

CLAIMS

WHAT IS CLAIMED IS:

1. A system for modeling a progression of a disease within a population, comprising:
 - a plurality of point-of-care devices, each comprising at least a programmable processor and a fluid transfer device;
 - an external device configured to be in communication with said plurality of point-of-care devices;
 - (a) a static database component comprising static data related to the disease and/or the population;
 - (b) a dynamic database component comprising dynamic data about the population and individual subjects; and
 - (c) a computer modeling component that is configured to model the data in the static database component and the dynamic database component, thereby modeling the disease within the population,
 - wherein the external device is configured to provide instructions to said programmable processor to implement a change in assay protocol based on output from the computer modeling component without having to provide new point-of-care-devices, and
 - wherein said instructions to the programmable processor comprises at least a step of transferring a bodily fluid sample to an individual assay unit.
2. The system of claim 1, wherein the disease is an infectious disease or a chronic disease.
3. The system of claim 02, wherein the infectious disease agent or an analyte thereof comprises an adenovirus, *Bordella pertussis*, *Chlamydia pneumoiea*, *Chlamydia trachomatis*, Cholera Toxin, Cholera Toxin β , *Campylobacter jejuni*, Cytomegalovirus, Diphtheria Toxin, Epstein-Barr NA, Epstein-Barr EA, Epstein-Barr VCA, *Helicobacter Pylori*, Hepatitis B virus (HBV) Core, Hepatitis B virus (HBV) Envelope, Hepatitis B virus (HBV) Surface (Ay), Hepatitis C virus (HCV) Core, Hepatitis C virus (HCV) NS3, Hepatitis C virus (HCV) NS4, Hepatitis C virus (HCV) NS5, Hepatitis A, Hepatitis D, Hepatitis E virus (HEV) orf2 3 KD, Hepatitis E virus (HEV) orf2 6 KD, Hepatitis E virus (HEV) orf3 3KD, Human immunodeficiency virus (HIV)-1 p24, Human immunodeficiency virus (HIV)-1 gp41, Human immunodeficiency virus (HIV)-1 gp120, Human papilloma virus (HPV), Herpes simplex virus HSV-1/2, Herpes simplex virus HSV-1 gD, Herpes simplex virus HSV-2 gG, Human T-cell leukemia virus (HTLV)-1/2, Influenza A, Influenza A H3N2, Influenza B, *Leishmania donovani*, Lyme disease, Mumps, *M. pneumoniae*, *M. tuberculosis*, Parainfluenza 1, Parainfluenza 2, Parainfluenza 3, Polio Virus, Respiratory syncytial virus (RSV), Rubella, Rubeola, Streptolysin O, Tetanus Toxin, T. pallidum 15 kd, T. pallidum p47, T. cruzi, Toxoplasma, or *Varicella Zoster*.
4. The system of claim 01, wherein the disease is an infectious disease comprising a microorganism, a microbe, a virus, a bacterium, an archaeum, a protozoan, a protist, a fungus or a microscopic plant.

5. The system of claim 4, wherein the virus comprises influenza or HIV.
6. The system of claim 4, wherein the bacterium comprises mycobacterium tuberculosis.
7. The system of claim 4, wherein the protozoan comprises malaria.
8. The system of claim ~~0~~1, wherein the disease is a chronic disease or condition comprising diabetes, prediabetes, insulin resistance, metabolic disorder, obesity, or cardiovascular disease.
9. The system of claim 1, wherein the static database component comprises information about the individuals in the population.

28. The system of claim **15**, wherein the biomarker or physiological parameter is determined using ~~a one of the~~ point-of-care devices.

29. The system of claim **128**, wherein the point of care device performs one or more of cartridge assays, real time PCR, rapid antigen tests, viral culture, and immunoassays.

~~30. The system of claim 28, wherein the system comprises a plurality of point of care devices.~~

~~31.30.~~ The system of claim **281**, wherein the point of care devices ~~is~~ are positioned at one or more of a school, a workplace, a shopping center, a community center, a religious institution, a hospital, a health clinic, a mobile unit, or a home.

