Supplementary Materials for

Harmony COVID-19: A ready-to-use kit, low-cost detector, and smartphone app for point-of-care SARS-CoV-2 RNA detection

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Published 15 December 2021, Sci. Adv. 7, eabj1281 (2021)
DOI: 10.1126/sciadvabj1281

The PDF file includes:

Supplementary Text
Figs. S1 to S10
Tables S1 to S5
References

Other Supplementary Material for this manuscript includes the following:

Movies S1 and S2
Supplementary Text
Development of lyophilized RT-LAMP formulation
Trehalose can stabilize several enzymes, but we found that 2.5% (w/v) trehalose resulted in a slower reaction at 63°C, the optimal reaction temperature of the excipient-free RT-LAMP. An increase of reaction temperature to 65°C can speed up the trehalose-containing RT-LAMP reactions but resulted in unreliable detection at 20 RNA copies/reaction (Fig. S1).
Fig. S1. Effects of excipients on fresh RT-LAMP reactions tested on a commercial real-time thermal cycler.

(A) Time to detection of SARS-CoV-2 RNA and IAC targets in the RT-LAMP containing 2.5\% (w/v) trehalose and 0-2000 copies of SARS-CoV-2 RNA/40µL reaction. N/A means undetectable. For each condition, two technical replicates were run at 4 different reaction temperatures (i.e., 55°C, 59°C, 63°C, and 65°C).

(B) Time to detection of SARS-CoV-2 RNA and IAC targets in the RT-LAMP reactions containing 0 or 20 copies of SARS-CoV-2 RNA/reaction, with and without 2.5\% (w/v) mannitol, at 63°C.
Fig. S2. Cross-reactivity of MERS and SARS in lyophilized RT-LAMP.

Detection time (min) of SARS-CoV-2 RNA and IAC targets in the presence of 4000 copies of either SARS-CoV-1 RNA or MERS RNA in 40µL RT-LAMP reactions at 63°C. Two technical replicates were conducted in each condition. In the reactions without SARS-CoV-2 RNA, we did not observe amplification of FAM signal but observed IAC amplification indicating the amplification reaction was functioning properly in each replicate. 100 copies of SARS-CoV-2 RNA were amplified in each positive control replicate, indicating proper function of SARS-CoV-2 amplification in this master mix.

| non-SARS-CoV-2 RNA (copies/reaction) | SARS-CoV-2 RNA (copies/reaction) | min to detection |
|--------------------------------------|----------------------------------|-----------------|
| 4000 copies SARS-CoV-1               | 0                                | N/A             |
| 4000 copies SARS-CoV-1               | 100                              | 23.5, 24.1      |
| 4000 copies MERS                     | 0                                | N/A             |
| 4000 copies MERS                     | 100                              | 24.7, 24.7      |

Fig. S2. Cross-reactivity of MERS and SARS in lyophilized RT-LAMP.

Detection time (min) of SARS-CoV-2 RNA and IAC targets in the presence of 4000 copies of either SARS-CoV-1 RNA or MERS RNA in 40µL RT-LAMP reactions at 63°C. Two technical replicates were conducted in each condition. In the reactions without SARS-CoV-2 RNA, we did not observe amplification of FAM signal but observed IAC amplification indicating the amplification reaction was functioning properly in each replicate. 100 copies of SARS-CoV-2 RNA were amplified in each positive control replicate, indicating proper function of SARS-CoV-2 amplification in this master mix.
Fig. S3. Heat block used in Harmony COVID-19 device.

