

**The Global Health Innovation Quotient Prize:  
A Milestone-Based Prize to Stimulate R&D for Point-of-Care Fever Diagnostics**

June 16, 2011

*Proposal submitted by BIO Ventures for Global Health  
for consideration by the WHO/CEWG*

*Authors/Contributors: Melinda Moree, Don Joseph, Priya Mehta, Elizabeth Ponder, Nadine Weich, Andrew S. Robertson*

**Contact:**

**Melinda Moree**

Chief Executive Officer  
BIO Ventures for Global Health  
221 Main Street, Suite 1600  
San Francisco, CA 94105

Email: [mmoree@bvgh.org](mailto:mmoree@bvgh.org)  
Office: 206-325-5409  
Fax: 415-446-9446  
Web: [www.bvgh.org](http://www.bvgh.org)

**Don Joseph**

Chief Operating Officer  
BIO Ventures for Global Health  
221 Main Street, Suite 1600  
San Francisco, CA 94105

Email: [djoseph@bvgh.org](mailto:djoseph@bvgh.org)  
Office: 415-446-9444  
Fax: 415-446-9446  
Web: [www.bvgh.org](http://www.bvgh.org)

## **Brief Description of Proposal**

We are proposing a milestone-based prize to promote the development and launch of a multiplex point-of-care (POC) diagnostic test for the differential diagnosis of fever, targeted primarily at children less than 5 years of age. The Global Health Innovation Quotient Prize (“IQ Prize”) divides product development into successive parts—set at industry-recognized inflection points—and rewards for successful completion of these milestones. In contrast with prize strategies that focus primarily on the “end reward”, the milestone approach used by the IQ Prize helps companies recover expended costs sooner, while rewarding for particular steps involving innovative risk. This approach provides an incentive for the private sector, and allows small and medium -sized companies to participate by decreasing the required capital investment, as well as decreasing the risk associated with pursuing global health research and development (R&D).

The IQ Prize includes the following key elements:

1. A target product profile (TPP), detailing the sensitivity, specificity, time to read-out, price targets, and other relevant requirements to diagnose between parasitic, bacterial, and viral causes of fever in children in low resource settings. Two standards have been developed: “Core requirements”, reflecting the requirements the POC diagnostic must meet in order to have a significant health impact in the developing world; and “Optimal standards”, reflecting higher specifications as indicated by in-country health care workers. (See Section VII.A for the full TPP). A developer must meet the core requirements in order to qualify for an award.
2. A milestone structure rewarding successful completion of key inflection points in the product development process and providing adequate commercial incentive to motivate industry participation. Sponsors would only award developers for the successful accomplishment of each milestone (Figure 1.)
  - **Milestone #1: Platform technology proof of concept:** (\$3.9 million / award; 15 awards made).
  - **Milestone #2: Platform build / prototype construction:** (\$7.8 million / award; 3 awards made).
  - **Milestone #3: Clinical validation:** (Between \$29.2 and \$36.5 million / award; 2 awards made).
  - **Milestone #4: Regulatory approval / CE mark:** (\$300,000 / award, 2 awards made).
3. Milestone award amounts that reflect both costs and risk incurred by the developer at that particular stage of development. Risk premiums will be applied where achievement of milestones requires significant innovation and carries significant technical risk. Further, an additional premium will be paid for achieving the “optimal standards” of the TPP.
4. A set number of awards would be made for each milestone. Determination of how many awards to be made is based on expected attrition rates at each stage of the competition. Estimates of likely attrition rates were gathered from industry stakeholders.

5. An independent evaluation board comprised of technical and global health experts, to both inform the technical requirements of each milestone, communicate with developers to clarify the technical requirements, and determine when an entry meets the technical requirements and when an award should be administered.
6. An intellectual property policy that allows awardees a reasonable time to continue in the competition to pursue product development for low-resource settings, and grants sponsors a residual non-exclusive right to awardees' intellectual property if further development is not pursued during this period.

Taken as a whole, the milestone approach used by the IQ prize constitutes a potentially powerful tool to promote R&D investment in global health. In combination with other innovation incentives, the IQ Prize should help make meaningful progress in the fight against neglected tropical disease in areas such as the development of next-generation diagnostics.

