolkit and organization among many
in mHealth and ICT4D. Medic Mobile staff have deep knowledge of our toolkit’s most impactful niche in our technical ecosystem, including its current capabilities, growing edges and limitations. We also have deep familiarity with the broader organizational and funding ecosystem, including strong relationships with ministries of health in specific countries. Thanks to our work with a growing number of model building partners, we are immersed in several groundbreaking new models of community health care and have learned a great deal from comparing technology and service design patterns across health systems. Our team of ten designers are constantly conducting fieldwork in new settings and our analytics database grows by hundreds of thousands of actions a month. To synthesize insights that span these health systems, it is important to alternate between studies in particular locals and a more global vision. Research needs to take this broader perspective seriously if Medic Mobile is to leverage the findings.

As a matter of strategic focus, Medic Mobile also needs to pivot or gracefully exit projects that appear unlikely to work at a meaningful scale in the long term.ii And it is important to be disciplined about not taking on unsuitable research initiatives, for example when we are too busy or too poorly funded to advance them on a pathway to scale. This isn’t to say we only conduct research when we have big grants; to the contrary we pursue agile, internal learning initiatives every month. Still, it’s important to check that the available expertise and resources match the scope of the proposed project. In cases of practical necessity, the messy work of health systems strengthening sometimes entails rapidly adding support for a new health area, workflow or feature—involving informal learning that does not meet our expectations for formal research. These developments become part of the research backlog that we hope to develop more rigorously when resources are available.

All of these factors inform the Medic Mobile Research Roadmap, which we update continually and approve changes to at weekly and annual organizational strategy meetings. While all researchers are welcome to use our Standard toolkit as-is [33] or download and configure our open source software [25], we are only able to allocate staff to projects that are approved as part of our Research Roadmap.

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ii “Meaningful scale” is, of course, a subjective consideration. For a rough indicator, scale might mean multiple projects with 1,000s of health workers.
Effective Project Formation and Management

Even very well conceived studies can go awry due to practical shortcomings in innovation management or research project management. We’re a resource-constrained non-profit organization, and in the past many of our research efforts have struggled due to a simple lack of capacity in one or more areas, for example having lacked a sustained project team with multi-disciplinary research expertise, appropriate funding and a credible publication plan. As a basic standard of effective project formation, studies that go forward as part of our Research Roadmap should have a team in place with a leader (or principal investigator), a budget, explicit approval from Medic Mobile’s full strategy team with respect to organizational integration and strategic focus, and a reasonable, documented plan that outlines the following:

1. Key partners and project sites: Early stages of project formation are likely to happen iteratively and simultaneously. This will include doing background research and identifying areas of focus (e.g. breaking “NCDs” down into specific lines of inquiry such as case finding for cervical cancer), selecting suitable partners, project sites and study designs, raising money and securing ethical approval and the approval of MM’s strategy team and other key stakeholders.

2. Literature review: Time, resources and expertise to scan the landscape of existing research and practice or/and work with external collaborators with deep expertise in a given space. These scans should be documented in the form of polished concept notes if not peer-reviewed publications.

3. Design research: Serious funding for extensive experimentation and iterative, participatory design with health workers. Research projects typically should involve relatively more senior designers/researchers who are well versed in product as well as service design. This is a distinctive strength at Medic Mobile, in part because many of our global health partners lack expertise in technology design research.

4. Evaluations: All new initiatives merit some level of documented evaluation. For rigorous, controlled study designs including RCTs, we have had particular success in supporting partners to lead independent evaluations.

5. Product development: It is important for us to cultivate a mix of research projects, with some advancing the core toolkit and others exploring new health areas or workflows without necessarily developing new technical features. It is important that software development be appropriately and transparently
resourced, so that research efforts do not derail or distract from Medic Mobile’s focus on achieving impact at scale.

6. Timeline: Ample time is necessary for effective cycles of iterative prototyping, for evaluation methods that require certain sample sizes, and for producing operational documents to support scale up. The decision to scale should be based on milestones rather than pre-ordained timelines, often lasting as much as a year or two with under 200 users before scaling.