~~32.31.~~ The system of claim **128**, wherein the point of care device comprises a portable instrument.

~~33.32.~~ The system of claim **128**, wherein the point of care device comprises a portable cartridge.

~~34.33.~~ The system of claim **3332**, wherein the cartridge is configured to accept reagents for measuring the biomarkers.

~~35.34.~~ The system of claim **3332**, wherein the cartridge is configured to measure the biomarkers based on a protocol communicated from the computer modeling component.

~~36.35.~~ The system of claim **128**, wherein the cartridge is configured to measure a set of biomarkers from a plurality of bodily fluid samples.

~~37. The system of claim 28, wherein the point of care device measures more than one biomarker with more than 30% better accuracy and/or precision than standard methods.~~

~~38.36.~~ The system of claim **128**, wherein the point of care device comprises a graphical user interface configured for data entry.

~~39.37.~~ The system of claim **128**, wherein the point of care device is configured to communicate the biomarker or physiological parameter measurements to the computer modeling component.

~~40.38.~~ The system of claim **3937**, wherein the communication is wireless communication, wired communication, or a combination thereof.

~~41.39.~~ The system of claim **4038**, wherein the wireless communication comprises WiFi, Bluetooth, Zigbee, cellular, satellite, and/or WWAN.

~~42.40.~~ The system of claim **3937**, wherein the communication comprises a secure internet communication.

~~43.41.~~ The system of claim **128**, wherein the point of care device is configured to perform two way communications with the computer modeling component.

~~44.42.~~ The system of claim **128**, wherein the point of care device ~~are~~ is deployed according to instructions determined by the computer modeling component.

~~45.43.~~ The system of claim 1, wherein the modeling results are updated in real time when updated dynamic data becomes available.

~~46.44.~~ The system of claim 1, wherein the computer modeling component is configured to present the modeling results to one or more of healthcare professionals, government agencies and individual human subjects.

~~47.45.~~ The system of claim 1, wherein the computer modeling component is configured to predict one or more courses of action based on the modeling results.

~~48.46.~~ The system of claim ~~4745~~, wherein the one or more courses of action are ranked according to a ranking parameter.

~~49.47.~~ The system of claim ~~4846~~, wherein the ranking parameter comprises financial considerations, number of affected individuals, quality-adjusted life year (QALY), and/or quality-adjusted life year (QALY) per economic cost unit.

~~50.48.~~ The system of claim ~~4745~~, wherein the one or more courses of action comprise a strategy to control the spread of the disease.

~~51.49.~~ The system of claim ~~5048~~, wherein the strategy to control the spread of the disease comprises one or more of household quarantine, individual quarantine, geographic quarantine, social distancing, hospitalization, school closure, work place closure, travel restrictions, public transit closure, therapeutic treatment or intervention, prophylactic treatment or intervention, vaccination, provision of protective clothing, provision of masks, and additional point-of-care testing.

~~52.50.~~ The system of claim ~~5048~~, wherein the strategy to control the spread of the disease comprises one or more of counseling at risk or affected individuals for behavior modification, repeated biomarker and/or physiological measurements, and reward for the individual.

~~53.51.~~ The system of claim ~~5048~~, wherein the strategy to control the spread of the disease comprises one or more of patient triage recommendations, resource management, efficacy index for each strategy, costs of each strategy, return on investment for each strategy.

~~54.52.~~ The system of claim ~~5048~~, wherein the strategy to control the spread of the disease comprises one or more of targeted prophylaxis, blanket prophylaxis, targeted antibiotic prophylaxis, blanket antibiotic prophylaxis, targeted anti-viral prophylaxis, blanket anti-viral prophylaxis, targeted vaccination, and blanket vaccination.

~~55.53.~~ The system of claim ~~5452~~, wherein targeted prophylaxis or vaccination comprises targeting the prophylaxis or vaccination to children between 1-4 yrs of age, children between 5-14 yrs of age, pregnant women, young adults between 15-30 yrs of age, first-line medical response workers, individuals identified to at high risk of mortality, or geriatric individuals.

