

# WEARABLES FOR GOOD USE CASE HANDBOOK

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A COMPANION PIECE TO THE  
"WEARABLES FOR GOOD" CHALLENGE

a product of





Could wearable and  
sensor technology  
be the next mobile  
**revolution?**

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Can we develop innovative, affordable solutions to make wearables and sensor technology a game-changer for women and children across the world? Join us in this multi-disciplinary conversation as we explore possibilities.

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# INTRODUCTION TO THE HANDBOOK

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This handbook aims to bring together the design, technology, and social impact communities to encourage the creation of wearable solutions for social good. It describes specific use cases and principles—through the lens of UNICEF Innovation—so that the design, science, impact, and technology communities can work together to create solutions for some of the world’s most serious challenges.

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## HANDBOOK CONTENTS

- 3 INTRODUCTION TO THE HANDBOOK
- 5 SOCIAL IMPACT + WEARABLES
- 8 CONSIDERATIONS + PRINCIPLES
- 12 FOCUS AREAS + PROMPTS
- 16 WHERE DO WE GO FROM HERE?

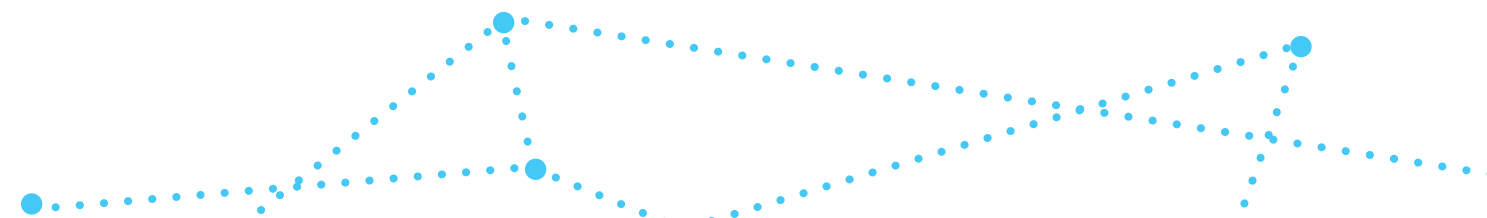
## AN OPPORTUNITY TO DO GOOD BUSINESS BY DOING GOOD

The potential of wearables as product category should not be underestimated. Investors have spent over half a billion dollars in equity and debt on wearable technology startups since 2009.<sup>1</sup> Business Insider estimates that the value of the wearables market will rise from \$2.5 billion in 2014 to \$12.6 billion by 2018. It is predicted that the revenue from smart wearable devices will generate \$22.9 billion in revenue by 2020. As it grows, the market will expand beyond devices aimed mostly at consumers living in developed economies to include products and services that support the needs and aspirations of people around the world living in developing markets or in low-resource geographies.

**Social impact** is loosely described as an action that benefits an individual, a community, an entire population or society at large, increasing the quality of life. In more specific instances, social impact work may focus on alleviating poverty, improving healthcare services for the most vulnerable—especially women and children—or providing disaster response and relief. Agriculture has become also a recent focus of impact programs, which aim to improve farming methods, crop security, and distribution channels to improve nutrition.

Throughout this spectrum of social good, mobile technologies have played an increasingly important role over the last decade and wearables are primed to possibly drive the next wave of development for social impact. Wearables open new channels for connecting the hardest to reach to services, new ways for citizens to have their voices heard, and new opportunities for civic engagement in larger government processes.

Inspired by research in the field of wearable technology, we see an opportunity to expand upon the concept of T4D (technology for development) by focusing on the potential applications of wearables in the developing world. We also encourage the creation of new technologies for existing areas. In this way we can achieve parallel development, rather than succumbing to the old paradigm of technology looking for a use case.



This handbook is a **companion piece to the Wearables for Good Challenge**, led by UNICEF, ARM, and frog. The social impact focus areas in this handbook are specific to UNICEF and the wearables challenge, as it seeks out new technologies to ameliorate problems in the areas of alert/response, diagnosis/treatment/referral, behavior change, and data collection/insight. These areas will be described in detail later in this document.


The focus areas in this handbook are particular to the context and environments in which UNICEF works, as part of the 7 pillars within UNICEF's overall strategic plan. These seven pillars are **Child Protection; Education; Health; HIV/AIDS; Nutrition; Social Inclusion; and Water, Sanitation and Hygiene (WASH)**. We have created 4 areas of focus for the wearables challenge, for which we are seeking new ideas and solutions to existing, intractable problems.

While these use cases are particular to the focus areas of the challenge, we hope that by sharing them widely the design, technology and impact communities will be able to extrapolate interesting scenarios and begin to apply insights and solutions to adjacent spaces. In that sense, this handbook isn't meant to cover every possible use case or focus area for UNICEF, the challenge, or social impact in general. We strive, through this document and the challenge, to open a dialogue in areas yet uncharted.

