COVID-19 ეპიდემია საქართველოში პროგნოზი და პოლიტიკის შეთავაზებები
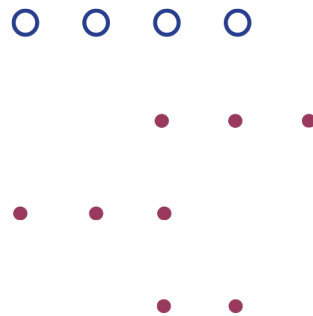
მადლიერების გამოხატვა

დოკუმენტი მომზადებულია საერთაშორისო ფონდი კურაციოს მიერ საქართველოს ოკუპირებული ტერიტორიებიდან დევნილთა, შრომის, ჯანმრთელობისა და სოციალური დაცვის სამინისტროსთვის.

სამუშაო შესრულდა ჯანმრთელობის მსოფლიო ორგანიზაციასთან არსებული ჯანდაცვის პოლიტიკისა და სისტემების კვლევის ალიანსის ფინანსური მხარდაჭერით. საერთაშორისო ფონდი კურაციო მადლობას უხდის ალიანსს პროექტის დაფინანსებისთვის, რომელიც მიზნად ისახავს ქვეყნის პოლიტიკური საჭიროებების საპასუხოდ საერთაშორისო მტკიცებულებების მიმოხილვას და პოლიტიკის ინფორმირებას.

დოკუმენტი მომზადებულია ქართულ და ინგლისურ ენებზე. დანართები წარმოდგენილია, მხოლოდ ინგლისურ ენაზე.
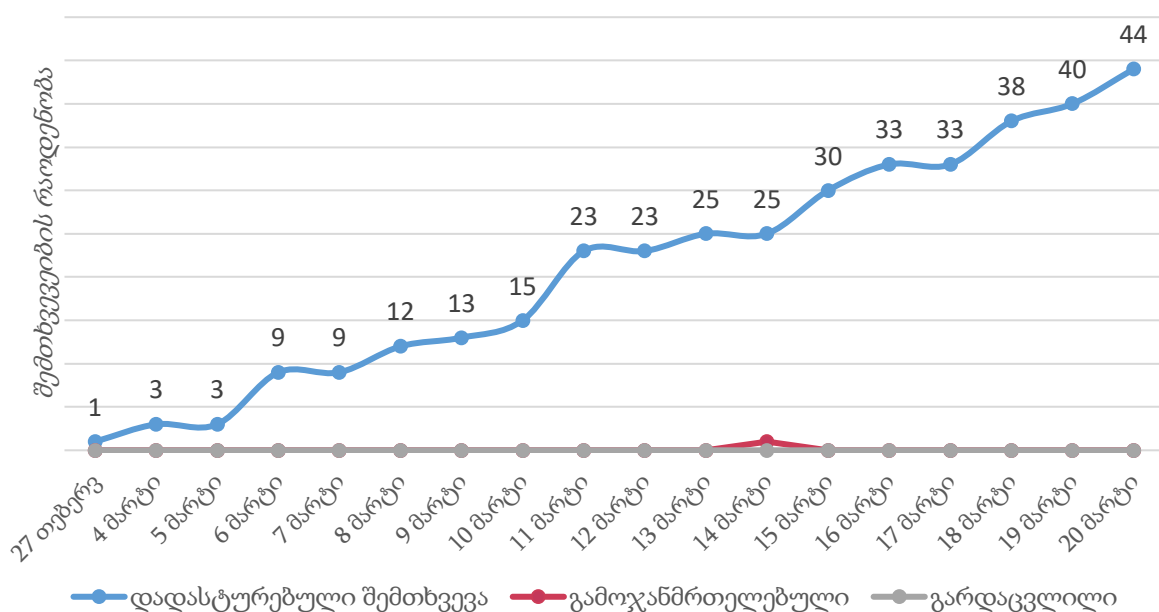
სარჩევი

შესავალი

COVID-19 ეპიდემია საქართველოში

საქართველოში კორონავირუსის (COVID-19) პირველი შემთხვევა 2020 წლის 27 თებერვალს დაფიქსირდა. 22 მარტის მონაცემებით საქართველოში 54 შემთხვევაა დასტურებული. შემთხვევების დინამიკა იხილეთ გრაფიკი 1-ზე.

კორონავირუსის პირველი შემთხვევის იდენტიფიცირებიდან 3 კვირის თავზე ვირუსის გავრცელების ეპიდემიოლოგიური სურათი ცხადად მიუთითებს ქვეყნის მიერ გატარებულ

საქართველო, 22 მარტი 2020

- ახალი შესაძლო შემთხვევა 64
- დადასტურებული შემთხვევა 54
- გამოჯანმრთელდა 3
- სააავადმყოფოში წევს 51 პაციენტი
- საკარანტინო ზონაშია 3254 ადამიანი
- საკარანტინო ზონა და თვით იზოლაცია დატოვა 191 ადამიანმა

დროულ და პროგრესულ ღონისძიებებზე, რომლებიც მოიცავს ვირუსის გავრცელების მაღალი მაჩვენებლის მქონე ქვეყნებიდან საქართველოში ჩამომსვლელ პირთა სკრინინგს, ტესტირებას, კონტაქტების მოძიებას, კარანტინისა და თვით-იზოლაციის წესების შემოღებას, საერთაშორისო ფრენების შეჩერების გადაწყვეტილებას, საგანმანათლებლო დაწესებულებების დახურვას, დასაქმებულებისთვის ონლან სამუშაო გრაფიკზე გადასვლის მოწოდებას, მასობრივი თავშეყრის შეზღუდვებს, საზოგადოებრივი ტრანსპორტის ნაწილობრივ შეზღუდვას, ეპიდზედამხედველობის ღონისძიებების, მ.შ ახალი პროტოკოლების შემუშავება-დამტკიცებას, საზოგადოებასთან აქტიურ კომუნიკაციას და .აშ.

გრაფიკი 1. COVID-19 შემთხვევების დინამიკა 2020 წლის 20 მარტის მდგომარეობით

ჯანმრთელობის მსოფლიო ორგანიზაციის (ჯანმო) კლასიფიკაციის მიხედვით ამჟამად **საქართველო ეპიდემიის გავრცელების „კლასტერულ" ფაზაში იმყოფება** (ეპიდემიის მე-3 სცენარი), რომელიც შემთხვევების კლასტერული გადაცემით ხასიათდება (WHO, 2020b). ეპიდემიის მომდევნო საფეხური „მასობრივი გავრცელებაა", რომლის დროსაც გადაცემის ჯაჭვის იდენტიფიკაცია შეუძლებელი ხდება.

ეპიდემიის გავრცელების ტენდენციები მსოფლიოს სხვადასხვა ქვეყანაში

რამდენი დღე სჭირდებათ ქვეყნებს ეპიდემიის მასობრივი გავრცელების საფეხურზე გადასასვლელად? კითხვაზე პასუხი განსხვავებულია ქვეყნების მიხედვით მათ მიერ ეპიდემიის საპასუხოდ გატარებული ღონისძიებების შესაბამისად. ევროპის ქვეყნებს და ამერიკას პირველი 100 დადასტურებული შემთხვევის გამოსავლენად 11-დან 37 დღემდე დასჭირდათ.