Drawing credit: Bryan Willman.
Fig. S4. The design of optical and heater circuit boards for the Harmony COVID-19 device. (A) LED board (B) the detector board
Fig. S5. Circuit board assembly and required parts. (A) LED board. (B) LED board assembled to the lid heater board. (C) Custom-cut filter pieces. (D) Detector board and the main board. Each device require the following parts: thick film resistors (RCL12251R20FKEG, RCL12252R20FKEG, CRCW08050000Z0EBC and RCL12254R70FKEG from Vishey; RN73C1J75RBTDF from TE Connectivity; FTS-105-03-F-DV from Samtec; CR0402AJW-472GAS from Bourns), thin film resistors (RN73H1ETTP3003B25 from KOA Speer; ERJ-2RKF22R0X from Panasonic), multilayer ceramic capacitors (C0402C104M4RACAUTO, KEMET; 0603YC105KAT2A, AVX),
multilayer ceramic capacitor (GRM188R60J226MEA0D, Murata), USB connectors (10118193-0001LF and 10118192-0001LF, FCI / Amphenol), FFC & FPC connector (52745-1497, Molex), standard yellow LEDs (LY E63B-CBEA-26-1-Z, Osram Opto Semiconductor), standard blue LEDs (150141BS63140, Wurth Elektronik), board-to-board & mezzanine connector (CLP-105-02-F-D and FLE-105-01-G-DV-K-TR, Samtec), FFC/FPC jumper cables (15166-0143, Molex), FFC & FPC connector (52559-1452, Molex), 2 headers & wire Housings (FTSH-105-01-F-DH, Samtec), MOSFET (FDMA410NZ, ON Semiconductor), 2 board-mount temperature sensors (PTS060301B100RP100 from Vishay), ARM Microcontrollers (CY8C5888LTI-LP097, Cypress Semiconductor), Photodiodes (SFH 2201, Opto Semiconductor).
Fig. S6. Device assembly.

(A), Top part (B), Bottom part of the device are assembled using 10 screws, 2 compression springs, and 2 torsion springs (McMaster-Carr, Elmhurst, IL) including: Torsion Spring 90 Degree Angle, Left-Hand Wound, 0.204" OD (9271K109), Torsion Spring 90 Degree Angle, Right-Hand Wound, 0.204" OD (9271K143), Black-Oxide Alloy Steel Socket Head Screw M3 x 0.5 mm Thread, 5 mm Long (91290A110), Black-Oxide Alloy Steel Socket Head Screw M3 x 0.5 mm Thread, 10 mm Long (91290A115), Black-Oxide Alloy Steel Socket Head Screw M3 x 0.5 mm Thread, 15 mm Long (91290A572), Black-Oxide Alloy Steel Socket Head Screw M3 x 0.5 mm Thread, 20 mm Long (91290A123), Black-Oxide Alloy Steel Socket Head Screw M3 x 0.5 mm Thread, 25 mm Long (91290A125), Black-Oxide Alloy Steel Socket Head Screw M3 x 0.5 mm Thread, 30 mm Long, Partially Threaded (91290A130), Music-Wire Steel Compression Springs 0.875" Long, 0.36" OD, 0.296" ID (9434K73).
Fig. S7. Analysis of XPRIZE panel of contrived samples containing less than 20 copies/reaction.
Fig. S8. Real-time amplification curves of samples analyzed by HARMONY Covid-19. (A) XPRIZE panel of contrived specimens (B) Extracted RNA from VTM specimens (C) VTM specimens without extraction. Data were exported from the software as .txt file and plotted using in-house Python code available at https://zenodo.org/record/5502373#.YT7XsZ5KgsM
Fig. S9. Standard curves of RT-qPCR using CDC N1 and N2 primers. (A) Amplification curves of N1 assay and (B) N2 assay ranging from 0 to $10^7$ copies/reaction (rxn) of SARS-CoV-2 synthetic RNA. Calibration curves for (C) N1 and (D) N2 assays.
Fig. S10. Real-time amplification curves of RT-qPCR using CDC primers/probes. (A) N1 assay. (B) N2 assay. (C) RP assay. Data were exported from the CFX Maestro (Biorad).
Table S1.
Summary of RT-LAMP based technologies that have received the US FDA emergency use authorization as of July 15th, 2021. Note that multiple tests were previously approved but recently removed from the list. Information was gathered from the package inserts and patents. Some aspects of the tests are not available, so listed as not available (N/A).