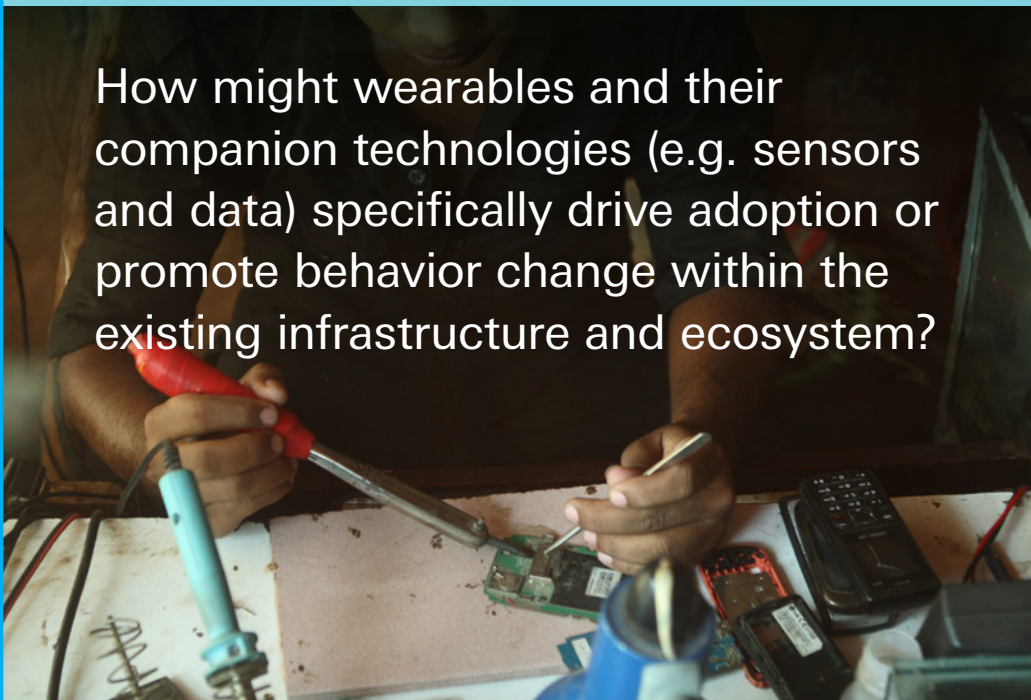
## THIS HANDBOOK RAISES QUESTIONS SUCH AS:




How might we expand the definition of wearables to envision their potential positive impact on people, data, objects, and services on communities of need?



How might wearables and the IoT serve resource-constrained communities, as mobile infrastructure has in recent years?



How might wearables and their companion technologies (e.g. sensors and data) specifically drive adoption or promote behavior change within the existing infrastructure and ecosystem?



Are wearables a viable technology asset in communities of need given common constraints such as lack of connectivity or electricity, access to repairs and parts, humidity or other harsh environmental factors, and varying levels of literacy?



How might we (re)design a wearable to be a viable technology asset while considering UNICEF's open innovation principles, on the ground context, and constraints?

# SOCIAL IMPACT + WEARABLES

“In the 21st century, you have to use technology as one of the tools in the toolkit to bring about social change.”

Beth Simone Noveck

## WHY USE TECHNOLOGY TO ADDRESS SOCIAL PROBLEMS?

Social impact is often misconstrued as a purely philanthropic effort, and one that is based solely on financial or personnel aid. Technology and innovation, however, are crucially important and growing aspects of the social impact sector, as demonstrated by the team at UNICEF devoted specifically to innovation. UNICEF Innovation is an interdisciplinary team of individuals around the world tasked with identifying, prototyping, and scaling technologies and practices that strengthen our work. For our team, the question becomes not how do we reach people at the last mile but rather how many people are we reaching in the right way for what they need. There is an untapped market in creating innovations for people in developing countries who truly need to access the three pillars of global citizenship: information, opportunity and choice. We want to encourage the idea that all of us — makers, engineers, do-gooders, executives, computer scientists, inventors, innovators — are making things that are not just nice to have, but that people need.



As the design, technology, and scientific communities come together to create new solutions, there are many considerations and examples to follow. First is the possibility of **both analog and digital solutions**, ranging from low to high-tech. For example, UNICEF uses the MUAC (mid-upper arm circumference) measuring tape, which measures the circumference of a child's arm using printed color bands in red, green, and yellow to indicate at a glance whether the child falls into acceptable levels of nutrition. This is an example of a low-tech, durable, analog wearable that is robust, highly distributable, and has an excellent success rate for gathering and understanding the data it sets out to collect.



Successful designs in this space will also consider an **entire system** as opposed to a single point of influence. For example, health-related behavior change in an individual often requires the support and participation of their family or caretakers, in addition to the involvement of their medical community. Solutions must drive systemic change, and so we must design and develop technologies in service of the entire ecosystem around an individual, instead of narrowly focusing on one desired outcome.

One final consideration deals with the **collection and sharing of data**. Data should not be gathered simply for the sake of information collection, but instead it should be used as a medium to facilitate collaboration and catalyze change. In other words, data is not an endpoint. It is fluid and dynamic, and can be a force for opening new pathways

of development and provide information and context easier than ever before.

