



Supplement S2. Automatic decision-making algorithms applied to a web-platform surveillance system: An occupational-academic cluster case

INPUTS { Web-Platform and App-SMARTER-Co }

// **Category 1.** Initializing survey and monitoring of the population at cluster- i and time- j //

P_n ← Main cluster: Ambulatory population (**ap**) at workspace
 Am_c ← Subcluster- n (Subc): **ap** with functional relationships (external or internal at workspace)
 P_{pt} ← Operative team 1: Certified Physician(s) (P_{pt-1}) and laboratory technician (P_{pt-2})
 P_{ht} ← Operative team 2: Health commission
 M_t ← Operative team 3: Mitigation and sampling crew
 t ← Implementation time ($t_0 \dots t_j$) of the Surveillance System [Continuous to End period]
 t_0 ← Start surveillance
 t_1 ← Time at qPCR results
 t_j ← Daily monitoring ($t_{0+1} \dots t_j$)
 S_u ← Workspace- i with n -spatial units defining a subcluster **ap**.
 SA ← Survey assistance
 DSm ← Daily self-monitoring from time- $0+1$ to time- j
 CE ← Clinical and epidemiological data at survey [90 variables] and monitoring [25 variables]

// **Category 2.** Clinical data of individual- i ($i = 1 \dots n$ individuals at P_n //

M_s ← Main putative COVID-19 symptoms at individual- i [Fever, Dry cough and Headache]
 S_s ← Secondary putative COVID-19 symptoms at individual- i [Body Pain, Throat Pain, Rhinorrhea, Conjunctivitis, Chest pain, Diarrhea, Chills, Nausea, Vomiting or Fatigue]
 Cd ← Chronic diseases [Hypertension, Diabetes, Obesity, COPD, Smoking, Cancer, HIV, Asthma, Cardiovascular Diseases, Renal or Hepatic Insufficiency & Immunosuppressive]
 Am ← Ambulatory individual- i with putative COVID-19 symptoms (M_s and/or S_s)
 P_{os} ← Ambulatory individual- i positive to SARS-CoV-2
 AA ← Anosmia or/and Ageusia at individual- i
 Ag ← Age of individual- i [3 to n -years old]
 Re ← RT-PCR testing result of individual- i using ambulatory self-collected mouthwash-saliva procedure ["ready" or "in progress"] (Figure 1).
 $qPCR$ ← SARS-CoV-2 in-house detection protocol with RT-qPCR (Supplementary Material 1).

// **Category 3.** Clinical-Epidemiological and Epidemiological data of individual- i ($i=1 \dots n$ individuals at P_n //

C_{pos} ← Individual- i in contact with a SARS-CoV-2 positive(s)
 S_{subc} ← n -Spatial units with **ap** at risk [Building, floor, division, family house, other]
 Occ ← Occupational **ap** at risk [Student, teacher, public relationships, driver, gardener, etc.,]
 Cur ← Classroom or laboratory activity of individual- i ?
 Tt ← Transportation type risk [Low=private, Moderate=other or High=public]
 Z_{risk} ← Risk associated to the living area of an individual- i [Low, Moderate or High]
 Sc_{risk} ← Subcluster **ap** risk [Low, Moderate or High]
 Mit ← Mitigation protocol [yes or no]
 Ws ← Weighted sampling base on risk criteria [selected or no-selected]

OUTPUTS { Algorithms 1-9 } (Figure 4)

// **Type 1.** Alert risk notification to user through:

SMARTER-Co → WWW platform → SMARTER-Co { t_0 ; SMARTER-Co → P_n } //

Upon **low**, **moderate** or **high Risk**:

Confinement: "No required but daily monitoring suggested", "Preventive confining and daily monitoring", "Mandatory confinement and daily monitoring" or "Quarantine confining and daily monitoring mandatory"

Surveillance "Ambulatory" or "Clinical"

Testing = "You were selected for self-collecting mouthwash-saliva specimen for SARS-CoV-2 detection. Please after sampling, start your self-monitoring"; or
 "You are not a COVID-19 suspect. Please star daily self-monitoring for early warning"

Notification₁ / SMARTER-Co: Based on risk at survey and daily monitoring.

// Type 2. Alert communication - WWW-Platform notify laboratory results to Operative team 1 and 2
 WWW-Platform → SMS / Dashboard { t_1 ; **WWW-Platform / SMS** $P_{pt-1} \rightarrow P_{pt} \& P_{ht}$ }
 //

Notification₂ / SMS, Dashboard: Based on testing results from $P_{pt-1} \rightarrow P_{pt} \& P_{ht}$.