| Developer | Intended use | Product name | Core technology | DNA polymerase | SARS-CoV-2 target(s) | Control | # reaction/sample tested | LAMP multiplexity | Reported LoD | Samples require nucleic acid extraction prior to RT-LAMP | Reagent set up from wet reaction (no lyophilized reaction) | Additional reaction setup after RT-LAMP | Post-reaction analysis |
|-----------|--------------|--------------|-----------------|----------------|---------------------|---------|--------------------------|-----------------|--------------|------------------------------------------------------|---------------------------------------------------------------|-----------------------------|-----------------------|
| Mammoth Biosciences, Inc OR University of California, San Francisco (UCSF) and Mammoth Biosciences | H | SARS-CoV-2 DETECTR™ Reagent Kit | RT-LAMP, CRISPR | Bst | N | Human RP | 2 | Single-target LAMP | 12 | 20 | 100 | Yes, EZ1 Virus Mini Kit v2.0 with automated extraction | Yes, reagents are thawed at room temperature but kept on ice throughout setting up. | Yes, CRISPR | Yes, based on the difference of end-point fluorescence signal from baseline signal |
| MobileDetect Bio Inc. | H, M | MobileDetect Bio BCC19 (MD-Bio BCC19) Test Kit | RT-LAMP | Not provided | N,E | N/A | 1 | Two-target, single readout | 75 | N/A | 75 | No, 1uL VTM sample directly amplified in 25uL reaction. | Yes, reagents must be thawed on ice 30 min prior to set up. | No | Yes, cell phone analysis based on color difference of positive and negative. |
| SEASON BIOMATERIALS, Inc. | H | AQ-TOP™ COVID-19 Rapid Detection Kit PLUS | RT-LAMP | Bst | N, ORF | Human RP | 2 | Biplexed FAM/H EX-VIC-JOE with amp control | 1 | 5 | 50 | 1.67 | Yes, multiple authorized kits | Yes, reagents are thawed at room temperature but kept on ice throughout setting up. | No | Yes, based on automatic CT call by RT-qPCR machine |
| Company                        | Target | Kit Name                                           | RT-LAMP | Primers Provided | Primer Description                                                                 | Human RP | Human Port | Human Type | Human Sensitivity | Human Specificity | CRISPR Reaction | CRISPR Specificity | CRISPR Sensitivity | CRISPR Tools | Calculation of Signal Ratio |
|-------------------------------|--------|---------------------------------------------------|---------|-----------------|-------------------------------------------------------------------------------------|----------|------------|------------|-------------------|------------------|------------------|---------------------|-------------------|--------------|-------------------------|
| Sherlock BioSciences, Inc.    | H      | Sherlock™ CRISPR SARS-CoV-2 Kit                  | RT-LAMP | Not provided    | N, ORF                                                                              | 3        | 6.75       | 45         | 360               | Yes              | Not provided    | Yes, 2 components     | Yes, manual calculation of signal ratio |
| Color Health, Inc.            | H      | Color SARS-CoV-2 RT-LAMP Diagnostic Assay        | RT-LAMP | Not provided    | N, E 2                                                                              | 3        | 0.75       | N/A        | N/A               | Yes              | No              | Yes, Viral DNA/RNA 300 Kit H96 (Perkin Elmer, CMG-1033) | Yes               | No           | Yes, manual calculation of signal ratio |
| Lucira Health, Inc.           | H, M, W| Lucira™ CHECK-IT COVID-19 Test Kit               | RT-LAMP | Bst or GspM     | N (2 regions)                                                                       | 5        | 0.9        | N/A        | N/A               | No               | No              | No                  | No, real-time analysis based on the color change of halochromic agent(s) due to pH change as an outcome from amplification |
Continued Table. S1.