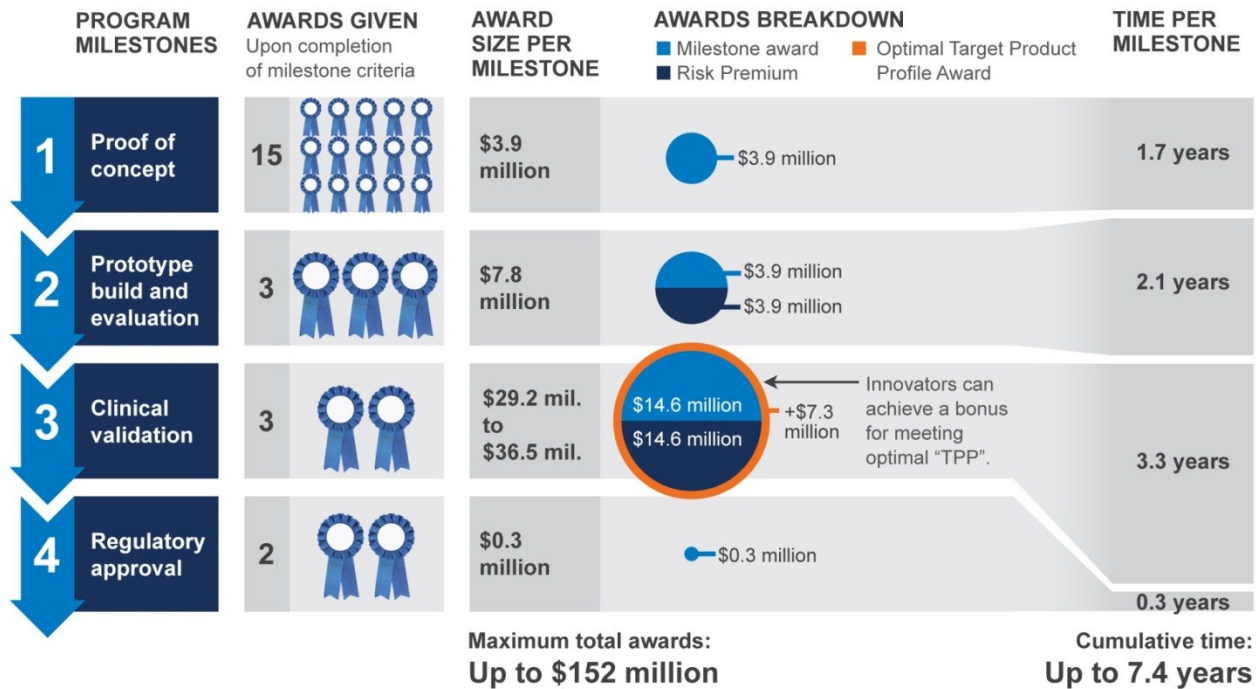


Figure 1. Overview of the IQ Prize for POC Fever Diagnostics

**II. Describe and justify the potential public health impact of the proposal:**

The target multiplex POC diagnostic would be able to distinguish between malarial, bacterial (including bacterial pneumonia), and viral causes of fever. Two key health benefits of multiplexing pneumonia and malaria diagnostics are: 1) Increasing the accurate diagnosis of bacterial pneumonia, which previously may have been undiagnosed or misdiagnosed due to a lack of diagnostic tools or due to positive malaria RDT results in a person with multiple infections; and 2) Reducing the onset of antibiotic resistance by ensuring that antibiotics are used only for bacterial pneumonia rather than being overprescribed presumptively.

We conducted a health impact analysis of the proposed multiplex POC diagnostic on children under the age of 5 (excluding neonates) and for bacterial pneumonia only (Table 1). Within various developing world regions, overall mortality due to pneumonia is estimated to drop as much as estimated 15%-25% among the population treated as a result of introducing the proposed POC diagnostic. If the aggressive goal of universal adoption were achieved, this implies that the proposed diagnostic has the potential to save between 355,000 and 460,000 children per year worldwide. The number of lives saved would be especially high in sub-Saharan Africa and India. The impact would of course be significantly lower until high levels of adoption are achieved, which may take several years following product introduction. The proposed multiplex POC diagnostic will have significant impact at all infrastructure levels, but will make the most noticeable impact in rural areas. In settings with minimal infrastructure, the new diagnostic will provide earlier diagnosis to more people, have significantly higher accuracy than current unaided clinical diagnosis, and reduce misdiagnosis of pneumonia as malaria.

| Region                       | Pneumonia Deaths (<5 years) <sup>1</sup> | Potential Reduction in Pneumonia Mortality (%) <sup>2</sup> | Potential Lives Saved (universal roll-out) |
|------------------------------|--|---|--|
| <b>Sub-Saharan Africa</b>    | 1,100,000                                | 15-20%  | 165,000 – 220,000                          |
| <b>India</b>                 | 700,000                                  | 20-25%  | 140,000 – 175,000                          |
| <b>China</b>                 | 100,000                                  | 20-25%  | 20,000 - 25,000                            |
| <b>Latin America</b>         | 50,000                                   | 15-20%  | 7,500 – 10,000                             |
| <b>N. America and Europe</b> | <2,000                                   | 5-10%   | 100 – 200                                  |
| <b>Rest of World</b>         | 150,000                                  | 10-15%  | 22,500 – 30,000                            |
| <b>Global</b>                | 2,100,000                                | 15-20%  | 355,000 – 460,000                          |

**Table 1: Lives Potentially Saved with a multiplex diagnostic to differentially diagnose causes of fever in children under the age of five.**

<sup>1</sup> Pneumonia: The forgotten killer of children, The United Nations Children’s Fund (UNICEF)/World Health Organization (WHO), 2006.