### WHY WEARABLES?

The benefit of certain technological solutions in social impact scenarios is clear; for example, mobile technologies have been widely adopted globally and have contributed to financial inclusion, disaster relief and health care, among others. However, it is ambitious to imagine that the nascent and controversial field of wearables might be equally applicable to these scenarios. Consumer wearables in the fitness tracker category have so far proven to be less than successful in the long term; studies show that many users abandon these devices within 6 months of purchase.<sup>2</sup>

Limiting factors in this space include physical comfort, charging considerations, lack of a real customer need, and interoperability issues, not to mention identity, cultural context and fashion. The lack of standards or leading players in the market combined with nuances of culture, religion and other regional factors will magnify these challenges in communities of need.

It is important to remember that mobile technologies have succeeded in communities where, five years ago, cost and lack of supporting infrastructure led many to predict mobile technology would never take off. Furthermore, we know that many of the aspects that make commercial wearables successful are exactly the characteristics required for addressing certain social impact use cases, especially those outlined by UNICEF. Monitoring and measuring vital signs and other bodily statistics, sensing environmental conditions, real- or near-realtime collection of data, alerts and communications, and gesturing and controlling other parts of the system are all features of consumer wearables that are directly applicable to UNICEF and other impact influencers.

The challenge is to design the appropriate touchpoints, services, and supporting ecosystem with an appreciation for the existing infrastructure and its inherent constraints.

## WHAT DO WE MEAN BY WEARABLES? WHAT CAN WEARABLES DO?

In today's parlance, wearables too often refer to fitness tracking devices worn on the wrist, used to monitor performance for the purpose of gaining insight on personal health. Consumers and developers are beginning to understand that the potential application of this technology goes well beyond simple tracking of physical activity or other biometric data points. We know that wearables use sensors to measure conditions, either within the body or the environment, and can track and monitor the resulting data over time to create a comprehensive map of fluctuating events. The Fitbit is the archetypal product example in this category.

Beyond the simple idea of a tracking device, a wearable (like a mobile phone) can be used as a communication device—either one way or two—by sending and receiving various types of alerts and messages. The Apple Watch is currently positioned to own this category. Wearables are also expanding the opportunities for gesture-based control, where the device is used to interact with, direct, and control other devices or actions. Examples include Disney's MagicBand, an RFID enabled wristband used to unlock experiences in Disney's parks, and headsets like Emotiv and Muse, which are being explored as devices that can control interfaces using the power of our thoughts.

As their capabilities and uses expand, we are also reconsidering where a wearable is worn. Wearables could also include a device that is in the body, on the body in any location, or perhaps even frequently near the body. Cochlear implants, pacemakers, and even ingestible devices containing sensors that travel through the intestines are all examples of wearables operating in the body.



The head (the Emotiv and Muse headbands), ear (bluetooth earbuds), eyes (contacts that can measure blood glucose in diabetics), chest (heart monitors) and other locations are being considered for varied applications. With the proliferation of sensors, wearables are even moving off of the body to spaces near the body; sensors implanted in hospital beds can track a patient's sleep patterns, body movements, and vital signs without the need for any device being attached to the patient. Gartner believes that 30% of smart wearables will be unobtrusive to the eye by 2017.<sup>3</sup>

**These new applications require us to rethink the purpose and ethical implications of wearables.** When wearables are no longer a singular touchpoint—worn by an individual for the purpose of personal insight—but have evolved into one node in a cooperative system of people, services, organizations, and data, these implications are immense. We imagine use cases where a wearable is used not only to track personal health data, but also to reference

available data about public water well safety, transportation logistics, or mobile money applications. **This is the “why” of wearables for social good:** we need to create new nodes in an existing development network that will help deliver services at the last mile, where resources are often constrained.<sup>4</sup>

With this view, we can expand the call to action of the Wearables for Good challenge outward to include the objects, people, data, and services with which wearables interact. Related domains include smart cities, IoT, sensors, privacy, and others. This creates a much larger platform for solving intractable social problems in the areas of health, poverty and financial inclusion, transportation, and disaster relief. It also provides a robust set of opportunities specific to the UNICEF Wearables for Good challenge, which focuses on developing wearable and sensor technology solutions that can serve across the seven strategic pillars for UNICEF.

# CONSIDERATIONS + PRINCIPLES

For the purposes of this handbook, we want to illustrate a sampling of needs via four focus areas: **1 Alert / Response, 2 Diagnosis / Treatment / Referral, 3 Behavior Change, and 4 Data Collection / Data Insights.**

However, the Wearables for Good Challenge is open to ideas in any of UNICEF's seven strategic pillars: Child Protection; Education; Health; HIV/AIDS; Nutrition; Social Inclusion; and Water, Sanitation and Hygiene (WASH). Here in the handbook we note where focus areas have overlapped with the seven pillars. Adhering to our design principles, we want to encourage that products that are entered in this challenge are created to be open source and in the public domain.

## SYSTEMIC CONSIDERATIONS

What are the situations, scenarios and constraints for which wearable technologies might be applicable? How can we describe the issues that UNICEF, community members and the technology community are trying to solve, together?

How might technologists, designers and data scientists join those working in social impact in developing ideas for wearable technology that could have impact on seemingly intractable problems? We hope to bridge the divide in the conversation with this handbook, by providing sample use cases and high level design principles specific to UNICEF and its particular challenges.

Building a wearable for the developing world requires an insight into that environment, the context of need, and an understanding of the end user. There are many considerations in creating wearables for these types of needs.