// Type 3. Alert communication - Operative team 2 notify testing results to P_n
 WWW-Platform → SMS { t_1 ; **SMS / $P_{pt} \& P_{ht} \rightarrow P_n$** } //

Notification_{3.1} / SMS: Based on testing results from $P_{pt} \& P_{ht} \rightarrow P_n$

qPCR Positive = “You are positive to SARS-CoV-2. Quarantine confining and Daily monitoring mandatory. Notify close contacts from last 5-days” or
Negative = “You are negative to SARS-CoV-2. Continue daily monitoring”

Notification_{3.2} / SMS: Based on positive results prompt for clinical monitoring from $P_{pt} \rightarrow P_{os}$

// Type 4. Alert mitigation - Operative team 2 notify actions to Operative team 3
 WWW-Platform → SMS { t_1 ; **SMS / $P_{ht} \rightarrow M_t$** } //

Notification₄ / SMS: Based on positive individual(s) prompt for mitigation protocol from $P_{ht} \rightarrow M_t$

// Type 5. Alert communication - Positive individual notify to contacts at subcluster(s)-n { t_1 ; $P_{os} \rightarrow Am_c$ } //
 SMS, @mail, WSP, etc. { t_1 ; **social networks (SN) / $P_{os} \rightarrow Am_c$** } //

Notification₅ / SN: Based on SMS of positivity and resending to ambulatory closed-contacts prompting for immediate SMARTER-Co downloading and surveying, from $P_{os} \rightarrow Am_c$

// Type 6, 7 and 8. Patient appointment for SARS-CoV-2 re-testing after mandatory quarantine period
 WWW-Platform → SMS { t_1 ; **SMS / $P_{pt} \& P_{ht} \rightarrow P_{os}$** } //

Notification₆ / SMS: Based on clinical monitoring by patient, and surveillance by Operative team 1 prompt for re-testing at specific date and time appointed to laboratory- i .
 From $P_{pt} \& P_{ht} \rightarrow P_{os}$

Notification₇ / SMS: Positive = “You are still positive to SARS-CoV-2. Continue quarantine confining and Daily monitoring mandatory. Wait next appointment”
 From $P_{pt} \& P_{ht} \rightarrow P_{os}$

Notification₈ / SMS: Negative = “You are negative to SARS-CoV-2. Stop quarantine confining, continue preventive daily monitoring. Reinsert to cluster- j ”
 From $P_{pt} \& P_{ht} \rightarrow P_{os}$

Initialize SA;

// **Algorithm 1** (Clinical) based on Symptoms of High Risk //

```

if AA = “yes”; and  $M_s \geq 0$ ; and  $S_s \geq 0$ ; and  $Cd \geq 0$ ; then;
  print Risk → “High”
  print Confinement → “Mandatory confinement and daily monitoring”
  print Surveillance → “Clinical”
  print Testing → “yes”; else;
    do Notification1 [SMARTER-Co →  $P_n$ ]; end do;
end if;
else;
```

// **Algorithm 2** (Clinical) based on Symptoms and Chronic disease //

```

if  $M_s \geq 2$ ; and  $S_s \geq 1$ ; and  $Cd \geq 1$ ; then;
  print Risk  $\rightarrow$  "High"
  print Confinement  $\rightarrow$  "Mandatory confinement and daily monitoring"
  print Surveillance  $\rightarrow$  "Clinical"
  print Testing  $\rightarrow$  "yes"; else;
    do Notification1 [SMARTER-Co  $\rightarrow$   $P_n$ ]; end do;
end if;
else;

```

// **Algorithm 3** (Clinical) based on Symptoms //

```

if  $M_s \geq 2$ ; and  $S_s \geq 1$ ; then;
  print Risk  $\rightarrow$  "Moderate"
  print Confinement  $\rightarrow$  "Preventive confining and daily monitoring"
  print Surveillance  $\rightarrow$  "Clinical"
  print Testing  $\rightarrow$  "no"; else;
    do Notification1 [SMARTER-Co  $\rightarrow$   $P_n$ ]; end do;
end if;
else;

```

// **Algorithm 4** (Clinical-Epidemiological) based on Positive contact and Symptoms //

```

if  $C_{pos} = \text{"yes"};$  and  $M_s > 0$ ; or  $S_s > 0$ ; and  $Cd \geq 0$ ; then;
  print Risk  $\rightarrow$  "High"
  print Confinement  $\rightarrow$  "Mandatory confinement and daily monitoring"
  print Surveillance  $\rightarrow$  "Clinical"
  print Testing  $\rightarrow$  "yes"; else;
    do Notification1 [SMARTER-Co  $\rightarrow$   $P_n$ ]; end do;
end if;
else;

```

// **Algorithm 5** (Epidemiological) based on Positive(s) contact //

```

if  $C_{pos} = \text{"yes"};$  then;
  print Risk  $\rightarrow$  "Moderate"
  print Confinement  $\rightarrow$  "Preventive confining and daily monitoring"
  print Surveillance  $\rightarrow$  "Clinical"
  print Testing  $\rightarrow$  "no"; else;
    do Notification1 [SMARTER-Co  $\rightarrow$   $P_n$ ]; end do;
end if;
else;