გრაფიკი 2. COVID-19 შემთხვევების დინამიკა ევროპის ზოგიერთ ქვეყანასა და აშშ-ში

რამდენი დღე დასჭირდა პირველი 100 შემთხვევის პოვნას
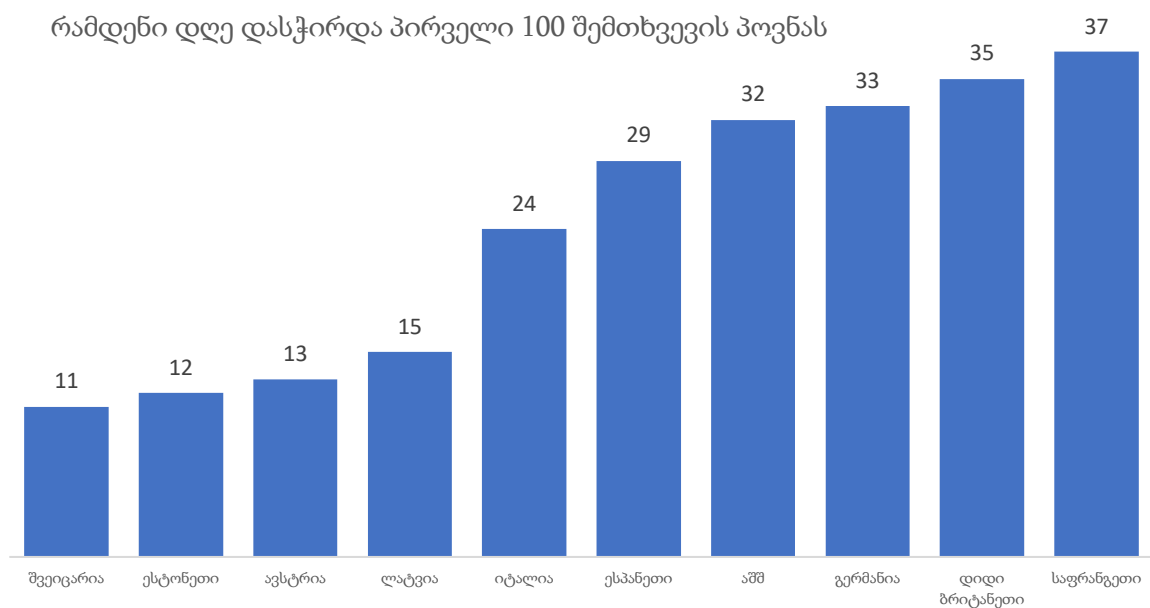
თუმცა, ნიშანდობლივია, რომ ქვეყანებს, რომლებიც პასიური საპასუხო აქტივობებით გამოირჩეოდა (იტალია, საფრანგეთი, გერმანია, დიდი ბრიტანეთი, შვეიცარია, ესპანეთი, ავსტრია, აშშ) პირველი 100 შემთხვევის შემდეგ 500 შემთხვევა 3-4 დღეში დაუდგა. მიუხედავად იმისა, რომ გრაფიკზე გერმანია, დიდი ბრიტანეთი და შვეიცარია შედარებით დაბალ მრუდს აჩვენებს, ყველა ამ ქვეყანას COVID-19-ის ახალი შემთხვევების ყოველდღიური 25-32% ზრდა აქვს. (ECDC, 2020c; Our World Data, 2020)

ესტონეთში ეპიდემიის ზრდა 5% ზრდით მიდის, ლატვიამ ახლახან გამოავლინა 100-ზე მეტი ადამიანი, ხოლო ლატვიაში შემთხვევათა რა-ზა 100-მდეა. შედარების დროს, რა თქმა უნდა გასათვალისწინებელია ქვეყნის ზომა და მოსახლეობის სიმჭიდროვე.

COVID-19 ეპიდემია საქართველოში
პროგნოზი და პოლიტიკის შეთავაზებები

გრაფიკი 3. COVID-19 შემთხვევების ზრდა პირველი 100 დღის შემდეგ (იტალია, გერმანია, დიდი ბრიტანეთი, საფრანგეთი, ესპანეთი, შვეიცარია, ავსტრია, აშშ)
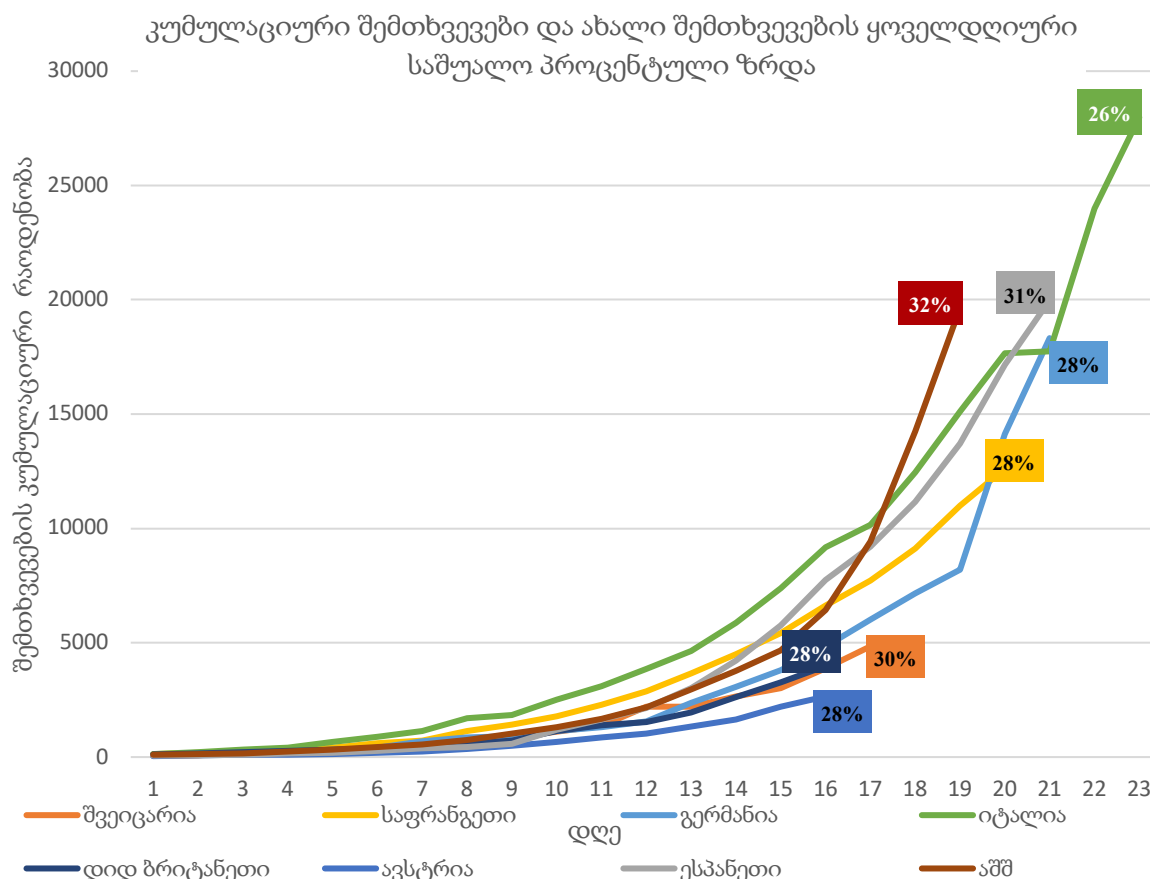
აზიის ქვეყნები, რომლებმაც ეპიდემიასთან ბრძოლის მკაცრი და დროული ღონისძიებები გაატარეს, როგორიცაა სამხრეთ კორეა, ჰონგ კონგი, სინგაპური, და ტაივანი პირველი 100 შემთხვევა დააუდგათ 20, 36, 36 და 66 დღის შემდეგ, შესაბამისად. რაც შეეხება დაინფიცირებული შემთხვევების 500-მდე გაზრდას სამხრეთ კორეამ ამ ნიშნულს 100 შემთხვევიდან 2 დღეში მიაღწია, სინგაპურსა და ჰონგ კონგს ინფიცირებულთა რაოდენობის გაორმაგებისთვის 14 დღე დასჭირდა. ტაივანმა კი 100 შემთხვევას გადააჭარბა სულ ახლახან – 66-ე დღეს (ECDC, 2020c). სამხრეთ კორეაში ეპიდემიის სწრაფი მატება უკავშირდება ეპიდემიის დასაწყისში ეპიდაფეთქების შემდეგ ჩატარებულ ინტენსიურ კონტაქტების კვლევას და მასშტაბურ ტესტირებას, რის გამოც გამოვლენილ შემთხვევათა რაოდენობა, სავარაუდოდ მაქსიმალურად უახლოვდება ინფექციის რეალურ გავრცელებას (Shim et al., 2020; Kuhn, 2020; Our World Data, 2020).