### We must ask the questions, how can wearable & sensor technology...?

- Strengthen health and community systems
- Scale up and integrate into existing services
- Create an understanding of what systems are present in the intended market and the gaps that have room for development
- Be sustainable (financially and otherwise)
- Lend knowledge for implementation science (the "how and what" to do)
- Reduce inequalities that exist due to social and economic marginalization (address social determinants)

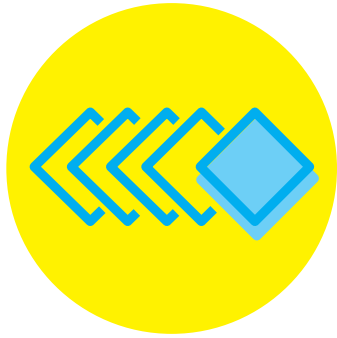
## DESIGN CONSIDERATIONS

Oftentimes in emerging economies well-maintained and adequately-financed public services are not in place. **Limiting factors to be considered include:**

- Geographic distance to facilities and services
- Very low quality or non-existent public services
- Inadequately skilled personnel
- Lack of financial resources
- Time constraints
- Competing economic motivations
- Social marginalization



A wearable built to address social good would ultimately need to follow a systemic, communitarian approach. **It must be:**



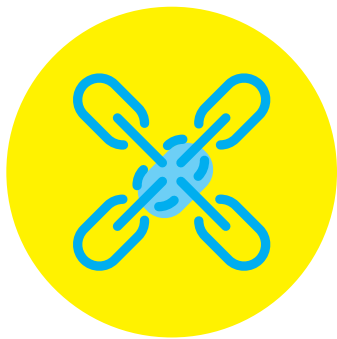
## Cost-Effective

Can be executed en masse in low cost areas, with a demonstrated business case and need



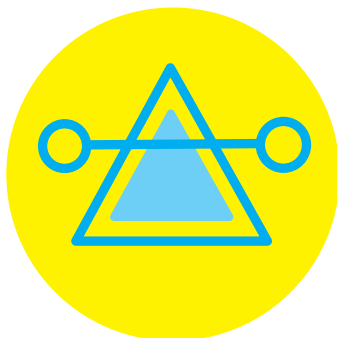
## Low-Power

Runs off a battery, has long battery life (possibly alternate energy), is power efficient where there is no power



## Rugged + Durable

Is waterproof, shockproof, weatherproof, heat resistant, easily stored, and built to last



## Scalable

Can be applied to varying environments and communities, consider a larger ecosystem, easily produced/developed, easy to use, easy to maintain (fixed/addressed by local skill)

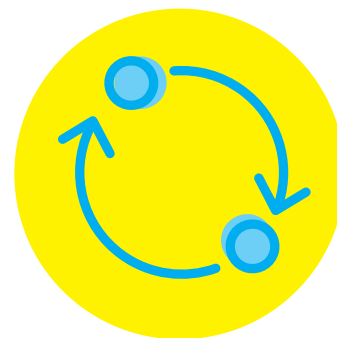


# UNICEF INNOVATION'S DESIGN PRINCIPLES

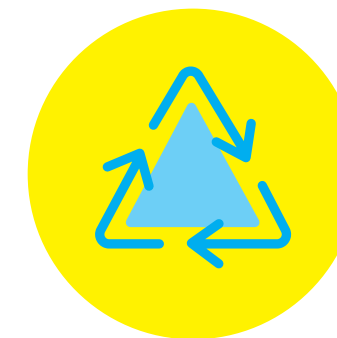
Design principles can both encourage and constrain technologists, scientists, and designers who are considering solutions to wide-reaching problems. In this handbook, we refer to UNICEF's "Principles for Innovation and Technology in Development." These principles are not intended as hard and fast rules, but are shared as best practices that inform the design of technology-enabled development programs.