<sup>2</sup> Estimated reduction in pneumonia mortality resulting from new diagnostics has not taken into account the potential introduction of pneumonia vaccines because these vaccines (1) are significantly more expensive than other childhood vaccinations, and (2) have low coverage rates, especially in areas where a POC diagnostic will be most helpful (i.e., low resource settings).

A secondary benefit of the fever panel would be its impact on delaying the onset of antibiotic resistance through more accurate diagnosis of bacterial infection, leading to the reduction of inappropriate use of antibiotics. While documented evidence is limited, many global health experts anticipate that the burden of antibiotic resistance in the developing world is becoming particularly severe, especially in areas where access to secondary, non-resistant medication is unavailable. We conducted an assessment of the anticipated reduction in antibiotic usage resulting from universal adoption of a multiplex POC diagnostic for fever (Table 2). This benefit is in addition to the potential lives saved in Table 1.

| Region  | Sub-Saharan Africa | India  | China  | Latin America | North America, Europe | Rest of World |
|---|--------------------|--------|--------|---------------|-----------------------|---------------|
| <b>Reduction in antibiotic prescription (%)</b>                     | 5 -10%             | 10-15% | 15-20% | 15-20%        | 5-10%                 | 10-15%        |
| <b>Reduction in inappropriate antibiotic prescriptions per year</b> | 20-25M             | 30-35M | 25-30M | 25-30M        | 10-15M                | 50-55M        |

**Table 2: Reduction in Antibiotic Prescription for Bacterial Pneumonia following the introduction of a multiplex diagnostic for fever<sup>3,4</sup>**

<sup>3</sup> The Race against Drug Resistance, A report of the Center for Global Development’s Drug Resistance Working Group.

<sup>4</sup> The Center for Global Development (June 15, 2010), Press release "When Medicines Fail"

### III. Describe and justify the technical feasibility of the proposal:

We sought to identify a target product that was aggressive yet feasible based on current technology, required an innovative step in development or adaptation towards low-resource settings, and would provide a significant impact on health in developing countries. In consultation with over 80 global health experts, clinicians in the field, and industry representatives, we developed a target product profile consistent with a diagnostic test that can provide a clinically actionable, differential diagnosis of causes of fever and lower-tract respiratory infection, and will allow for better treatment decisions, including in children under the age of five (see section VII.A for the full TPP, and section VII.B for the full list of interviewees). Based on achievable improvements over existing technologies, the TPP requires that the diagnostic test must have a sensitivity that is at least 90% that of current technologies, be able to detect 80% of bacterial and malarial pathogens that cause fever symptoms, and maintain a reproducibility of 85% or higher. Importantly, the diagnostic must also be usable in the low-resource settings of the developing world, and meet criteria including usability, weight, and renewable energy sources.

Following completion of the TPP, we identified key activities within the POC diagnostic development process to serve as “milestones.” Discrete product development activities were grouped to form development steps (milestones) where success could be quantitatively and objectively measured against the TPP.

Importantly, we further vetted this list with a many of the 80 stakeholders we interviewed, and convened a working group of 10 industry participants that we identified as potential competitors for a POC diagnostic capable of determining the causes of fever (for the full list of stakeholders, see section VII.B). From this process, we identified four recognized steps within diagnostic development that can serve as “milestones.” These are:

**Milestone #1: Demonstration of proof of concept for platform technology:** Developer must demonstrate the ability of the technology to diagnose, at a minimum, each of the relevant pathogens specified in the TPP using existing biomarkers.

**Milestone #2: Platform build / prototype construction:** Developer must build and optimize prototype devices to prove the “fever panel” test concept on relevant clinical samples. Successful achievement of this milestone is defined as meeting or exceeding key requirements defined in the TPP, including: test sensitivity, specificity, inter-site reproducibility, time to result, and duration of valid result.

**Milestone #3: Clinical validation:** Developer must submit a device that meets the criteria of Milestone #2 for performance evaluation within field-based clinics. In addition to accuracy and consistency, criteria for clinical utility include overall simplicity of use, stability over time, size, ease of transport, and cost for production.

**Milestone #4: Regulatory approval / CE mark:** Developer must obtain approval through either the FDA or European CE mark process.

These milestones represent key activities that must be taken by any biotechnology firm developing a diagnostic for the developing world. Further, each milestone may potentially be met by a variety of different technological approaches. As a result, we anticipate this approach to be much more attractive to biotechnology companies, which offer a unique source of innovation but are often unable to pursue global health markets.

Notably, other global health challenges can potentially be addressed by the IQ Prize approach. This structure will help engage the small and medium sized biotechnology companies, which are a recognized source of innovation. Adaptation of this approach through the careful design of the TPP and proper, credible identification of milestones, can further expand this incentive strategy to other indications, including diarrhea, malnutrition, and respiratory infections.