გრაფიკი 4. COVID-19 შემთხვევების მატების დინამიკა აზიის ზოგიერთ ქვეყანაში
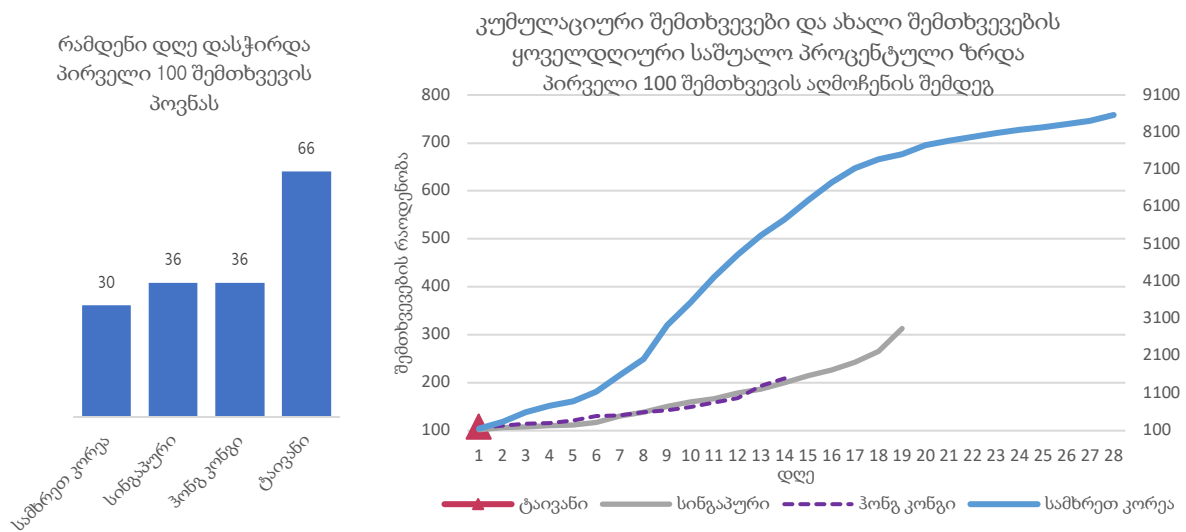
ზემოხსენებულ ქვეყნებში ეპიდემიის ზრდის ტემპის მახასიათებლების გათვალისწინებით შეგვიძლია ვივარაუდოთ საქართველოში COVID-19-ის გავრცელების ტემპი ევროპა/აშშ და აზიის ქვეყნების საშუალო მაჩვენებლებს შორის არის. ამ დაშვებით ასევე სავარაუდოა, რომ პირველი 100 შემთხვევის გამოვლენა საქართველოში ეპიდემიის დაწყებიდან 30-35 დღეზე მოხდება.

COVID-19 ეპიდემიის პროგნოზი საქართველოში

COVID-19 ეპიდემიისთვის ჯანდაცვის სისტემის მზაობის შესაფასებლად საერთაშორისო ფონდმა კურაციომ გააკეთა მოდელირების სავარჯიშო, რომლისთვისაც გამოიყენა ორი სხვადასხვა ინსტრუმენტი:

1. **COVID-19 Hospital Impact Model for Epidemics,** რომელიც შემუშავებულია პენსილვანიის Penn Medicine Predictive Healthcare Team-ის მიერ სპეციალურად ამ ეპიდემიისთვის https://penn-chime.phl.io/

2. **FluSurge2.0,** რომელიც ამერიკის დაავადებათა კონტროლის ცენტრის მიერ პანდემიური გრიპის პროგნოზისთვის შეიქმნა https://www.cdc.gov/flu/pandemic-resources/tools/flusurge.ht

პირველი მოდელი (**COVID-19 Hospital Impact Model for Epidemics)** ეფუძნება რამდენიმე დაშვებას, რომელიც კორონავირუსის ჰოსპიტალიზებული შემთხვევების მართვის მახასიათებლებს უკავშირდება და საშუალებას იძლევა განისაზღვროს „სოციალური დისტანცირების" სხვადასხვა დონის გავლენა ვირუსით გამოწვეული ჰოსპიტალიზაციის დონეზე. ხოლო მეორე მოდელი პანდემიური გრიპის შესაფასებლად გამოიყენება და არ არის მოგებული COVID-19-ის ეპიდემიოლოგიურ მახასიათებლებზე.

ქვემოთ წარმოგიდგენთ ორივე მოდელის მიხედვით მიღებული შედეგების შედარებას (იხილეთ გრაფიკი 5).

გრაფიკი 5 **ჰოსპიტალიზაციის შედარება სხვადასხვა მოდელის გამოყენებით**
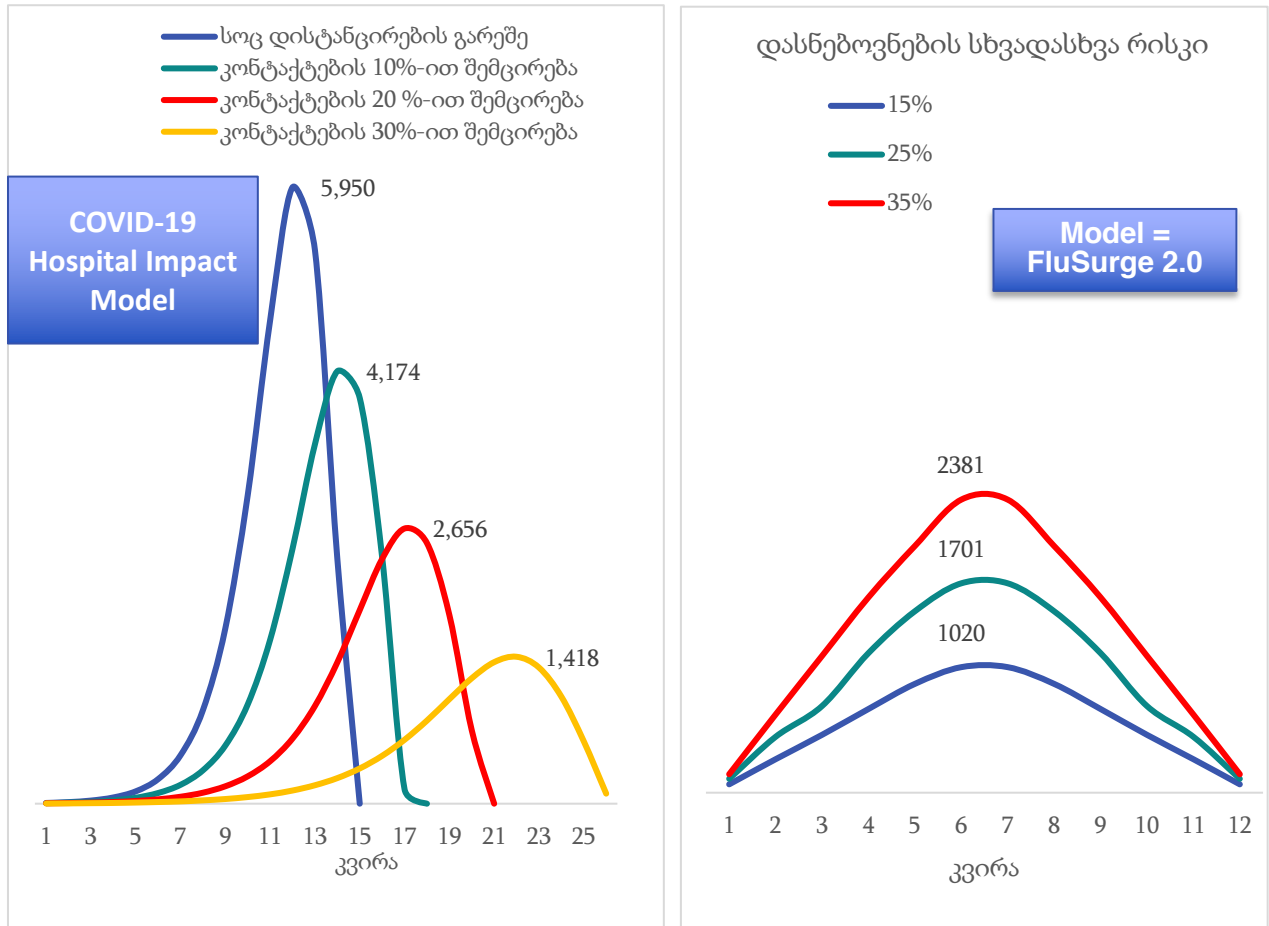
პროგნოზირების საფუძველზე მიღებული ძირითადი დასკვნები