| Developer | Intended use | Product name | Amplicon exposure after LAMP | Estimated operating time | Test batch size (reaction, samples) | Cost | Equipment involved |
|-----------|--------------|--------------|-----------------------------|--------------------------|-----------------------------------|------|--------------------|
| Mammoth Biosciences, Inc OR University of California, San Francisco (UCSF) and Mammoth Biosciences | H | SARS-CoV-2 DETECTR™ Reagent Kit | Yes | **85 min excluding analysis step**<br>20-min automatic extraction; 30-min RT-LAMP; 15-min CRISPR (anticipated minimal 20-min hands-on from thawing, mixing, and aliquoting reactions for both steps) | 96 (reaction), 48 (samples) | N/A | • Qiagen EZ1 Advanced benchtop automated extraction (48 samples)  
• ABI 7500 Fast Dx Real-Time PCR system (Thermo Scientific) with software  
• Minicentrifuges  
• Multichannel or single channel pipette and barrier tips (10 µL – 200 µL);  
• PCR plate/tube strip support frame/racks  
• PCR cooler rack |
| MobileDetect Bio Inc. | H, M | MobileDetect Bio BCC19 (MD-Bio BCC19) Test Kit | No | **60 min excluding post-analysis step**<br>30-min thawing reagents, 30-min RT-LAMP; (anticipated 10-min hands-on from mixing and aliquoting reagents) | 8 or 96 | N/A | • Custom heater or thermal cycler  
• Cell phone with software  
• Minivortex  
• Reaction set up station  
• Reaction analysis station  
• Micropipettes  
• Filtered tips |
| SEASUN BIOMATERIALS, Inc. | H | AQ-TOP™ COVID-19 Rapid Detection Kit PLUS | No | **70 min excluding analysis step**<br>30-min manual extraction; 30 min RT-LAMP (anticipated minimal 10-min hands-on from thawing, mixing, and aliquoting reactions) | 96 (reaction), 48 (samples) | N/A | • Real-time PCR system (CFX 96 real-time PCR detection system with software CFX manager V3.1 or Applied Biosystems real-time PCR system 7500 with Software 2.0.6)  
• Centrifuge  
• Micropipettes  
• Filtered tips  
• Vortex |
| Sherlock BioSciences, Inc. | H | Sherlock™ CRISPR SARS-CoV-2 Kit | Yes | **110 min excluding analysis step**<br>30-min manual extraction; 40 min RT-LAMP; 10-min CRISPR (anticipated minimal 30 -min hands-on from thawing, mixing, and aliquoting reactions) | 383(reaction), 30 (samples) | N/A | • Heat block with a heated lid capable of maintaining 61°C or PCR instrument with a heated lid  
• Vortex  
• Microcentrifuge  
• Cold blocks  
• Micropipettes  
• Filtered tips |
| Color Health, Inc. | H | Color SARS-CoV-2 RT-LAMP Diagnostic Assay | No | **110 min excluding analysis step**<br>20-min bead-based RNA extraction; 70 min RT-LAMP; (anticipated minimal 20-min hands-on from thawing, mixing, and aliquoting reactions with robots) | 384 (reaction), 128(samples) | N/A | • Hamilton STAR/STARlet automated liquid handler with Venus 4 software  
• Agilent Bravo automated liquid handling platform with software |
| Lucira Health, Inc. | Home, H, M, W | Lucira™ CHECK-IT COVID-19 Test Kit | No | 30-min sample run time (with anticipated 2-min handson). Positive samples are called as soon as finished | 1 | $50/test | • Perkin Elmer Chemagic 360 extraction instrument platform and Chemagic software v6.3.0.3 • Biotek Synergy NEO2 multi-mode microplate reader with Gen5 software v3.9 |

SARS-CoV-2 DETECTR Reagent Kits (53, 54)
MobileDetect Bio BCC19 (MD-Bio BCC19) Test Kit (55, 56)
AQ-TOP COVID-19 Rapid Detection Kit PLUS (57)
Sherlock CRISPR SARS-CoV-2 Kit (58)
Color SARS-CoV-2 RT-LAMP Diagnostic Assay (59)
Lucira CHECK-IT COVID-19 Test Kit (60, 61)

1 H (High complexity CLIA labs), M (Moderate complexity CLIA labs), W (CLIA-waived, patient care settings), Home (used at home)
2 ORF assay is available but removed from the current kits.
Table S2.