#### **IV. Describe and justify the financial feasibility of the proposal:**

A key objective is to engage and motivate enough private sector firms to develop two POC diagnostics that meet the TPP specifications. After initial consultation about the proposed TPP and milestones with a substantial number of interviewees, including a panel of potential industry competitors, we determined that milestone awards should reflect the approximate cost of development for that phase. Further, prizes should be adjusted to compensate developers for steps that require significant innovation and carry significant technical risk. In addition to feedback gathered from stakeholder interviews and targeted expert working group panel, we have approximated the cost, time, and likely attrition rate associated with achieving each milestone (Figure 1).

Based on these estimates, we have proposed an award size, including a risk premium where appropriate, at each milestone (Figure 1). In total, considering the number of awards made at each milestone, the total cost of the incentive is close to \$155.5 million. This cost is a fraction of other international incentives, such as the Advanced Market Commitment for pneumococcus vaccines, which required a total of \$1.5 billion in contributions.

Finally, we believe that this approach, which takes into account cost of development, necessary risk premiums, premiums for reaching the optimal TPP, and making enough awards to accommodate for rates of attrition, would work in multiple scenarios outside of POC Dx, including therapeutics and vaccine development. Our consultations indicate that the proposed IQ Prize, combined with the potential for a sustainable market, would motivate real investment on the part of small and medium private sector players.

**V. Describe in what way the proposal addresses cross-cutting issues:**

Our proposal further addresses several cross-cutting issues raised by numerous global health stakeholders:

Intellectual Property & Technology Transfer - In order to retain the desired motivation of developers, the IQ Prize is designed so that the developers retain all rights to their pre-existing and newly developed IP. However, developers who accept milestone awards will be required to pursue subsequent milestones in good faith within a fixed period of time; failure to do so would permit sponsors to invoke a license to all technology developed through the incentive. In this way, sponsor interests would be protected if a developer receives significant milestone payment(s) and subsequently withdraws from further competition; or is unable to follow through on supply if their product is one of the final products chosen.

If a company goes through the competition and receives one of the final awards (Milestone 4), but is not able or willing to provide ongoing supply at scale, the company would also be required to provide the license described above, along with adequate technology/ know-how transfer to reasonably enable effective use of the license by a third party manufacturer. The same due diligence, quality, and expiration rules would protect the company in this setting.

The effect of the foregoing would be for the company to continue to own all IP generated: its own core IP, as well as IP generated in the competition. The sponsor receives assurance, however, that if the competitor exits following receipt of at least two milestone payments, the sponsor retains some benefit via the non-exclusive license. The sponsor is further protected by the license requirement if a company receives an award for an approved product but cannot or will not manufacture and supply the product. The company is protected by due diligence and quality requirements in the license arrangement, which itself would expire if the sponsor or sub-licensee does not progress the subject IP toward product approval or manufacture.

Access and Affordability – Our proposal addresses access and affordability in the following ways. First, our TPP will have a target *ex-works* price target to promote the ultimate uptake of the product. This price will be determined based on cost to produce, expected volume, country demand, priority, and other relevant factors.

Second, the proposed prize program has the end goal of commercializing two products that meet at least the minimal TPP. This will ensure post-prize competition that is expected to drive prices down even further (and may be preferred in order to address regional or country differences in manufacturing requirements and capabilities). Further, by incentivizing the development of multiple products, donors can help protect against short-term unanticipated obstacles, for example, in the event the developer temporarily discontinues work, shifts their market focus, or decides to sell their technology to a third party who cancels the project.

Third, developers are encouraged to meet developing world demand and will be required to submit a plan for manufacturing and distribution to do so. Donors will also take an active role in facilitating market access. A developer unable or unwilling to supply a relevant market will provide an enabling out license of its IP to a third party supplier, to allow the market to be served.

Fourth and as discussed above, is our approach to intellectual property, setting price targets within the TPP, and reimbursing companies only for cost of development rather than for market price. These

concepts will aid in incentivizing companies to make their product available to the developing world at affordable and accessible prices. Likewise, our approach to these issues appears to be consistent with the principles of de-linkage. This incentive strategy increases the likelihood that innovative developments are made available to low and middle income countries at an affordable price, irrespective of the cost of product development.

Governance and Administration – We propose the incentives administration and governance structure to be built around a program secretariat, likely as part of a larger host organization. The proposed secretariat will maintain high levels of credibility and transparency, and will be responsible for managing the incentive program on behalf of donors, performing the following activities, among others:

- Managing the enrollment of competitors,
- Directing the flow of milestone funding from donors to developers;
- Managing relationships with developers;
- Facilitating the work of the expert advisory group (EAG) in assessing the satisfaction of milestones; and
- Maintaining communication links among stakeholders and with the general public.

To support the secretariat, we propose convening a panel of industry experts, or an Expert Advisory Group (EAG), who are familiar with all aspects of the development and manufacture of POC diagnostics, including expertise in the developing world. Throughout the course of the program, the EAG will meet to objectively determine whether a participating developer has satisfied milestone requirements and would therefore be eligible to receive a milestone award.