⭕ სოციალური დისტანცირება უმნიშვნელოვანესია ეპიდემიის შესაკავებლად (Anderson, Heesterbeek, Klinkenberg, & Hollingsworth, 2020);

⭕ სოციალური დისტანცირების გარეშე ეპიდემიის პიკი სწრაფად მიიღწევა და პიკურ კვირაში ახალი ჰოსპიტალური შემთხვევების რაოდენობა 5,950-ი იქნება, რასაც ქვეყნის ჯანდაცვის სიტემა ვერ გაუძლებს.

⭕ სოციალური დისტანცირების ღონისძიებების გამოყენება, რომლებიც 10% ით ამცირებს კონტაქტების რაოდენობას, ეპიდემიის მიმდინარეობას ახანგრძლივებს, ეპიდემიის პიკი მიიღწევა მე-14 კვირას და ახალი ჰოსპიტალიზებული პაციენტების რაოდენობა 4,174-მდე მცირდება;

⭕ 20%-ით კონტაქტების რაოდენობის შემცირებით ეპიდემია პიკს მიაღწევს მე-17 კვირას, და ახალი ჰოსპიტალიზაციის შემთხვევები 2,656-მდე შემცირდება, რაც კიდევ უფრო ამცირებს ტვირთს ჰოსპიტალურ სექტორზე

⭕   30%-ით კონტაქტების რაოდენობის შემცირებით ეპიდემიის პიკის მიღწევა შესაძლებელია 22-ე კვირას და ჰოსპიტალიზაციის შემთხვევების რაოდენობის შემცირება 1,418-მდე.

⭕   **COVID-19 Hospital Impact** მოდლით მიღებული გათვლები მნიშვნელოვნად აღემატება FluSurge 2.0-ით მიღებულ შედეგებს 12-კვირიანი ეპიდემიისთვის.

მტკიცებულებების საჭიროება – როგორ ვმართოთ ეპიდემია ეფექტურად?

ვინაიდან ეპიდემიის გამომწვევი უცნობია მსოფლიოსთვის, მნიშვნელოვანია ისეთი ქვეყნების გამოცდილება, რომელთაც წარმატებული ნაბიჯები გადადგეს და გადაა`ვადეს ეპიდემიის პიკი.

სადღეისოდ ასეთი ქვეყნებია სინგაპური, ჰონგ კონგი, სამხრეთ კორეა და ტაივანი. მოძიებული მტკიცებულებების სინთეზის საფუძველზე, რომელიც ქვემოთ არის მოცემული, წარმოგიდგენთ შემოთავაზებებსს, რაც საქართველოს ეპიდემიის ეფექტურად მართვაში დაეხმარება.

მნიშვნელოვანია, აღინიშნოს, რომ ინფორმაცია ყოველდღიურად განახლებადია და შესაბამისად მტკიცებულებებიც თანდათან გროვდება. შესაბამისად სხვა ქვეყნების გამოცდილების მუდმივი მონიტორინგი ალბათ სასარგებლო იქნება.

ეპიდემიის ეფექტური მართვისთვის გასატარებელი ღონისძიებები და აქტივობები

დაგეგმვა / კოორდინაცია ეროვნულ დონეზე

○ ეპიდემიის სურათის შესაბამისად სამედიცინო სერვისების სიმძლავრეების (უკვე გამოთავისუფლებული ან გამოსათავისუფლებელი ზოგადი და კრიტიკული/ რეანიმაციული საწოლების, ფილტვების ხელოვნური ვენტილაციის აპარატების) დაზუსტების და სისტემის მოსალოდნელი დატვირთვის შედარებითი ანალიზის საფუძველზე **სამოქმედო გეგმის შემუშავება** და **მუდმივი განახლება**;

○ ერთის მხრივ, **საკარანტინო პუნქტების გადლიერება** ქვეყნის საზღვრებზე ახალი შემთხვევების იმპორტირების აცილების მიზნით და, მეორეს მხრივ, შიდა გადაცემის შემცირება **სოციალური დისტანცირებით, რაც** საზოგადოებრივი ჯანმრთელობის სხვა ღონისძიებებთან ერთად მნიშვნელოვანია ეპიდემიის ზრდის ტემპის შესანელებლად (Ferguson et al., 2020). მიუხედავად იმისა, რომ ამ მეთოდების ხანგრძლივად გამოყენება რთულია და ახლავს ეკონომიკური გამოწვევები, იგი კრიტიკულად მნიშვნელოვანია **ჯანდაცვის სისტემის გადატვირთვის თავიდან ასაცილებლად.** ამასთან ერთად მნიშვნელოვანია მისი მუდმივი მონიტორინგი.

○ სოციალური დისტანცირების ეფექტურობიდან გამომდინარე რთულია იმის პროგნოზირება თუ რა ვადით მოხდება ეპიდემიის პიკის გადავადება და პიკის შემცირება. ამიტომ მიზანშეწონილია ჯანდაცვის სისტემის **მზადება უფრო პესიმისტური სცენარით** დაიგეგმოს (მრუდი – კონტაქტების 10% შემცირება).

○ გაგრძელდეს მუდმივი, გამჭვირვალე და კოორდინირებული **კომუნიკაცია** მოსახლეობასთან.

საზოგადოებრივი ჯანდაცვის ღონისძიებები

○ **თვითიზოლაციის და კარანტინის მონიტორინგის გაუმჯობესება** ახალი ტექნოლოგიების გამოყენებით, მაგ. ელექტრო სამაჯურების გამოყენება, რომლებიც ადამიანების გადაადგილების ინფორმაციას დროის რეალურ რეჟიმში იძლევა;

○ საკომუნიკაციო მესიჯების ჩამოყალიბება და სხვადასხვა საკომუნიკაციო წყაროს გამოყენება (მ.შ. სოციალური მედია) **სწორი, შეთანხმებული საკომუნიკაციო კამპანიისთვის.** სოციალური მედიის როლი განსაკუთრებით მნიშვნელოვანია ხანგრძლივი ფართომასშტაბიანი შემაკავებელი ღონისძიებების

დროს, მოთხოვნებისადმი დამყოლობის ხელშესაწყობად და ცრუ ინფორმაციის, მოლოდინების თავიდან ასაცილებლად.