7. Credible publications: Researchers have distinctive deliverables and documentation expectations, even when some of their activities (e.g. fieldwork, prototyping) directly overlap with designers and other staff. For this reason, dedicated researchers should cooperate with and complement (rather than overriding or replacing) the work of Medic Mobile’s designers, data scientists, tech leads etc. Research projects use specific research methods, collect data to certain standards of rigor and ultimately write credible publications. Some projects are suited to internal learning and a brief concept note or training materials may be enough; in other cases peer-reviewed publication will help us raise research funding, gain the support of partners and collaborators, and scale our work. Generally speaking, all studies should plan to produce internal working documents that are pragmatic and suited to the general audience and timelines of practitioners. Example documents are available upon request; in the past they have included concept notes reviewing literature, training materials, and internal slide decks of design insights produced weeks after fieldwork, long before manuscripts are written.

When We Avoid Doing Research
Research is expensive and time consuming—we should not invest in it unless there is a clear organizational reason.

• Previously studied workflows and features need to be continuously monitored but typically not re-studied.
• Projects focused on scale goals or/and with aggressive or strict timelines are poor candidates for exploratory R&D.
• Projects with no additional research funding (beyond routine design and implementation funding) are poor candidates for formal research.
• Projects in which we lack relevant technical or medical expertise and have not yet recruited external expertise are poor candidates for research.
• Projects in which there is ample research already published are good candidates for scoping reviews, but poorer candidates for new empirical studies.
• If people (within Medic or external) cannot articulate how the outcomes of a specific study could shape initiatives that we are actively planning to scale up, it’s poorly aligned with our organizational strategy.

It’s important to note that we typically incubate ideas for months before they seem ready for serious investment. Our research pipeline includes a long list of ideas that we would like to explore, and we work closely with technical, academic and funding partners to draw together the right expertise and resources before Medic Mobile’s strategy team gives the project a green light to move forward.

**RESEARCH PARTNERSHIPS**

To summarize the themes above, we might simply say that Medic Mobile works with *research partners*. We are not interested in being a hands-off solution vendor or software development consultants for hire. Most of our research takes place with our model building partners or with well established university labs working with our standard toolkit or at one of our government adoption sites. Model building partners are philosophically aligned organizations that do groundbreaking work to a high standard of excellence. They share Medic Mobile’s commitment to establishing new models of care that strengthen the role of community health workers, they support our human-centered design process and they also integrate research with ongoing implementation efforts. Often they invest long term in a specific community. And they do not take dissemination for granted; they invest in technical support and advocacy to scale up the model with an ecosystem of partners.

Most model building partners equip all of their community health workers with the Medic Mobile toolkit to support data-driven models of doorstep care. As a result, their partnership with Medic Mobile is typically organization-wide and sustained long term, even while specific studies are time delimited and funded on a case-by-case basis. Working with model building partners in a handful of countries across several continents affords a remarkable opportunity to compare technology and service design patterns and see what works in diverse settings.

Our list of model building partners serves both to illustrate what we seek in a research partner, and more broadly to convey our sense of what kinds of community health systems are best designed to advance global health equity.

**Model Building Partners**

- Abwenzi Pa Za Umoyo (Partners in Health), Malawi
- BRAC, Bangladesh and Uganda
Children in Crisis, Guatemala
Hope Through Health, Togo
Living Goods, Uganda and Kenya
Muso, Mali
One Heart World-Wide, Nepal
Pivot, Madagascar
Village Health Works, Burundi

ACKNOWLEDGEMENTS
Our research efforts are indebted to more partners than we can mention here. Key contributors include thousands of community health workers and the teams that support them, the authors of the studies listed below, and the 70+ Medic Mobile staff whom are pictured here at a January 2018 meet-up in Kenya.

REFERENCES CITED
1. Personal communication, 2016 baseline results from the second RCT of the Living Goods-BRAC model in Uganda.


8. PDF versions of every paper in the Medic Mobile research archive are available at http://bit.ly/2hWUX2C


25. Source code for the Medic Mobile toolkit is available at github.com/medic


33. For more about Medic Mobile’s standard toolkit and other deployment options, see: https://medicmobile.org/deploy-medic-mobile

**MEDIC MOBILE RESEARCH ARCHIVE**

PDFs of the 32 peer-reviewed publications in this bibliography, as well as more than 20 technical reports and white papers, are available in the Medic Mobile research archive. Citations are organized chronologically within sections, with more recent publications toward the top of the list. Co-authors currently or previously employed by Medic Mobile are in bold.

**Literature Review and Landscape Analysis**


**Human-Centered Design Research**


8. Oliver M, Geniets A, Winters N, Rega I, Mbae SM. What do community health workers have to say about their work,
and how can this inform improved programme design? A case study with CHWs within Kenya. Global Health Action. 2015 May 22;8(0):14876.


Program Evaluations and Field Experiments


Commentary, Position Papers and Advocacy