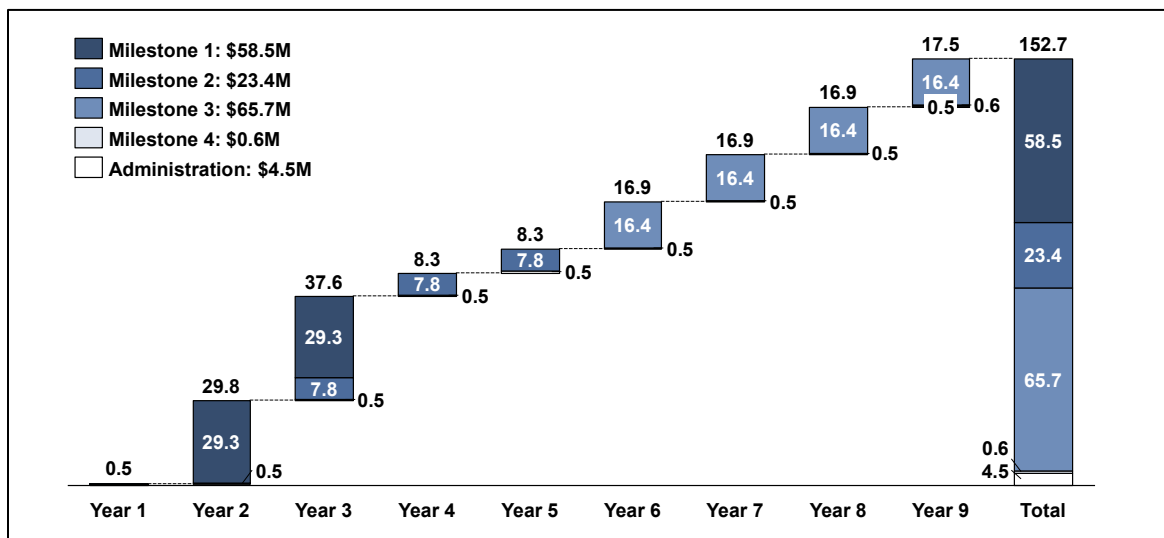
Compatibility with other incentives – The IQ Prize strategy should be compatible with most other incentive strategies, including push funding (grants, contracts), cost reduction strategies (open sources and IP sharing schemes), and pull-based incentives (advanced market commitments and additional prize incentives).

**VI. Identify key steps necessary to begin implementation and key issues to be resolved for implementation to begin:**

The following steps would need to be taken in order to begin implementation of this incentive:

1. Creation of a secretariat to help administer the incentive. A secretariat that would perform the duties as outlined above would need to be first created, ideally through partnership with a larger host organization.
2. Creation of an independent and credible EAG – In order to maintain both credibility and transparency, the secretariat will need to assist with the creation of an independent EAG, comprised of recognized scientific, medical, commercial, and global health experts, selected by the donor(s) and familiar with all aspects of the development and manufacture of POC diagnostics. Throughout the course of the program, the EAG will meet to objectively determine whether a participating developer has satisfied milestone requirements and would therefore be eligible to receive a milestone award, and will help review and verify the proposed milestone criteria. The EAG membership will be adjusted as appropriate to reflect the different technologies used at each milestone.
3. Securing donor commitments to fund the IQ Prize and supporting interventions. Sponsorship of the incentive would ideal require donors to commit the full amount of the incentive (\$155 million) over nine years. This figure includes administration and overhead costs, which assume (1) the cost of two fully-loaded administrator FTE salaries of \$150k and (2) general operating expenses incurred by the host organization of \$200k per year. Limited additional costs associated with the expert working group and milestone evaluations have not been included. Further refinement of these figures will be required prior to project launch. Total donor projections are highlighted in figure 2.

**Figure 2: Summary of Total Donor Cost over the Project Timeline (\$M)**



In addition, implementation will also require secured funding for a **secondary package of supporting interventions** over the course of the incentive. These interventions will help developing-world access to the final diagnostic products, and help meet identified supply-chain challenges. These interventions include:

- a. Measuring demand for a multiplex fever diagnostic and ensuring sufficient supply for the developing world;
- b. Promoting adoption by developing country governments and multilateral organizations who manage health care systems, especially in low resource settings; and
- c. Encouraging continued innovation to incorporate optimal parameters and integration of additional biomarkers in subsequent product developments.

The broader package of supporting interventions has not been included in estimates of overall funding requirements of the proposed IQ Prize, as they would be funded outside the scope of the prize.