⭕ სწრაფი ტესტირების კონკრეტული მიზნების განსაზღვრა, ალგორითმის შემუშავება და დანერგვა სამედიცინო დაწესებულებებში კერძო სექტორის მონაწილეობით ფასების რეგულირების თანხლებით;

⭕ რესურსების გათვალისწინებით კონცენტრირება მაღალპრიორიტეტულ აქტივობებზე, მ.შ კონფირმატორული ტესტების რაციონალური მოხმარება

ჯანდაცვის სისტემის ღონისძიებები

⭕ **ჰოსპიტლების დაყოფა** სხვადასხვა სიმძიმის პაციენტების მართვისთვის

⭕ **პაციენტების ტრიაჟი** დაწესებულებებში მიმართვიანობის მაქსიმალურად შემცირების მიზნით (Cao et al., 2020; Parodi, Jewkes, Cha, & Park, n.d.)

⭕ ტრიაჟის ალგორითმის შემუშავება, რომელიც განსაზღვრავს COVID-19-ით ავადობის რისკს და მისი არსებობის შემთხვევაში (მსუბუქი შემთხვევის ჩათვლით) მიმართავს პაციენტს შესაბამის დაწესებულებაში.

   o ზინაზე მოვლის პროტოკოლის შემუშავება, რაც მნიშვნელოვანია პაციენტის ზინაზე დაყოვნებისას იქნას გათვალისწინებული, დაავადების ზინაზე გავრცელების პრევენციისთვის

   o ცხელი ხაზის, 112-ის, ოჯახის ექიმები და სოფლის ექიმების აღჭურვა ტრიაჟის ალგორითმით და ზინაზე მოვლის პროტოკოლით

   o ოჯახის ექიმების **ვირტუალური კონსულტაციების** ორგანიზება კერძო სექტორის აქტიური მონაწილეობით, რაც შესაძლებელი იქნება ქალაქებში ამ ეტაპზე. კონსულტაციები უნდა ეფუძნებოდეს COVID-19 ინფექციის გამოვლენის და ტრაიჟის დადგენილ ალგორითმს

   o საკომუნიკაციო მესიჯებში სამედიცინო სერვისებში მიმართვიანობის წესის გახმოვანება. სატელეფონო ტექსტური მესიჯების გამოყენება ამ მიზნებისთვის

⭕ COVID-19 **კლინიკური მართვის გაიდლაინის** შემუშავება/დამტკიცება უახლესი რეკომენდაციების შესაბამისად (Metlay et al., 2019; WHO, 2020a)

⭕ **საკარანტინე ადგილებად გამოყენებული სამედიცინო დაწესებულებების ჩანაცვლება** ალტერნატიული არასამედიცინო დაწესებულებებით, სადაც განთავსდებიან ახლო კონტაქტები, ხოლო ამ სამედიცინო დაწესებულებების მომზადება მსუბუქი პაციენტების განსათავსებლად, რათა შემცირდეს მსუბუქი პაციენტებისგან ინფექციის გავრცელება ოჯახის წევრებში (ECDC, 2020b; WHO, 2020d)

⭕   ზედამხედველობის გაფართოება ატიპური პნევმონიის შემთხვევებზე COVID-19-ის გამოსავლენად ქვეყნის მასშტაბით პირველადი ჯანდაცვის და ჰოსპიტალურ სექტორში, საყრდენ სადგურებში ეპიდზედამხედველობის გაგრძელება COVID-19-ზე (WHO, 2020d)

⭕   **ჯანდაცვის პროგრამებით ბენეფიციარებისთვის სერვისის მიწოდების გადაწყობა** მოსახლეობის გარკვეული ჯგუფებისთვის უსაფრთხოების და სერვისების უწყვეტობის უზრუნველსაყოფად (მაგ. იმუნიზაცია, ტუბერკულოზის, ქრონიკული დაავადებების სამკურნალო მედიკამენტების სუბსიდირების და სხვა პროგრამები)

ინფექციის პრევენცია და კონტროლი სამედიცინო დაწესებულებებში

⭕   დაწესებულებების (მათ შორის იმ ჰოსპიტლების, რომლებიც არ მონაწილეობენ COVID-19 ის მართვაში, და პირველადი ჯანდაცვის მომსახურების მიმწოდებლების) მიერ მზადყოფნის გეგმების შემუშავება, რომელიც უნდა მოიცავდეს ქვემოჩამოთვლილს (Liu, Li, & Feng, 2020)

⭕   დაწესებულებაში პაციენტის ტრიაჟის ალგორითმის განხორციელება (მაგ. ჩინეთის ალგორითმი Annex 3)

⭕   დაწესებულებაში პაციენტის მიერ ინფექციის კონტროლის სტანდარტული პროცედურების განხორციელება (WHO, 2020c)

⭕ დაწესებულებების მიერ პერსონალის (ექიმები, უმცროსი ექიმები, ექთნები, სანიტრები) მუშაობის სახელობითი გეგმის შემუშავება შემდეგი პრინციპების დაცვით(Liew, Siow, Maclaren, & See, 2020)) იხ Annex 4.

→ კორონავირუსის მართვისთვის გამოყოფილ დაწესებულებებში უპირატესად ინფიცირების მაღალი რისკის განყოფილებებში (ემერჯენსი, კრიტიკული თერაპია) და შედარებისდაგვარად თერაპიულ განყოფილებებში პერსონალის დაწესებულებაში დაყოვნების და ბინაზე ყოფნის 14/14 დღიანი გრაფიკის შემუშავება (14 დღე ჰოსპიტალში მორიგეობა/დასვენების მონაცვლეობა, შემდეგ 14 დღე ბინაზე დაყოვნება თვითიზოლაციის დაცვით (ტემპერატურის კონტროლი და ა.შ.). ასეთი გრაფიკისთვის შესაბამისი დაწესებულებაში ინფრასტრუქტურის და საკვებით მომარაგების უზრუნველყოფა

→ პერსონალის მორიგეობის ჩანაცვლების გეგმის შემუშავება პერსონალის გაცდენის შემთხვევაში

→ პერსონალის დაწესებულებაში დაშვების კრიტერიუმების შემუშავება

→ დამატებითი პერსონალის მობილიზების გეგმის შემუშავება საათებით და გვარ-სახელებით.

⭕ პერსონალის უსაფრთხოების უზრუნველყოფა

→ პერსონალური დაცვის საშუალებებით მომარაგება და სწავლების ჩატარება უახლესი რეკომენდაციების შესაბამისად (ECDC, 2020a; WHO, 2020c) უპირველეს ყოვლისა COVID-19 მართვისთვის გამოყოფილი დაწესებულებებისთვის, მაგრამ ასევე სხვა მსხვილი ჰოსპიტლებისთვის

→ დაწესებულებებში შესაბამისი სივრცეების გამოყოფა სადაც მოხდება პერსონალური დაცვის საშუალებების ჩაცმა და გახდა.

→ ჯანმრთელობის მდგომარეობის კუთხით მაღალი რისკის პერსონალისთვის (ქრონიკული დაავადებები, ასაკოვანი ჯგუფი) შედავათების დაწესება (შვებულება, ნაკლებად სარისკო განყოფილებაში გადაყვანა, ა.შ.)