**Primers, probes, and control sequences.** For primers and probes F2/B2 sequences are underlined, non-template linker sequences are italicized, and adapter sequences are in bold.

| SARS-CoV-2 NC1 Primers | Sequence (5’ to 3’) |
|-------------------------|---------------------|
| NC1 FIP                 | CCACCTGCGTTCTCCATTTCGCCATACGTGTTGTTG |
| NC1 BIP                 | GCGTCAAAACAACTCGGTTATTGCCATGTTGAGAGAGCG |
| NC1 LF                  | TGGTTACTGCGAGTTGAGATTG |
| NC1 LB + T Adapter      | ACCAACACCTCACATCACACACATAATAGGTTTTACCATGACGAGAGG |
| NC1 F3                  | TGGACCCAAATACAGCG |
| NC1 B3                  | ATCTGGACTGCTATTGAGTTGTTTA |
| SARS-CoV-2 NC2 Primer   | Sequence |
| NC2 FIP                 | CAGCTTCTGCGGAATGTTGTTGAGACGTTGAAATG |
| NC2 BIP                 | CTTCCCTATGCTGCTAAACAAAGGCAATTGGGCGGTCATTG |
| NC2 LF                  | GTAGTAGAAATACCATCTGGAG |
| NC2 LB + T Adapter      | ACCAACACCTCACATCACACACATAATAGGTTTTACCATGACGAGAGG |
| NC2 F3                  | CTACCTACGAAGACGCTACG |
| NC2 B3                  | GACAGTTGTTAGGAGGAG |
| SARS-CoV-2 NC3 Primer   | Sequence |
| NC3 FIP                 | TGTGTAGGGTCAACACGTTGCGTCGTCGAG |
| NC3 BIP                 | TGGCCATCAAAATGGAGATGACAAAGGCTTTCATTGAGTCCATG |
| NC3 LF + T Adapter      | ACCAACACCTCACATCACACACATAATAGGTTTTACCATGACGAGAGG |
| NC3 LB                  | CCAAAATTCAAGATCAGTAC |
| NC3 F3                  | GACCAGAAACTTACAGCAAG |
| NC3 B3                  | GCTTGAATTTCACTAGCAGTTC |
| IAC (NC1) primer        | Sequence |
| IAC FL + C Adapter      | ACCACACCTACACACACACCATATAACTAACCTCACGACATCCATCCTACCA |
| Target UDP              | Sequence |
| CoV UDP Probe           | FITC – CCATCAGCAACAAAGACTACCCACCTCGCCACAAAACCAACACCTC |
| CoV UDP Quencher        | ACATCACATACATAA TTGGTGGCGGAGGTTGAGTCTTTTGGGTGATGG – Iowa Black® FQ |
| Control UDP             | Sequence |
| IAC UDP Probe           | Tex615 – CCTGACACTTCCGAACCCACACCTACGACAGAACCACACCTAC |
| IAC UDP Quencher        | CACACTAATAACTAA AGAAGAAGTGGTGGTGACGAGTCCAGAGG – BH2 |
| IAC Template            | Sequence |
| IAC (NC1) ssDNA         | AAT GGA CCC CAA AAT CAG CGA AAT GCA CCC CGC ATT ATC TTT GGT GGA CCC TGT GGA TGT GTC AAT GGG TGG TGC CAG AAT GGA GAA CGC AGT GGG CGA TCA AAA CAA CGT CGG CCC CAA GGT GAT GTC CAG CCA TCC TCA CCA TCG TCC ACC CCA CTG CTC ACT CAA CAT GGC AAG AAT TAA CAC CAA TAG CAG TCC AGA TG |
Sample transfer methods at the POC
Volumetric transfer pipettes are used in POC tests, but we have not identified a unified dispenser used in commercial pathogen tests. A unified dispenser integrating the swab and the buffer container in a single unit could reduce opportunities for sample mix-up when multiple samples are processed simultaneously. A simple workflow is crucial, especially in busy settings like clinics. However, in our hands, the in-house built dispenser led to variable dispensed fluid volumes and had a higher failure rate than those of the transfer pipette method. While the unified dispenser has many attractive features, we would not recommend using this in-house assembled dispenser unit until the method has been optimized to achieve a more accurately dispensed volume.