**VII. Provide the evidence base for the proposal including literature references and other relevant information:**

The following is provided as additional information:

**A. Target Product Profile developed for the POC Fever Panel Diagnostic:**

| Fever Panel Target Product Profile  |   |   |   |                     |  |                       |   |                    |   |   |   |                    |   |  |  |                        |   |      |      |                             |                    |                        |  |   |  |
|---|---|---|---|---------------------|--|-----------------------|---|--------------------|---|---|---|--------------------|---|--|--|------------------------|---|------|------|-----------------------------|--------------------|------------------------|--|---|--|
| <b>Disease / Pathogen</b>   | <ul style="list-style-type: none"> <li>• <b>Malaria:</b> definitive and distinct diagnosis of <i>Plasmodium falciparum</i> and <i>P. vivax</i>.</li> <li>• <b>Bacterial pneumonia:</b> diagnosis of bacterial pneumonia by either definitive diagnosis of each of the three major pathogens causing bacterial pneumonia or diagnosis as a group of organisms through novel biomarkers: <i>Streptococcus pneumoniae</i>, <i>Staphylococcus aureus</i>, <i>Haemophilus influenzae B</i>.</li> <li>• <b>Supplemental pan-bacterial marker:</b> One or more known general biomarker(s) for bacterial infection<sup>5</sup> to provide “rule-in” diagnosis of other bacterial infections that should receive antibiotic treatment or suggest referral for further testing even without definitive diagnosis, including atypical bacterial pneumonia and bacterial meningitis. A single biomarker or multiple biomarkers that comprise a signature are acceptable.</li> <li>• <b>(Optimal) Supplemental pan-viral marker:</b> general biomarker or multiple biomarkers that comprise a signature for common viral causes of fever, to confirm in patients who are entirely negative by the fever panel diagnostic that antibiotics should not be given.</li> <li>• <b>(Optimal) Active tuberculosis:</b> definitive and distinct diagnosis of <i>Mycobacterium tuberculosis</i>.</li> <li>• <b>(Optimal) HIV:</b> definitive and distinct diagnosis of human immunodeficiency virus.</li> </ul>   |   |   |                     |  |                       |   |                    |   |   |   |                    |   |  |  |                        |   |      |      |                             |                    |                        |  |   |  |
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| Optimal   | Minimal   |   |   |                     |  |                       |   |                    |   |   |   |                    |   |  |  |                        |   |      |      |                             |                    |                        |  |   |  |
| <b>Goal of Test</b>   | Differential diagnosis of the cause of fever for treatment, including in children <5  |   |   |                     |  |                       |   |                    |   |   |   |                    |   |  |  |                        |   |      |      |                             |                    |                        |  |   |  |
| <b>Reference Test</b>   | Culture and microbiologic testing for bacterial diseases and microscopy for malaria   |   |   |                     |  |                       |   |                    |   |   |   |                    |   |  |  |                        |   |      |      |                             |                    |                        |  |   |  |
| <b>Sensitivity</b>  | <table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="width: 50%;"> <ul style="list-style-type: none"> <li>• <i>P. falciparum</i> – <b>95%</b></li> <li>• <i>P. vivax</i> – <b>95%</b></li> <li>• <i>Streptococcus pneumoniae</i> – <b>95%</b></li> <li>• <i>Staphylococcus aureus</i> – <b>95%</b></li> <li>• <i>Haemophilus influenzae B</i> – <b>95%</b></li> <li>• Supplemental pan-bacterial marker(s) that, in combination with pathogen-specific markers above, can identify all bacterial pneumonia with an overall sensitivity of <b>95%</b>.</li> <li>• <b>Supplemental pan-viral marker(s)</b> – Best in class</li> <li>• <b>Tuberculosis</b> – Best in class</li> <li>• <b>HIV</b> – Best in class</li> </ul> </td> <td style="width: 50%;"> <ul style="list-style-type: none"> <li>• <i>P. falciparum</i> – <b>90%</b></li> <li>• <i>P. vivax</i> – <b>90%</b></li> <li>• <i>Streptococcus pneumoniae</i> – <b>90%</b></li> <li>• <i>Staphylococcus aureus</i> – <b>90%</b></li> <li>• <i>Haemophilus influenzae B</i> – <b>90%</b></li> <li>• Supplemental pan-bacterial marker(s) that, in combination with pathogen-specific markers above, can identify all bacterial pneumonia with an overall sensitivity of <b>90%</b>.</li> </ul> </td> </tr> </tbody> </table>   | <ul style="list-style-type: none"> <li>• <i>P. falciparum</i> – <b>95%</b></li> <li>• <i>P. vivax</i> – <b>95%</b></li> <li>• <i>Streptococcus pneumoniae</i> – <b>95%</b></li> <li>• <i>Staphylococcus aureus</i> – <b>95%</b></li> <li>• <i>Haemophilus influenzae B</i> – <b>95%</b></li> <li>• Supplemental pan-bacterial marker(s) that, in combination with pathogen-specific markers above, can identify all bacterial pneumonia with an overall sensitivity of <b>95%</b>.</li> <li>• <b>Supplemental pan-viral marker(s)</b> – Best in class</li> <li>• <b>Tuberculosis</b> – Best in class</li> <li>• <b>HIV</b> – Best in class</li> </ul> | <ul style="list-style-type: none"> <li>• <i>P. falciparum</i> – <b>90%</b></li> <li>• <i>P. vivax</i> – <b>90%</b></li> <li>• <i>Streptococcus pneumoniae</i> – <b>90%</b></li> <li>• <i>Staphylococcus aureus</i> – <b>90%</b></li> <li>• <i>Haemophilus influenzae B</i> – <b>90%</b></li> <li>• Supplemental pan-bacterial marker(s) that, in combination with pathogen-specific markers above, can identify all bacterial pneumonia with an overall sensitivity of <b>90%</b>.</li> </ul> |                     |  |                       |   |                    |   |   |   |                    |   |  |  |                        |   |      |      |                             |                    |                        |  |   |  |
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| <b>Specificity</b>  | <table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="width: 50%;">Each individual pathogen above, <b>85%</b></td> <td style="width: 50%;">Each individual pathogen above, <b>80%</b></td> </tr> </tbody> </table>   | Each individual pathogen above, <b>85%</b>  | Each individual pathogen above, <b>80%</b>  |                     |  |                       |   |                    |   |   |   |                    |   |  |  |                        |   |      |      |                             |                    |                        |  |   |  |
| Each individual pathogen above, <b>85%</b>  | Each individual pathogen above, <b>80%</b>  |   |   |                     |  |                       |   |                    |   |   |   |                    |   |  |  |                        |   |      |      |                             |                    |                        |  |   |  |
| <b>Reproducibility</b>  | <table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="width: 50%; text-align: center;">&gt;95%</td> <td style="width: 50%; text-align: center;">&gt;85%</td> </tr> </tbody> </table>   | >95%  | >85%  |                     |  |                       |   |                    |   |   |   |                    |   |  |  |                        |   |      |      |                             |                    |                        |  |   |  |
| >95%  | >85%  |   |   |                     |  |                       |   |                    |   |   |   |                    |   |  |  |                        |   |      |      |                             |                    |                        |  |   |  |
| <b>Biological Principle</b>   | Not pre-determined  |   |   |                     |  |                       |   |                    |   |   |   |                    |   |  |  |                        |   |      |      |                             |                    |                        |  |   |  |
| <b>Quality Control</b>  | Positive and negative control required  |   |   |                     |  |                       |   |                    |   |   |   |                    |   |  |  |                        |   |      |      |                             |                    |                        |  |   |  |
| <b>Test Result &amp; Interpretation</b>   | Visual readout that directs treatment without manual data interpretation  |   |   |                     |  |                       |   |                    |   |   |   |                    |   |  |  |                        |   |      |      |                             |                    |                        |  |   |  |