```

// **Algorithm 6** (Epidemiological) based on living area/mobility risk //

```

if  $M_s \geq 0$ ; and  $S_s \geq 0$ ; and  $Co \geq 0$ ; and  $Occ = \text{"Student"};$  and  $Tt = \text{"High"};$  and  $Z_{risk} = \text{"Moderate" or "High"};$ 
then;
  print Risk  $\rightarrow$  "Low"
  print Confinement  $\rightarrow$  "No required but daily monitoring suggested"
  print Surveillance  $\rightarrow$  "Ambulatory"; else;
if  $Ws = \text{"yes"};$  then;
  print Testing  $\rightarrow$  "yes"; else;
    do Notification1 [SMARTER-Co  $\rightarrow$   $P_n$ ]; end do;
end if;
else;

```

// **Algorithm 7** (Epidemiological) based on Occupational Cluster-i at Risk //

```

    if  $M_s \geq 0$ ; and  $S_s \geq 0$ ; and  $Co \geq 0$ ; and  $Occ = \text{"Worker"}$ ; and  $Ag \leq 37$ ; and  $Sc_{risk} = \text{"Moderate"}$ 
    or  $\text{"High"}$ ; and  $Z_{risk} = \text{"Moderate"}$  or  $\text{"High"}$ ; then;
    print Risk  $\rightarrow$  "Low"
    print Confinement  $\rightarrow$  "No required but daily monitoring suggested"
    print Surveillance  $\rightarrow$  "Ambulatory"; else;
    if  $Ws = \text{"yes"}$ ; then;
    print Testing  $\rightarrow$  "yes"; else;
    do Notification1 [SMARTER-Co  $\rightarrow P_n$ ]; end do;
end if;
else;

```

// **Algorithm 8** (Epidemiological) based on Occupational Subcluster-i at Risk //

```

    if  $Occ = \text{"Teacher"}$ ; and  $S_{clus} = \text{"Yes"}$ ; and  $Cur = \text{"Yes"}$ ; then;
    print Risk  $\rightarrow$  "Low"
    print Confinement  $\rightarrow$  "No required but daily monitoring suggested"
    print Surveillance  $\rightarrow$  "Ambulatory"; else;
    if  $Ws = \text{"yes"}$ ; then;
    print Testing  $\rightarrow$  "yes"; else;
    do Notification1 [SMARTER-Co  $\rightarrow P_n$ ]; end do;
end if;
else;

```

// **Algorithm 9** Undefined risk //

```

    if  $M_s = 0$ ; and  $S_s = 0$ ; and  $Co = 0$ ;  $C_{pos} = \text{"yes"}$ ; and  $Sc_{risk} = \text{"Low"}$ ; and  $Z_{risk} = \text{"Low"}$ ; and  $S_{clus} = \text{"No"}$ ; and
     $Tt = \text{"Low"}$ ; then;
    print Risk  $\rightarrow$  "Undefined"
    print Confinement  $\rightarrow$  "No required but daily monitoring suggested"
    print Surveillance  $\rightarrow$  "Ambulatory"
    print Testing  $\rightarrow$  "no"; else;
    do Notification1 [SMARTER-Co  $\rightarrow P_n$ ];
end if;
else;
    while  $t = \text{"Continuous"}$ ;
    repeat  $DSm$ ;
    until  $t = \text{"End period"}$ ;
end SA;
else;

```

// **Notification of decision-making algorithms through WWW-Platform //**

```

    if  $Re = \text{"ready"}$ ; then;
    do Notification2 [SMS, Dashboard / WWW-Platform  $\rightarrow \{P_{pt} \& P_{ht}\}$ ];
    end do;
    do Notification3.1 [SMS / WWW-Platform  $\{P_{pt} \rightarrow P_n\}$ ]; end do;
    if  $qPCR = \text{"Positive"}$ ; then;
    print Risk  $\rightarrow$  "High"
    print Confinement  $\rightarrow$  "Quarantine confining and daily monitoring mandatory";
    print Surveillance  $\rightarrow$  "Clinical"; else;
    do Notification3.2 [SMS / WWW-Platform  $\{P_{pt} \rightarrow P_n\}$ ]; end do;
    do Notification4 [SMS / WWW-Platform  $\{P_{ht} \rightarrow M\}$ ]; end do;
    do Notification5 [SMS, @mail, WSP  $\{P_{os} \rightarrow Am_{ck} (SM)\}$ ]; end do;
end if;
else;
    while  $qPCR = \text{"Positive"}$ ;
    repeat print Risk  $\rightarrow$  "High"

```

```

                                print Confinement → "Quarantine confining and daily
                                monitoring mandatory"; else;
                                do Notification6 [SMS / WWW-Platform { $P_{pt}$  &  $P_{ht}$  →  $P_{os}$  }];
                                do Notification7 [SMS / WWW-Platform { $P_{pt}$  &  $P_{ht}$  →  $P_{os}$  }];
                                end do;
                                until qPCR = "Negative";
                                else:
                                if qPCR = "Negative"; then;
                                do Notification8 [SMS / WWW-Platform { $P_{pt}$  &  $P_{ht}$  →  $P_{os}$  }];
                                end do;
                                else;
                                while t = "Continuous";
                                repeat DSm;
                                until t = "End period";
                                end;

```