⬤ აეროზოლ გენერირებადი პროცედურების ჩატარება უსაფრთხოების დაცვის პრინციპების გათვალისწინებით

○ მაგ. არაინვაზიური ვენტილაციის და მაღალი წნევით ნაზალური კანულის ოქსიგენაციისგან თავის შეკავება უარყოფითი წნევიანი პალატების არ არსებობის პირობებში

○ მაგ. ინტუბაციის, სანაციის ჩატარება მაღალი სიფრთხილით, პერსონალის დიფერენცირება ამგვარი პროცედურების ჩატარებისას

Evidence Synthesis

Synthesis of the evidence

All four counties Hong Kong, Singapore, Taiwan and South Korea were especially vulnerable to COVID-19 due to their proximity to and close ties to China mainland where the global epidemic started from. Owing to the experience from the previous epidemics (2003 SARS and 2009 pandemic influenza) the countries were well prepared to respond with early interventions.

COVID-19 epidemic requires combination of measures which the countries adopted from the early stages of the epidemic. The set of actions included border closure, social distancing, testing, surveillance and public communication activities with some variations.

Hong Kong deployed very extensive measures to encourage social distancing with early quarantine of contacts and other community response activities. Schools and working places were closed, intensified testing was introduced. The country applied innovative technologies in contact tracing namely use of wristbands.

Taiwan success in epidemic control was predominantly caused by social distancing. Taiwan suspended flights with slight delay compared to other three countries, however implemented social distancing activities (school closure, including home quarantine) with enforcement measures.

South Korea applied different approach. In response to the widespread transmission of local cases stemming from several clusters the country initiated active contact tracing, early identification of infectious individuals and their isolation. South Korea was the only country which initiated mass testing. Other measures included board closure, social distancing activities such as school and working places closure and cancellation of mass gatherings. Measures were enforced with administrative fines.

Singapore adopted multipronged containment measures to contain COVID-19 epidemic. Along with the border controls, and community education and precautions, the country implemented aggressive interventions to contain local transmission of the infection. These measures included surveillance among different population groups, patient isolation and quarantine, active monitoring of contacts. Small number of cases allowed for the system to undertake individualized efforts. Enhanced surveillance activities lead to rapid identification and isolation of cases, quarantine of close contacts that was effective in suppressing expansion of the epidemic (Ng et al., 2020).

Effectiveness of sole interventions might not be effective in combating the epidemic, e.g. Hellewell at al found that contact tracing and isolation might not contain outbreaks of COVID-19 unless very high levels of contact tracing are achieved, other author similarly indicates that contacts tracing could be successfull strategy in the early stages of the outbreak (Anderson et al., 2020).

County level effectiveness of the interventions could be measured by reduction of the reproduction number (R_0), although it will give insights on effectiveness of combination of measures and not on a single intervention. All four countries aimed to suppress the epidemic. The aim of the suppression is to reduce the R_0 below 1.0 (For COVID-19 R_0 is 2.5 in China settings (ECDC, 2020b)). In Spain, Italy, Iran R_0 is >6.0. All countries (Taiwan data not available) achieved reduction of the R_0, however only South Korea, with the largest disease burden, managed to suppress the R_0 below 1.0 after 40 days from the epidemic start. Other countries reproduction number value is between 1.0-2.5 (Abbott et al., 2020).

The Table 1 below presents set of measures deployed by the countries. Summary of the measures are presented below and more details in the Annex 2.

Table 1 Interventions by countries

Intervention	Short description / Country	South Korea	Hong-Kong	Singapore	Taiwan
Emergency response mechanisms	Country level coordination	+	+	+	+
	Declaring state of emergency	+	+	-	-
Risk communication & public engagement	Effective communication	+	+	+	+
Case finding, contact tracing and management	Active case finding, contact tracing & monitoring,	+	+	+	+
	Mobile apps to track interaction	+	-	-	-
	Quarantine and isolation	+	+	+	+
	Travel restrictions	+	+	+	+
Surveillance	Surveillance systems	+	+	+	+
	Intensive testing	+	+	+	+
	Mass testing including drive through testing stations	+	-	-	-
Social distancing	School closure	+	+	-	+
	Working places closure	+	+	-	+
	Stopping mass gathering >250	+	+	+	+ not banned but discouraged
Case Management	Ready hospitals for surge, triage procedures	+	+	+	+
Infection prevention & control (IPC)	Staff training in IPC and clinical management	+	+	+	+
Readiness of health care systems	Preparedness for the epidemic due to previous experience	+	+	+	+

Quick actions

→ Singapore, Taiwan, Hong Kong and South Korea were well prepared to Covid-19 epidemic due to previous experience with SARS outbreak in 2003. The governments of all four countries **acted proactively and quickly shifted to enhanced preparedness stage**. Whole **national responses were well coordinated and managed across the governmental structures, public and private organizations and communities**.

→ Right after the announcement of an unknown virus in Wuhan (China) the countries activated preparedness plans and quickly deployed mitigation interventions.

Rigorous detection, strict quarantine and isolation

→ Hong Kong, Taiwan and Singapore had all proactively implemented **travel restrictions** on passengers coming from the China mainland, contravening the WHO insistence that travel bans were not necessary. (20)

→ Singapore was the first country that **suspended flights** from Wuhan. Returnees were placed under 14-day compulsory leave. Every possible contacts of confirmed cases were identified through rigorous investigation (using police forces) and close contacts were put under **mandatory quarantine**. **Mass fever screening** was instituted at entry points to offices, schools, hotels, community centers and places of worship. (Wong, 20, 21) Violation of the quarantine rules is subject of fines up to 7,300 USD.

→ Hong Kong quickly set up systems to identify every case in the territory. The diagnostic tests were developed and rapidly deployed to every major hospital in the city. Holiday camps and newly constructed public-housing units that were still vacant were rapidly repurposed into quarantine facilities. Since mid-March Hong Kong uses **electronic wristbands to enforce quarantine measure**. (Cheng, 7, 28)

→ In Taiwan the flights from China were not closed immediately, but screening of travelers was put in place. Taiwan mainly used home-based quarantine, individuals were tracked through mobile phone, the gov issued cell phones to those in need to ensure that individuals remained locked during incubation period. Toll-free hotlines were established where citizens reported own or others' cases. The authorities introduced strict enforcement measures including fines up to 33,000 USD to ensure compliance to the rules (2, 29).

→ South Korea used **novel methods for contact tracing** including medical facilities records checking, phone-based global positioning system (GPS), card transaction records, and closed-circuit television. Contact investigations provided accurate information on the location, and time of exposure, and details of the situation, thus reducing omissions in a patient's route due to recall or confirmation bias (COVID-19 National Emergency Response Center Epidemiology & Case Management Team KCDC, 2020; Parodi et al., n.d.)

→ All four countries initiated **enhanced laboratory surveillance** to widen detection of cases. In Hong Kong surveillance initially included pneumonia cases without a microbiological diagnosis which was expanded to all inpatients with pneumonia and a purposively sampled proportion of outpatients and emergency attendees. In total about 1500 individuals were tested per day (Legido-Quigley et al., 2020)

→ From the third day after China announced about a novel virus Singapore's Ministry of Health alerted all physicians to identify any patient with pneumonia and a recent travel history to Wuhan. Pneumonia in hospital and primary care, severely ill patients in hospital intensive care units and deaths with possible infectious cause, and influenza-like illness (ILI) in sentinel primary care clinics were traced. Doctors were also allowed to test patients whom they viewed with suspicion for clinical or epidemiological reasons. In Taiwan patients with severe respiratory symptoms and tested negative for influenza were tested.