Table. S3.
Feedback from the HCWs
Among HCWs, 30% (3/10) reported problems dispensing the fluid using the unified system. However, 20% (2/10) of HCWs agreed that the unified dispenser offered an advantage in its similarity to other tools used in healthcare settings, and 30% (3/10) HCWs were concerned about contaminating the sample or the environment with the transfer pipette compared to the unified dispenser system. Only 1/10 (10%) HCW preferred the smallest tube (0.2mL) for either method, and 5/10 (50%) reported that larger (1.5mL) tubes were helpful for the unified system, while 40% (4/10) of HCWs said receptacle size did not make a difference when using the transfer pipette, and none reported preference for tube size when using the unified dispenser system. HCWs reported higher confidence in correctly completing the second kit compared to the first kit of each method, indicating a similar learning curve.

(A) User preference for reaction tube size
Note: Cells with 0% response were left empty to aid data visualization.

| Question                                      | User response, n (%) |
|-----------------------------------------------|----------------------|
|                                               | 0.2 mL  | 0.5 mL  | 1.5 mL  | 0.5mL or 1.5mL | no difference |
| Which tube size were you most confident using with the unified dispenser swab? | 4 (40%) | 5 (50%) | 1 (10%) |
| Which tube size were you most confident using with the transfer pipette? | 1 (10%) | 4 (40%) | 1 (10%) | 4 (40%) |

(B) User responses to survey questions during sample transfer usability testing.
Users were asked to provide their response on a Likert scale: (1) Not at all, (2) Slightly, (3) Somewhat, (4) Fairly, (5) Completely. Note: Phrasing of the questions below was slightly modified to be clear outside of the context of the written protocol/survey (original survey here). Cells with 0% response were left empty to aid data visualization.

| Question                                      | User response, n (%) |
|-----------------------------------------------|----------------------|
|                                               | (1)  | (2)  | (3)  | (4)  | (5)  |
How confident were you that you added the correct amount of liquid to each reaction tube using the **unified dispenser system**?

| | 2 (20%) | 1 (10%) | 4 (40%) | 3 (30%) |

How confident were you that you completed the protocol correctly using the **unified dispenser system** with the first kit?

| | 2 (20%) | 1 (10%) | 4 (40%) | 3 (30%) |

How confident were you that you completed the protocol correctly using the **unified dispenser system** with the second kit?

| | 5 (50%) | 5 (50%) |

How confident were you that you added the correct amount of liquid to each reaction tube using the **transfer pipette**?

| | 2 (20%) | 2 (20%) | 6 (60%) |

How confident were you that you completed the protocol correctly using the **transfer pipette** with the first kit?

| | 3 (30%) | 4 (40%) | 3 (30%) |

How confident were you that you completed the protocol correctly using the **transfer pipette** with the second kit?

| | 5 (50%) | 5 (50%) |

How confident were you that you completed the **on-screen instructions correctly**?

| | 1 (10%) | 4 (40%) | 5 (50%) |

(C) **User reported errors/challenges between two sample transfer methods.** Cells with no response were left empty to aid data visualization.