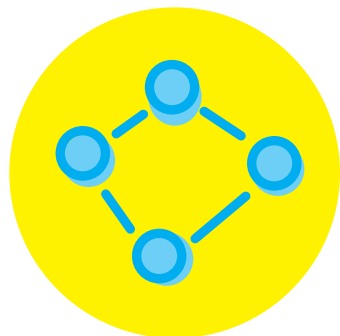
Design with the User



Build for Sustainability



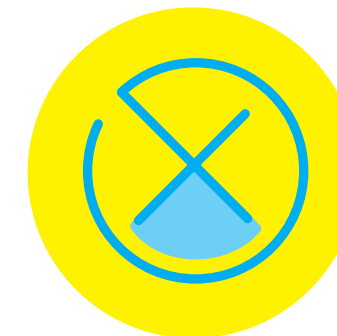
Reuse and Improve



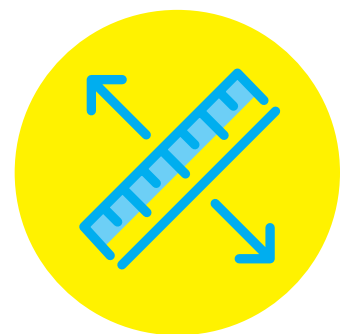
Understand the Existing Ecosystem



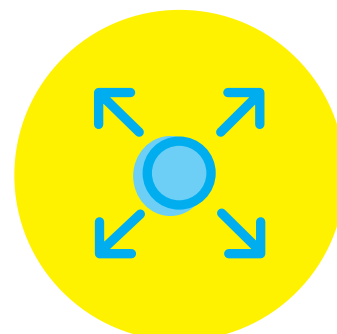
Be Data Driven



Do No Harm



Design for Scale



Use Open Standards, Open Data, Open Source, and Open Innovation



Be Collaborative

## Design with the User

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- Develop context appropriate solutions informed by user needs.
- Include all user groups in planning, development, implementation and assessment.
- Develop projects in an incremental and iterative manner.
- Design solutions that learn from and enhance existing workflows, and plan for organizational adaptation.
- Ensure solutions are sensitive to, and useful for, the most marginalized populations: women, children, those with disabilities, and those affected by conflict and disaster.

## Understand the Existing Ecosystem

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- Participate in networks and communities of likeminded practitioners.
- Align to existing technological, legal, and regulatory policies.

## Design for Scale

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- Design for scale from the start, and assess and mitigate dependencies that might limit ability to scale.
- Employ a “systems” approach to design, considering implications of design beyond an immediate project.
- Demonstrate impact before scaling a solution.
- Be replicable and customizable in other countries and contexts.
- Analyze all technology choices through the lens of national and regional scale.
- Factor in partnerships from the beginning and start early negotiations.

## Build for Sustainability

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- Plan for sustainability from the start, including planning for longterm financial health (e.g. assessing total cost of ownership).
- Utilize and invest in local communities and developers by default and help catalyze their growth.
- Engage with local governments to ensure integration into national strategy and identify high-level government advocates.

## Be Data Driven

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- Design projects so that impact can be measured at discrete milestones, with a focus on outcomes rather than outputs.
- Evaluate innovative solutions and areas where there are gaps in data and evidence.
- Use real-time information to monitor and inform management decisions at all levels.
- When possible, leverage data as a byproduct of user actions and transactions for assessments.

## Use Open Standards, Open Data, Open Source, and Open Innovation

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- Open data and functionalities and expose them in documented APIs (Application Programming Interfaces) where use by a larger community is possible.
- Invest in software as a public good.
- Develop software to be open source by default with the code made available in public repositories and supported through developer communities.

## Reuse and Improve

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- Use, modify and extend existing tools, platforms, and frameworks when possible.
- Develop in modular ways favoring approaches that are interoperable over those that are monolithic by design.

## Do No Harm

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- Consider the context and needs for privacy of personally identifiable information when designing solutions and mitigate accordingly.
- Assess and mitigate risks to the security of users and their data.
- Ensure equity and fairness in co-creation, and protect the best interests of the end-users.

## Be Collaborative

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- Engage diverse expertise across disciplines and industries at all stages.
- Work across sector silos to create coordinated and more holistic approaches.
- Document work, results, processes and best practices and share them widely.
- Publish materials under a Creative Commons license by default, with strong rationale if another licensing approach is taken.

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*UNICEF innovation principles have been endorsed or adopted by the following partners: UNICEF, USAID, Gates Foundation, EOSG Global Pulse, WFP, WHO, HRP, OCHA, UNDP, SIDA, IKEA Foundation, UN Foundation, and UNHCR.*

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# FOCUS AREAS + PROMPTS

For the purpose of this handbook, we have outlined some **examples** within each of the four focus areas identified, in the sections that follow. These examples are meant to simply inspire creative and critical thinking about what a device / tool / system would look like to tackle some of the issues that resource-constrained communities are facing. Endless possibilities abound for specific situations and context that wearable and sensor technology could address. We hope these examples promote further thinking, ideas and new conversations.

## 1 ALERT / RESPONSE

UNICEF PILLARS ADDRESSED:  
HEALTH, SOCIAL INCLUSION

### THE PROBLEM: Fire and Other Emergencies/Disasters

When fires swept through three Nairobi slums from January to March 2011, leaving an estimated 25,000 people homeless, authorities and agencies were slow to respond. Fires are common in slums from Dhaka to Nairobi but urban disasters receive a baffling lack of response from aid agencies, indicating major gaps in urban crisis preparedness.<sup>5</sup> Fires are not the only risk prevalent in low-income urban areas. Most of the world's people now live in cities. As urban development accelerates, the proliferation of informal settlements, declining ecosystems and failing infrastructure increase the vulnerability of inhabitants to disasters. It is estimated that eight out of 10 of the most populous cities in the world can be severely affected by an earthquake, while six out of 10 are vulnerable to storm surges and tsunamis.<sup>6</sup>

### STATEMENT OF NEED

Fires regularly occur in urban slums, often resulting from indoor stove use, trash burning, faulty wires and residents trying to keep warm. Rapid and haphazard community development forces homes close together and allows fire to spread easily. Pathways between homes are narrow and often blocked, making evacuations chaotic and dangerous. Residents commonly do not know who to call for assistance, and if first responders are available they have a difficult time finding and responding to fires and other disasters quickly.<sup>7</sup> Sensor technology could help with that response and also serve as alert and detection for natural disasters and other emergencies such as flooding, earthquakes, social conflicts, and violence.