→ South Korea experienced large outbreak of COVID-19 stemming from church services in one of the cities that lead to 55% of confirmed cases in the country. This and some other clusters were driving force of the epidemic. In response the government initiated **active contact tracing** that enabled to **identify and early isolate infectious individuals**. Analysis of these four major clusters of South Korea epidemic indicates that early social distancing measures

were effective in containing the epidemic (Shim, Tariq, Choi, Lee, & Chowell, 2020). Other **creative testing measures included 50 drive-through (testing of individuals in their vehicles)** testing stations across the country, where it takes only 10 minutes to go through the whole procedure. Test results are available within hours. The country has capacity of processing up to 15,000 diagnostic tests a day with active participation of private laboratories that accounted for 90% of lab capacity in the country. In total about 200,000 tests were done that resulted in the third largest number of confirmed infections after China and Italy (Bicker, 2020; Kuhn, 2020; Park & Power, 2020)

Social distancing and public health measures

→ Social distancing, as a key measure to stop epidemic spread was put into practice quickly in all Singapore, Hong Kong, Taiwan and South Korea with some variations.

→ Singapore has not implemented school closures, or other major social distancing measures, as there is no evidence of widespread community transmission. (Lee) Only large gatherings were closed.

→ In Taiwan schools were suspended several times (from 24 of January to 23 of March) for some time and resumed later. Organizers of mass events were encouraged to defer or cancel events; some religious institutions suspended services.

→ South Korea has adopted a gentler policy of voluntary containment and keeping citizens updated on its efforts in near real-time. (Strother, 2020) Thermal imaging cameras were placed in the entrances to major buildings, bottles of hand sanitizers have been placed in lifts. People dressed in costumes at subway entrances reminding people to wash their hands.

→ Hong Kong has also deployed very extensive measures to encourage social distancing. Many civil servants were asked to work from home for the following month. Most large-scale events have been canceled or postponed. All kindergartens and schools were closed starting from January 27 until late April (20 April, 2020).

Effective communication

→ All four countries put efforts to deliver timely, transparent and accurate information on a daily basis. Daily updates, press-conferences were done form the Ministries of Health, experts, other sector representatives. Communication activities were centrally managed and coordinated.

→ As traditional communication strategies were not sufficient the countries used various means of communication (social media, print media, posters and videos in public places) to keep population informed and advise about prevention strategies. Announcements included messages on regular handwashing, when, where and how to use masks, danger of saving masks to prevent them from becoming unavailable to frontline health workers.

→ South Korea used alert system to inform public on COVID-19 cases in certain areas. The messages identify where the patient had been prior to detection and at what time; they urge anyone who might have crossed paths with the individual to get tested immediately.

→ In Singapore, announcement of upgrading the alert level in the country resulted panic among the population, that was effectively managed by the Prime Minister's personal engagement. In

Taiwan the vice president, a prominent epidemiologist, was personally involved in communication with the public. (2, 22, Wong, Lee).

Economic response

→ In Singapore the government offers self-employed people $100 Singapore dollars (USD 73) per day, or to the employers if the patient is salaried, while employers are prohibited from detracting quarantine days from staffers' annual leave. The center for epidemics in Taiwan took an active role in resource allocation, including setting the price of masks and using government funds and military personnel to increase mask production. South Korea leader pledged $25 billion to deal with the crisis in the country.

Health System preparedness

Health Workers safety

- Infection control measures
    - Restricting health care workers from working if they have any upper respiratory tract symptoms, even in the absence of fever (Klompas, 2020)
    - Regular open staff forums along with face-to-face education sessions to provide "right-on-time" infection control updates and address staff concerns
    - Use of PPE among HCWs in performing aerosol generating procedures (AGPs) even though for caring patients without clinical features and epidemiological exposure risk in the general wards. Performance of AGPs such as endotracheal intubation, open suctioning, and use of high flow oxygen had been shown to be associated with the risk factors for nosocomial transmission of SARS-CoV among HCWs (60% of transmission)
    - Regular hand hygiene compliance assessments in the hospitals
    - Provision of surgical mask to all HCWs, patients, and visitors in clinical areas
    - Keeping 1 meter spacing between patients.
- Protection of first line HCW
- Special safety considerations for ICU staff involved in airway management
    - Use of infection isolation rooms
    - If infection isolation rooms are not available avoid non-invasive ventilation and high-flow-ventilation (47), this has **implication on number of ventilators needed** and should be considered during ventilators projections.

Triage

- China example (see Picture 1 for management plan):
    - Free online clinic working around the clock to facilitate the patient triage. Through free online consultation, the hospital preliminarily judged the treatment urgency, recommended non-emergency patients to delay hospital appointments or visit other non-anti-epidemic hospitals, **provided low-suspected patients treatment instruction when self-isolating at home, invited high-suspected patients to the designate hospital.** The online clinic effectively alleviated the hospital workload and facilitated early detection of potential cases. (China)
    - The assigned personnel at the emergency department (ED) conducted pre-examination and triage to divide visits into low-suspected, high-suspected, and other patients, and required different patients to follow the specified routines to enter ED and separate the intra-ED space into high-risk and low-risk regions. For suspected cases, the hospital assigned an independent Fever Clinic Room, Fever Observation Room, and CT Examination Room. Cases confirmed through qRT-PCR and/or CT were transferred to Quarantine Ward while excluded patients went to other departments or back home. The ED region separation triage system reduced the cross-infection by restricting the activity ranges of both patients and ED personnel.

- ○ ED requirement had the highest priority. The hospital established a capable command system, implemented effective coordination mechanisms, provided the ED with PPE and medical devices preferentially, equipped the triage and high-risk-region personnel with standardized personal protection, withdrew or postponed non-urgent appointments and operations, and dispatched aid personnel from other departments to ED. These measures concentrated the limited supply through the hospital on the staff who mostly needed protection.
- Other examples

  - ○ Hotline working 24 hours for advising patients on disease management, **identifying high-risk patients and referring them to designated facilities.** (South Korea)

  - ○ **Positive asymptomatic or mild cases placed in self-quarantine and monitored remotely through a smartphone app or checked regularly in telephone calls**. (South Korea)

  - ○ **Treating of patients with mild symptoms in residential centers or at home until a hospital bed becomes available**. When a bed is available, an ambulance picks the person up and takes the patient to a hospital with air-sealed isolation rooms. (South Korea)

  - ○ 1) Screening all visitors for any respiratory symptoms that may be related to a virus, including fever, myalgias, pharyngitis, rhinorrhea, and cough, and excluding them from visiting until they are better; 2) **restricting health care workers from working if they have any upper respiratory tract symptoms, even in the absence of fever;** and 3) **screening all patients,** in those with positive screening results regardless of illness severity, using precautions (single rooms, contact precautions, droplet precautions, and eye protection) and for patients with respiratory syndromes for the duration of their symptoms regardless of viral test results. (Klompas, 2020)

Economic challenges

There is economic burden associated with suppression of the epidemic. China and South Korea, Taiwan experience shows that suppression is possible in the short term, whether it will possible in the long run time will show (Ferguson et al., 2020).

Annexes

Annex 1. Methodology

What is a Rapid Response Product

A Rapid Response product responds to requests from policymakers and stakeholders by summarizing the research evidence drawn from systematic reviews and from primary research studies and provides them access to optimally packaged, relevant and best available research evidence.

The preparation of this rapid response involved the following steps:

1. Formulating a clear review question on a high priority topic requested by policymakers and stakeholders;

2. Establishing what is to be done, and in what timeline;

3. Identifying, selecting, appraising and synthesizing the relevant research evidence about the question;

4. Drafting the Rapid Response in such a way that the research evidence is presented concisely and in accessible language;

5. Submitting the Rapid Response for Peer/Merit Reviews;

6. Finalizing the Rapid Response based on the input of the peer/merit reviewers; and

7. Final submission, validation, and dissemination of the Rapid Response

Evidence search and studies selection

Country selection was based on the following criteria: Closeness to China and thus being especially vulnerable to the spread of infection, greater reduction in transmission shown by ability to contain the spread after 100th case, longer and flattered epidemic curve.