<sup>5</sup> Procalcitonin is an example of a general biomarker for bacterial infection.

|  | <b>Optimal</b>  | <b>Minimal</b>   |
|--|---|--|
| <b>Interfering Diseases</b>              | None  |  |
| <b>Specimen / Sample</b>                 | <b>One</b> of the following sample types: blood, saliva, sputum, mouth swab, or urine   | <b>One or more</b> of the following sample types collected in a single patient visit: blood, saliva, sputum, mouth swab, urine |
| <b>Sample preparation</b>                | None required (sample preparation/processing internal to device acceptable)   |  |
| <b>Special Handling/ Equipment</b>       | None required   |  |
| <b>Refrigeration requirements</b>        | None required   |  |
| <b>Power requirements</b>                | Prefer none, renewable battery power (e.g., solar recharger) acceptable   |  |
| <b>Stability</b>                         | <b>24</b> months at <b>55°C</b> and <b>90%</b> humidity   | <b>18</b> months at <b>45°C</b> and <b>80%</b> humidity  |
| <b>Water requirements</b>                | No running water required   |  |
| <b>Training Required</b>                 | Minimal: visual and intuitive interface and instructions; no language requirements to operate instrument; no more than 1 page of instructions |  |
| <b>Time to result</b>                    | <b>&lt;10</b> minutes   | <b>&lt;30</b> minutes  |
| <b>Duration of valid result</b>          | <b>&gt;72</b> hours   | <b>&gt;24</b> hours  |
| <b>Precautions</b>                       | Safe specimen / sample management   |  |
| <b>Steps to Test Result</b>              | 5 or less steps to result   |  |
| <b>Patient Record</b>                    | Patient identification required   |  |
| <b>Test/Platform size</b>                | <b>Handheld</b> device;<br><b>&lt;5 lbs</b> / 100 tests   | <b>Portable</b> device;<br><b>&lt;10 lbs</b> / 100 tests   |
| <b>Target Ex-Works Price<sup>6</sup></b> | <b>\$2-5, plus cost of device if one is required</b>  | <b>\$2-5, plus cost of device if one is required</b>   |

B. Organizations and Individuals Consulted:

**Academics / Global Health Clinicians:**

Brian D. Wright, PhD, University of California, Berkeley  
 David Brown, PhD, Independent Consultant  
 Doreen Ramogola-Masire, MD, Botswana-University of Pennsylvania Partnership  
 Elizabeth Molyneux, MD, World Child Cancer  
 George W. Rutherford, MD, University of California, San Francisco  
 Gerald J. Kost, PhD, University of California, Davis  
 Groesbeck Parham, MD, University of Alabama Medical Center  
 Kara Palamountain, Northwestern University

<sup>6</sup> Target ex-works price provided here should be considered a guideline. These target prices will be refined based on additional analysis prior to the launch of the incentive, as part of the process of validating the TPP. These prices are for the assay and do not take into account the cost of the device itself, should one be required.