### PROMPTS:

#### How might we create a wearable or sensor technology to...

- Create early warning systems for emergencies to alert community members via alarms and mobile alerts?
- Directly notify people who can help (firefighters, responders, residents) to take a specific action in response to an emergency?
- Demonstrate the potential of more dynamic emergency response services to focus more resources on this area?

### THE PROBLEM: Infections, Pneumonia, Respiratory Disease

For children under five, the leading causes of death are infections /sepsis, pneumonia, diarrhea, malaria, measles, and HIV/AIDS. 70% of these early child deaths are due to conditions that could be treated with access to simple, affordable interventions. Over half of all under five child deaths occur partly due to poor or delayed care seeking, leaving children in developing countries 10 times more likely to die than children in developed countries.<sup>8+9</sup>

Everyday approximately 1000 women die from preventable causes related to pregnancy and childbirth, with 99% of the deaths occurring in developing countries. On top of these causes, maternal mortality is influenced by infections/ sepsis, anemia, and embolism.<sup>8</sup>

### STATEMENT OF NEED

Infections are caused by poor sanitation, unclean cuts/wounds, air pollution, bacteria, worms, fungi, or tapeworms as either a viral or bacterial infection. Viral infections present themselves in a systemic manner (runny nose, sinus, congestion, body ache, etc.), whereas bacterial infections present themselves in a localized way (redness, swelling, pain, or pus around wound). Both forms result in an increase of white blood cells. Infections are commonly diagnosed by clinical presentation and blood tests; if they are not treated they can result in sepsis.

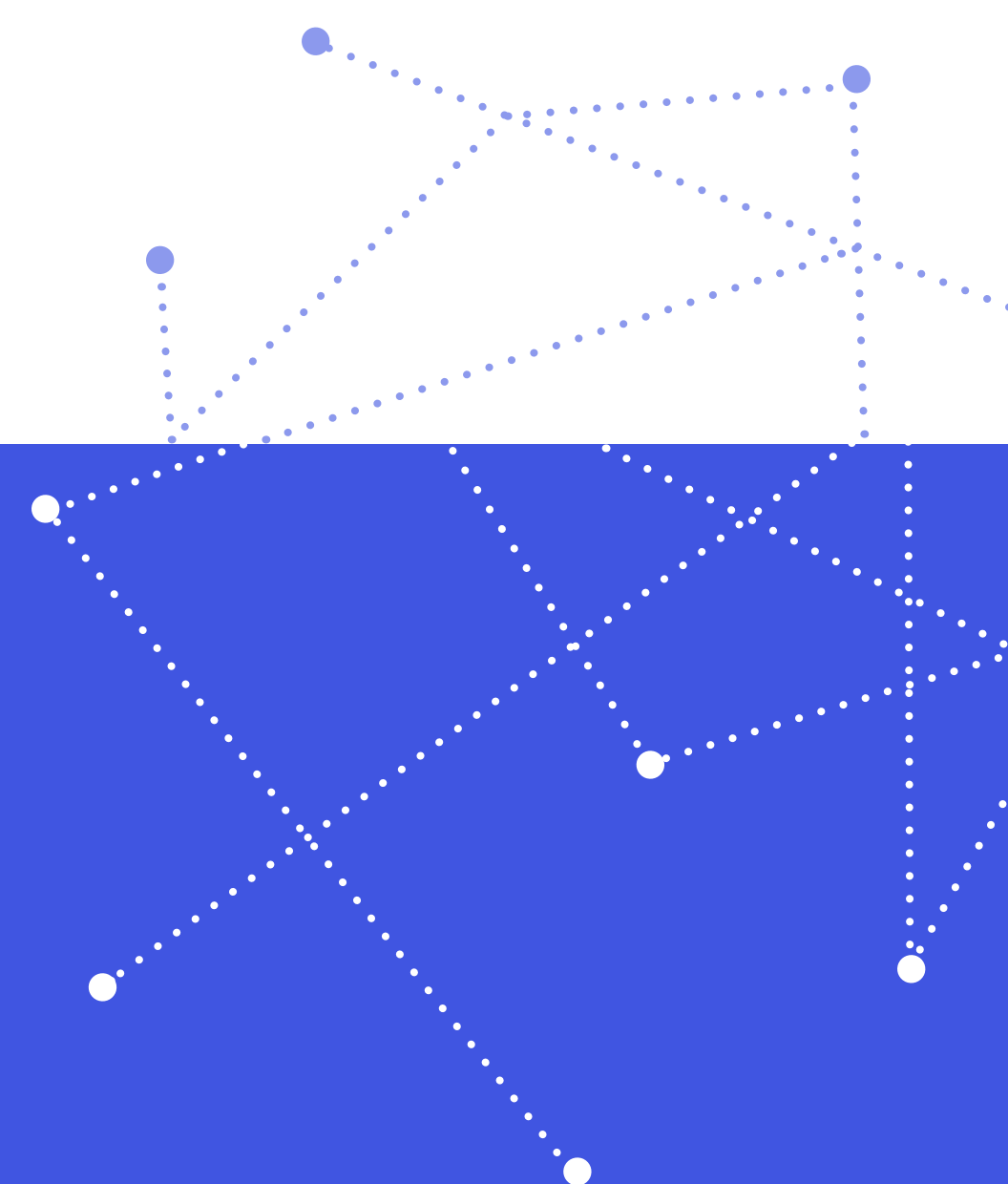
Pneumonia develops as a result of viruses, bacteria, or fungi. These can result from environmental factors such as indoor air-pollution (cooking or heating with biomass fuels such as wood or dung), crowded homes, and smoking/

secondhand smoke, or from a weakened immune system as a result of malnutrition, or preexisting illnesses (HIV, measles, etc.). Pneumonia presents itself in a variety of ways, including fast breathing, lower chest wall indrawing, and wheezing. Infants are commonly unable to feed or drink, or in severe cases unconscious, convulsing, or experiencing hypothermia.