~~56.54.~~ The system of claim 1, wherein the computer modeling component is configured to estimate a surveillance strategy based on the modeling results.

~~57.55.~~ The system of claim ~~5654~~, wherein the surveillance strategy comprises determining the disease status of an individual or group of individuals using a point of care device.

~~58.56.~~ The system of claim ~~5654~~, wherein the surveillance strategy is updated when a diseased individual is detected.

~~59.57.~~ The system of claim ~~5856~~, wherein the updated strategy comprises one or more of testing a household comprising the diseased individual, testing a school comprising the diseased individual, and testing a work place comprising the diseased individual.

~~60-58.~~ The system of claim ~~5856~~, wherein the updated strategy comprises one or more of quarantine, prophylaxis or hospitalization.

~~61-59.~~ The system of claim 1, wherein the computer modeling component comprises a graphical interface for displaying modeling results to a user.

~~62-60.~~ The system of claim 1, wherein the computer modeling component comprises a plurality of nonlinear ordinary differential equations.

~~63-61.~~ The system of claim 1, wherein the model of the data comprises a plurality of parameters.

~~64-62.~~ The system of claim ~~6361~~, wherein the computer modeling component comprises a learning machine that updates the plurality of parameters when the static data and/or dynamic data are updated.

~~65-63.~~ The system of claim 1, wherein the model of the data comprises a plurality of states.

~~66-64.~~ The system of claim ~~6563~~, wherein the plurality of states comprise one or more of: susceptible individuals, early exposed individuals, late exposed individuals, early infected individuals, late infected individuals, recovered individuals, individuals who died due to the infection and/or associated complications, asymptomatic individuals, individuals given therapeutic treatment, individuals given therapeutic treatment and quarantined, individuals treated prophylactically, vaccinated individuals, individuals protected due to vaccination, early infected individuals who are hospitalized, late infected individuals who are hospitalized, susceptible individuals who are home quarantined, early exposed individuals who are home quarantined, late exposed individuals who are home quarantined, early infected individuals who are home quarantined, late infected individuals who are home quarantined, asymptomatic individuals who are home quarantined, susceptible individuals quarantined in the whole neighborhood, early exposed individuals quarantined in the whole neighborhood, late exposed individuals quarantined in the whole neighborhood, early infected individuals quarantined in the whole neighborhood, late infected individuals quarantined in the whole neighborhood, asymptomatic individuals quarantined in the whole neighborhood, amount of therapeutic drug doses available, amount of antivirals and/or antibiotics available to the target population, home quarantined individuals that are vaccinated, home quarantined individuals that are protected due to vaccination, home quarantined individuals that recovered, susceptible individuals earmarked by mitigation policies for action, early exposed individuals earmarked by mitigation policies for action, late exposed individuals earmarked by mitigation policies for action, asymptomatic individuals earmarked by mitigation policies for action, early infected individuals earmarked by mitigation policies for action, late infected individuals earmarked by mitigation policies for action, prophylactic-treated individuals earmarked by mitigation policies for action, vaccinated individuals earmarked by mitigation policies for action, protected individuals earmarked by mitigation policies for action, recovered individuals earmarked by mitigation policies for action, susceptible individuals earmarked for therapeutic treatment, early exposed individuals earmarked for therapeutic treatment, late exposed individuals earmarked for therapeutic treatment, asymptomatic individuals

earmarked for therapeutic treatment, early infected individuals earmarked for therapeutic treatment,
late infected individuals