Julia Gage, PhD, National Cancer Institute  
Lynette Denny, MD, University of Capetown  
Madhukar Pai, PhD, McGill University  
Malcolm Molyneux, MD, Liverpool School of Tropical Medicine and Malawi-Liverpool-Wellcome Trust Clinical Research Programme.  
Mark Schiffman, MD, MPH, National Cancer Institute  
Paul Yager, PhD, University of Washington  
Paul A. Wilson, PhD, Columbia University  
Philip Castle, PhD, MPH, National Cancer Institute  
Rebecca Richards-Kortum, PhD, Rice University  
Rosanna Peeling, PhD, London School of Hygiene and Tropical Medicine  
Samuel Sia, PhD, Columbia University  
Serigne Mbaye Diene, PhD, Academy for Educational Development (AED)  
Talha Syed, JD, University of California, Berkeley  
Temina Madon, PhD, University of California, Berkeley

**Industry Executives and Investment Community:**

Alex Rubido, PhD, Independent Consultant  
Anthony P. Lakavage, JD, Becton Dickinson  
Bala S. Manian, PhD, ReaMetrix  
Candice Pillay, PhD, Technology Innovation Agency (South Africa)  
Chris Colwell, MPP, Becton Dickinson  
Daryl Pritchard, PhD, Biotechnology Industry Organization  
David Friedman, Ativa Medical  
David Mack, PhD, Alta Partners  
David Steinmiller, PhD, Claros Diagnostics  
Doug Dolginow, MD, Ignite Institute  
Elizabeth Bailey, MPP, Commons Capital  
Geoff McKinley, PhD, Independent Consultant  
Jack B. Wilkins, MBA, GeneEx  
James A. Geraghty, JD, Genzyme Corporation  
Jean-Francois de Lavisson, MBA, Ahimsa Partners  
John Clarkson, PhD, Atlas Genetics Ltd.  
John A. Hurvitz, JD, Covington & Burling LLP  
John McDonough, T2 Biosystems  
Karen Hedine, Micronics  
Knut Seifert, Roche Diagnostics  
Krista Thompson, MBA, Becton Dickenson  
Leighton Read, MD, Alloy Ventures  
Chandrasekhar Nair, MCE, bigtec Labs  
Natarajan Sriram, Tulip Group  
Neil Butler, Independent Consultant  
Patrick Beattie, Diagnostics for All  
Peter Chun, PhD, EASE-Medtrend Biotech Ltd.  
Peter Dailey, PhD, Cepheid  
Robert Schueren, PhD, Agilent Technologies

Robert Wallis, ME, Pfizer  
Sarah Smiley, AdvaMed  
Shama Bhat, PhD, Bhat Biotech India  
Susan Bromley, PhD, Novartis AG  
Syd Daftary, Bharat Serums & Vaccines Ltd./Advy Chemical  
Thomas Lowry, PhD, T2 Biosystems  
Teva Rothwell, Independent Consultant  
Una Ryan, OBE, PhD, DSc, Diagnostics for All  
Wendy Woods, MBA, Boston Consulting Group  
William Rodriguez, MD, Daktari  
Blessed Okole, Technology Innovation Agency

### **Non-Profit Organizations and Government Representatives**

Alan Magill, MD, Walter Reed Army Institute of Research  
Amy P. Wong, Clinton Health Access Initiative  
Bernhard Weigl, PhD, PATH  
David Wholley, MA, Foundation for National Institutes of Health  
Hellen Gelband, Resources for the Future  
Jane Rowley, Independent Consultant  
Kevin Kain, PhD, McLaughlin-Rotman Centre for Global Health, University of Toronto  
Mark Perkins, MD, The Foundation for Innovative New Diagnostics (FIND)  
Maurine Murtagh, JD, The Murtagh Group  
Patrick Lammie, PhD, U.S. Centers for Disease Control (CDC)  
Peter A. Singer, MD, McLaughlin-Rotman Centre for Global Health, University of Toronto  
Rachel Nugent, PhD, Center for Global Development  
Richard M. Thayer, MBA, The Catalysis Foundation and Halteres Associates  
Robert Hecht, PhD, Results for Development Institute  
Ruth Levine, PhD, U.S. Agency for International Development (USAID)  
Tala de los Santos, MBA, PATH  
Ted Roumel, PhD, Independent Consultant  
Tido von Schoen-Angerer, MD, MSc, Médecins Sans Frontières (MSF)  
Travis Carley, CCS  
Trevor Peter, PhD, Clinton Health Access Initiative (CHAI)  
Francis Moussy, PhD, WHO Special Programme for Research and Training in Tropical Diseases (WHO/TDR)