### PROMPTS:

#### How might we create a wearable or sensor technology to...

- Find ways to compare and contrast the symptoms of viruses and bacterial diseases in order to differentiate and diagnose correctly, more quickly?
- Find other, nonclinical ways of reviewing symptoms and testing, to get treatment started more quickly?
- Use environmental analysis as indicators of the likelihood of various infections?
- Look at the regularity of seasonal outbreaks and how that data might be used to predict or diagnose pneumonia and other respiratory diseases?
- Create sensors that also measure air quality to reduce respiratory disease in children?



**THE PROBLEM:**  
**Water, Sanitation,  
Hygiene**

Factors related to water, sanitation and hygiene (WASH) can dramatically impact children’s health as well as their ability to learn. In an atmosphere of poor health, children are unable to fulfill their education potential. For example, 400 million school-age children a year are infected by intestinal worms, which, research shows, sap their learning abilities. 1,400 children die every day from diarrheal diseases linked to the lack of safe water and adequate sanitation and hygiene.<sup>10+11</sup>

**STATEMENT OF NEED**

Schools can be an important environment for initiating change by helping to develop useful health and hygiene habits which can be passed on to families, as well as by providing the necessary facilities and supplies. However, many schools themselves have very poor facilities: a recent survey showed less than half of primary schools in the surveyed developing countries had access to safe water and adequate sanitation.<sup>10</sup> Conditions vary from inappropriate and inadequate sanitary facilities to the outright lack of latrines and safe water for drinking and hygiene. This situation contributes to poor health, absenteeism and the high dropout rates of girls. Solutions are needed to encourage hand washing, good hygiene practices, provision of adequate supplies and the proper use of these supplies – taking into account cultural issues and taboos, motivations, cost and supply chain considerations, etc. Teachers can function as role models, and behavior learned at school can lead to lifelong positive habits. It has been shown to be more cost-effective to work with children in school-based programs than with adults.

**PROMPTS:**

**How might we create a wearable or sensor technology to...**

- Educate about / encourage hand washing in a school setting?
- Encourage the passing on of good hygiene habits to the household?
- Monitor at water points to encourage good hygiene habits?
- Monitor supplies such as soap, sanitary napkins, and encourage school administrators, teachers, and other adults to make hygiene a priority for the environments they oversee?

**THE PROBLEM:**  
**Nutrition for Women  
and Children**

Globally, about one in four children under 5 years old are stunted; stunting and other forms of undernutrition reduce a child’s chance of survival, while also hindering optimal health and growth. Good nutrition is critical during the 1,000-day period covering pregnancy and the first two years of the child’s life – stunting reflects deficiencies during this period. In addition to the quality and frequency of infant and young child feeding and the incidence of infectious diseases, the mother’s nutrition and health status are important determinants of stunted growth and malnutrition.<sup>12</sup>

**STATEMENT OF NEED**

During pregnancy, a woman’s body has special nutritional needs. After she has given birth, she has a greater need for energy and also for the nutrients that make her breast milk nourishing to her baby. This is critical in situations where women are already malnourished before pregnancy and don’t receive certain vitamins or minerals. Malnutrition is not only about food; to prevent and treat it effectively, you need a broad approach which also tackles other problems such as poor access to basic health services and inappropriate feeding and caring practices of children. Proper nutrition gives every child the best start in life. Education from upstream to downstream—from mothers, family, caregivers, clinic staff and community health-care workers—is essential.

**PROMPTS:**

**How might we create a wearable or sensor technology to...**

- Measure or track maternal nutrition during pregnancy in order to achieve healthy birth weight?
- Both educate and inspire a pregnant woman’s support structure / family members to understand and prioritize maternal nutrition?
- Both educate and inspire pregnant women to seek out the best nutritional decisions?
- Involve the community health worker or clinic-based staff in monitoring and encouraging maternal nutrition before and after the birth of their children?

**THE PROBLEM:**  
**Access to Care**

Skilled care during childbirth and access to emergency obstetric care are the two most critical interventions needed to ensure safe motherhood.