earmarked for therapeutic treatment, susceptible individuals earmarked for surveillance, early exposed individuals earmarked for surveillance, late exposed individuals earmarked for surveillance, asymptomatic individuals earmarked for surveillance, early infected individuals earmarked for surveillance, late infected individuals earmarked for surveillance, prophylactic individuals earmarked for surveillance, vaccinated individuals earmarked for surveillance, protected individuals earmarked for surveillance, susceptible individuals in whole neighborhood quarantine earmarked by mitigation policies for action, early exposed individuals in whole neighborhood quarantine earmarked by mitigation policies for action, late exposed individuals in whole neighborhood quarantine earmarked by mitigation policies for action, asymptomatic individuals in whole neighborhood quarantine earmarked by mitigation policies for action, early infected individuals in whole neighborhood quarantine earmarked by mitigation policies for action, late infected individuals in whole neighborhood quarantine earmarked by mitigation policies for action, prophylactic-treated individuals in whole neighborhood quarantine individuals earmarked by mitigation policies for action, cumulative number of therapeutic doses administered, cumulative number of antivirals and/or antibiotics administered, cumulative number of home quarantined asymptomatic individuals, cumulative number of home quarantined symptomatic individuals, cumulative number of total infected individuals, cumulative number of infected individuals who are not quarantined, cumulative number of infected individuals with some action taken, cumulative number of hospitalized individuals, and cumulative number of deaths.

67.65. A system for controlling spread of influenza within a population, comprising:
a plurality of point-of-care devices, each comprising at least a programmable processor and a fluid transfer device;
an external device configured to be in communication with said plurality of point-of-care devices;
 (a) a static database component comprising static data related to the influenza and/or the population;
 (b) a dynamic database component comprising dynamic data about the population; and
 (c) a computer modeling component that is configured to model the data in the static database component and the dynamic database component, thereby modeling the incidence of the influenza within the population-;

wherein the external device is configured to provide instructions to said programmable processor to implement a change in assay protocol based on output from the computer modeling component without having to provide new point-of-care-devices, and
wherein said instructions to the programmable processor comprises at least a step of transferring a bodily fluid sample to an individual assay unit.

68.66. A system for controlling spread of human immunodeficiency virus (HIV) within a population, comprising:

a plurality of point-of-care devices, each comprising at least a programmable processor and a fluid transfer device;

an external device configured to be in communication with said plurality of point-of-care devices;

(a) a static database component comprising static data related to the HIV and/or the population;

(b) a dynamic database component comprising dynamic data about the population; and

(c) a computer modeling component that is configured to model the data in the static database component and the dynamic database component, thereby modeling the incidence of the HIV within the population;

wherein the external device is configured to provide instructions to said programmable processor to implement a change in assay protocol based on output from the computer modeling component without having to provide new point-of-care-devices, and

wherein said instructions to the programmable processor comprises at least a step of transferring a bodily fluid sample to an individual assay unit.

69.67. A system for controlling spread of hepatitis within a population, comprising:

a plurality of point-of-care devices, each comprising at least a programmable processor and a fluid transfer device;

an external device configured to be in communication with said plurality of point-of-care devices;

(a) a static database component comprising static data related to the hepatitis and/or the population;

(b) a dynamic database component comprising dynamic data about the population; and

(e) a computer modeling component that is configured to model the data in the static database component and the dynamic database component, thereby modeling the incidence of the hepatitis within the population;

wherein the external device is configured to provide instructions to said programmable processor to implement a change in assay protocol based on output from the computer modeling component without having to provide new point-of-care-devices, and

wherein said instructions to the programmable processor comprises at least a step of transferring a bodily fluid sample to an individual assay unit.

70-68. A system for controlling spread of diabetes within a population, comprising:

a plurality of point-of-care devices, each comprising at least a programmable processor and a fluid transfer device;

an external device configured to be in communication with said plurality of point-of-care devices;

(a) a static database component comprising static data related to the diabetes and/or the population;

(b) a dynamic database component comprising dynamic data about the population; and

(e) a computer modeling component that is configured to model the data in the static database component and the dynamic database component, thereby modeling the incidence of the diabetes within the population.

wherein the external device is configured to provide instructions to said programmable processor to implement a change in assay protocol based on output from the computer modeling component without having to provide new point-of-care-devices, and

wherein said instructions to the programmable processor comprises at least a step of transferring a bodily fluid sample to an individual assay unit.