| Reported error | Number of occurrences for the unified dispensing system | Number of occurrences for the transfer pipette |
|----------------|--------------------------------------------------------|-----------------------------------------------|
| The transfer method was hard to aim at the receiving reaction tube. | 1 | |
| Transfer method dripped/leaked before dispensing to the reaction tube. | 2 | |
| The materials were too small or difficult to handle. | | 3 |
| It was hard to execute specific instructions due to unfamiliarity with the sample transfer device. | 2 | 1 |
| Challenging to dispense a consistent amount of fluid. | | 3 |
| Not confident liquid was dispensed to the tube. | | 2 |
| Concerned about contaminating samples or the environment. | | 3 |
### Table S4.
Detailed reagent and device cost at a production scale of 10,000 units

| Item         | Supplier                        | Cost/device (US$)                                                                 |
|--------------|---------------------------------|-----------------------------------------------------------------------------------|
| Detector boards | Macrofab                       | $7 each x 2 ($14 total)                                                           |
| Main board   | Macrofab                        | $25 each                                                                          |
| LED board    | Macrofab                        | $9 each                                                                           |
| Lid Heater   | Oshpark                         | $7 each                                                                           |
| Heat block   | Bryan Willman                   | $12 each                                                                          |
| Housing      | Xometry – HP MultiJet Fusion    | $50 (costs here should be reduced for scale-up production)                        |
|              | 3D printing, no volume discount |                                                                                   |
| Red filters  | Newport                         | $10 each, $40 in total                                                            |
| Green filters| Newport                         | $20 each, $80 in total                                                            |
| Assembly     | N/A                             | $30 (half an hour assembly time at $60/hour cost)                                  |
| **Total**    |                                 | **$267 per unit**                                                                 |

| Item         | Supplier                        | Cost/device (US$)                                                                 |
|--------------|---------------------------------|-----------------------------------------------------------------------------------|
| Detector boards | Macrofab                       | $7 each x 2 ($14 total)                                                           |
| Main board   | Macrofab                        | $25 each                                                                          |
| LED board    | Macrofab                        | $9 each                                                                           |
| Lid Heater   | Oshpark                         | $7 each                                                                           |
| Heat block   | Bryan Willman                   | $12 each                                                                          |
| Housing      | Xometry – HP MultiJet Fusion    | $50 (costs here should be reduced for scale-up production)                        |
|              | 3D printing, no volume discount |                                                                                   |
| Red filters  | Newport                         | $10 each, $40 in total                                                            |
| Green filters| Newport                         | $20 each, $80 in total                                                            |
| Assembly     | N/A                             | $30 (half an hour assembly time at $60/hour cost)                                  |
| **Total**    |                                 | **$267 per unit**                                                                 |
### Table S5.
Consumable costs per test

| Item                                      | Supplier               | Costs per kit (US$) |
|-------------------------------------------|------------------------|---------------------|
| Sampling components ($2 maximum)         | Multiple sources       | $2                  |
| Desiccant                                 | Multiple sources       | $0.5                |
| PCR tube                                  | Multiple sources       | Negligible          |
| DNA polymerase                            | Produced in-house      | Negligible          |
| Reverse transcriptase                     | New England Biolabs    | $3.5                |
| Thermostable inorganic pyrophosphatase    | New England Biolabs    | $0.23               |
| Primers                                   | Integrated DNA Technologies | $0.03              |
| Fluorescent probe/quenchers              | Integrated DNA Technologies | $0.24              |
| Triton-X100                               | Sigma-Aldrich          | Negligible          |
| dNTPs                                     | New England Biolabs    | $0.38               |
| Mannitol                                  | OPS Diagnostics        | Negligible          |
| DL-Dithiothreitol (DTT)                   | Promega                | Negligible          |
| Nuclease-free water                       | VWR                    | Negligible          |
| 1X Tris low-EDTA buffer                   | VWR                    | Negligible          |
| Rnasin ribonuclease inhibitor             | Promega                | $0.71               |
| DNA internal amplification control        | Integrated DNA Technologies | $0.01              |
| **Cost of goods**                         |                        | **$8.00**           |
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