Worldwide, about one third of births take place without the assistance of skilled health personnel. In 2013, this translated into more than 40 million unattended births, over 80 percent of which were in South Asia and sub-Saharan Africa. Inadequate or nonexistent care and dearth of resources during pregnancy and delivery is largely responsible for the annual deaths of an estimated 289,000 mothers and 2.8 million newborns in the first month of life. Indeed, roughly three quarters of all maternal deaths take place during delivery and in the immediate postpartum period.<sup>13</sup>

**STATEMENT OF NEED**

To improve maternal and newborn survival, skilled health personnel (a doctor, nurse or midwife) should be capable of handling normal deliveries safely. They must also be able to recognize warning signs for complications and refer the mother to emergency care. Non-skilled attendants can neither predict nor cope with serious complications such as haemorrhage or sepsis, which are the leading killers of mothers during and after childbirth.<sup>13</sup>

**PROMPTS:**

**How might we create a wearable or sensor technology to...**

- Track health of the mother and fetus in very low resource environments?
- Transmit basic critical information to health care workers to help them make decisions?
- Help to identify critical signs after birth to trigger referral to emergency care?
- Transmit outside expertise to the birth attendants who are delivering a mother?

**THE PROBLEM:**  
**Birth Registration**

The births of nearly 230 million children under the age of five worldwide (representing around one in three children in that age group) have

never been recorded. This lack of formal recognition by many governments usually means that a child is unable to obtain a birth certificate and as a result may be denied healthcare or education. Later in life, the lack of official identification documents can mean that a child may enter into marriage or the labour market, or be conscripted into the armed forces, before the legal age. Registering children at birth is the first step in securing their recognition before the law, safeguarding their rights, and ensuring that any violation of these rights does not go unnoticed.<sup>14</sup>

**STATEMENT OF NEED**

If a child is born at home, or even in a health facility, without the resources, knowledge, and an easy-to-follow process, their family may not be able to ensure that their birth is officially registered. The process often requires multiple steps and traveling long distances to submit the necessary information. Sometimes a lack of the right supplies—from the paper forms to the right stamp—may halt the process. Some governments struggle with collecting data from hard-to-reach areas and may not have adequate knowledge of where large populations of unregistered children are, and while informal processes exist within families and religious groups, they are not always linked to the formal process.

**PROMPTS:**

**How might we create a wearable or sensor technology to...**

- Use informal community gatherings around the birth of a child, gift exchange, and other traditions to collect critical birth data?
- Give confidence to community-gathered data to trigger official recognition of the data?
- Empower clinic health workers and hospital staff to collect, submit, review and verify birth data in ways that don't overwhelm their other duties?

# WHERE DO WE GO FROM HERE?

Our goal for this handbook is to catalyze the identification of groundbreaking opportunities which will accelerate the development of disruptive wearable and sensor technology that can be applied in communities of need. These could be items that already exist or are adaptable, or can be a new idea or concept that needs further development and design mentorship to determine if it can become a reality. These technologies should be excitingly innovative, feasible to execute, and display appropriate context.

Across disciplines, we need to reframe our concept of wearables and envision and advocate for what is possible with this technology. We need to design for local contexts and empower users through data while protecting their privacy. This future-forward thinking has the potential to impact the lives of thousands of children. We want to encourage those who use this handbook to look for ideas that can shift universal perspective and improve the world in a meaningful way.

We hope we have inspired your inner maker, doer, innovator, inventor! We also hope you will consider the following calls to action:

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- 1 Enter the Wearables for Good challenge. Go to [wearablesforgood.com](http://wearablesforgood.com) to learn more.
  - 2 Share/submit your use cases and ideas for this handbook to us at [hello@wearablesforgood.com](mailto:hello@wearablesforgood.com)
  - 3 Start conversations in your own domain or industry.
  - 4 Participate in communities around the conversation. Go to [wearablesforgood.com](http://wearablesforgood.com) to get involved.
  - 5 Follow our work on Twitter: [@UNICEFinnovate](https://twitter.com/UNICEFinnovate) + [@frogdesign](https://twitter.com/frogdesign) #wearablesforgood
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**THANK YOU** to the following friends and community members who responded to our call to review and provide personal insight to the information and approach contained within this handbook.

Following UNICEF's principles of open innovation, together we will keep the conversation going and invite you to do so within your own community, to push the conversation forward where you are able, from whichever domain you operate within.

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**Dana Lauren Zucker**  
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**Danielle Cass**  
USAID

**Katherine Gage**  
USAID

**Billie Whitehouse**  
Wearable Experiments

**Kyle Ellicott**  
Wearable World

**Betsy Fore**  
Wondermento

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- 3 Gartner**  
<http://cloudtweaks.com/2014/12/gartner-30-percent-wearables-2017/>
- 4 Huffington Post/UNICEF Innovation**  
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<http://www.who.int/mediacentre/factsheets/fs178/en/>
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- 10 UNICEF**  
[http://www.unicef.org/wash/index\\_schools.html](http://www.unicef.org/wash/index_schools.html)
- 11 UNICEF**  
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- 13 UNICEF**  
<http://data.unicef.org/maternal-health/delivery-care>
- 14 UNICEF**  
<http://data.unicef.org/child-protection/birth-registration>

## Additional Resources

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- 1 UNICEF DATA**  
<http://data.unicef.org/>
- 2 UNICEF's State of the World's Children:**  
<http://www.unicef.org/sowc/>
- 3 UNICEF's Strategic Plan, Results Framework and more:**  
<http://www.unicef.org/strategicplan/>
- 4 UNICEF Innovation Product Catalogue:**  
<http://bit.ly/1GjUb6Y>

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