A search was performed using the PubMed and Google. Key terms used for search was COVID-19 AND country. The search was performed on 16th of March. PubMed search yielded in 37 studies and other resources for all four countries. The titles of these resources were scanned and relevant abstracts were retrieved (13). In Google search titles of first 30 hints for each country were scanned and 23 papers, web resources, newspapers, blogs, stories, reports and guidelines from Ministry of Health web page were retrieved.

For data abstraction we used a framework based on the critical preparedness, readiness and response actions for COVID-19 (WHO, 2020b).

We expanded our search to complement data on health system's preparedness (triage, hospital management and infection control strategies) from other countries experiences.
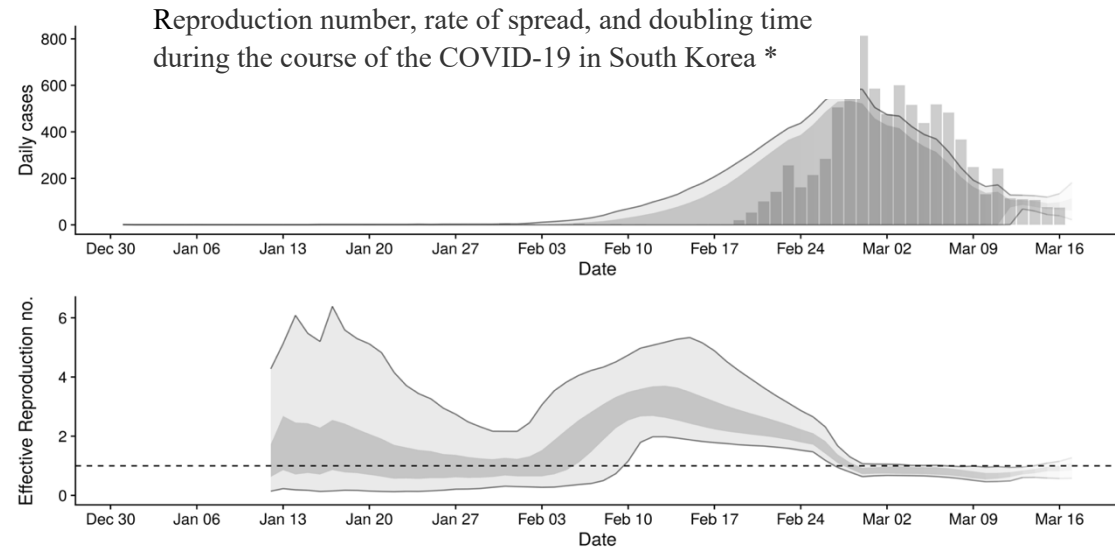
Annex 2 Country examples

South Korea experience

Short overview: East Asian nation on the southern half of the Korean Peninsula with 51.47 mln population.

First case of COVID-19 diagnosed in January 20. After that, suddenly, South Korea's coronavirus cases multiplied 180-fold in a two-week span. At its peak, medical experts were diagnosing more than 900 new cases a day, making South Korea the second-largest outbreak in the world. Although soon after South Korea managed to slow down the epidemic.

Reproduction number, rate of spread, and doubling time during the course of the COVID-19 in South Korea *

A. Cases by date of report (bars) and estimated cases by date of onset. B. Time-varying estimate of the effective reproduction number. Light grey ribbon = 95% CI. Dark grey ribbon =IQR. Based on data from the 2020-03-17. Confidence in the estimated values is indicated by shading with reduced shading corresponding to reduced confidence.

Measures	Note	Description
Emergency response mechanisms	Includes country level coordination	The country has entered a war against the infectious disease. The leader has ordered all state agencies to operate around the clock and pledged $25 billion to deal with the crisis (Strother, 2020).
Risk communication and public engagement		In stark contrast to China's hard-handed tactics, such as locking down entire cities and tightly controlling the dissemination of information about the disease, Korea has adopted a gentler policy of voluntary containment and keeping citizens updated on its efforts in near real-time (Strother, 2020). Communication campaign included: • **Official emergency alert**s on citizens cellphone every time a new coronavirus case is reported in certain area. The **messages** identify where the patient had been prior to detection and at what time; they urge anyone who might have crossed paths with the individual to get tested immediately.

Measures	Note	Description
		• The KCDC has opened a coronavirus hotline, holds **daily televised press conferences** and offers personal hygiene advice that plays on a loop on many buses and in subway stations in Seoul. Announcement says: "When taking public transportation, please wear a mask, please make it a habit of washing your hands frequently, when you cough please block your mouth and nose."
Case finding, contact tracing and management	Active case finding, contact tracing and monitoring, quarantine of contact and isolation	• The epicenter of the South Korean COVID-19 outbreak has been identified in Daegu, a city of 2.5 million people, approximately 150 miles South East of Seoul. The rapid spread of COVID-19 in South Korea has been attributed to one case linked to a superspreading event that has led to more than 3,900 secondary cases stemming from church services in the city of Daegu (55% of confirmed cases are linked to this cluster of infections). Three other clusters have been reported including one set in Chundo Daenam hospital in Chungdo-gun, (118 cases), one set in the gym in Cheonan, (92 cases), and one Pilgrimage to Israel cluster (49 cases). These few clusters have become the major driving force of the infection (Shim et al., 2020) • According Enhanced the 2019-nCoV quarantine guideline in Republic of Korea, those who has 'routine contacts' with confirmed cases regardless of the times requires a mandatory period of 14 days of self-quarantine (KCDC, 2020) o Local government officials are in charge of managing the people who are self-quarantine as 1:1 system. Central government will provide the proper information of contacts into local government so that they can take proactive action and cooperation. • South Korea uses **novel methods for contact tracing** to overcome recall and confirmation biases that can occur while determining the location of the contact that are **checking medical facilities records, phone-based global positioning system (GPS), card transaction records, and closed-circuit television (CCTV)**. Government authorities can then make some of this public, so anyone who may have been exposed can get themselves - or their friends and family members – tested (COVID-19 National Emergency Response Center Epidemiology & Case Management Team KCDC, 2020; Parodi et al., n.d.) 1. **History of using medical facilities and visiting pharmacies -** History of using medical facilities, and visiting pharmacies was used to estimate the window of time of infection, through an accurate evaluation of the clinical symptoms of the infectious disease, and initial onset of the symptoms. If a medical facility was included in the patient's route quarantine of the medical facility was conducted. 2. **GPS –** In addition to the interviews, identification of the routes that the patient could not remember was also possible. GPS uses cellular phone networks, therefore there are limitations in identifying the exact locations of a patient's route.

COVID-19 ეპიდემია საქართველოში
პროგნოზი და პოლიტიკის შეთავაზებები

Measures	Note	Description
		3. **Credit card transaction log -** Credit card transaction logs were used to assess the consistency in the route of the patient identified through interview, and the scope of contacts was assessed by specifying the locations visited. 4. **CCTV -** By checking the video footage of the location of a patient's path, CCTV provided help to identify the details of each situation. For example, CCTV was used to evaluate the level of exposure risk by identifying whether the patient wore masks or had respiratory symptoms such as a cough. • In South Korea, authorities have a different response to a similar-sized outbreak. They are testing hundreds of thousands of people for infections and **tracking potential carriers like detectives, using cell phone and satellite technology** (Parodi et al., n.d.)

Surveillance	Surveillance using existing resp disease surveillance systems and hosp. based surveillance	• South Korea applied **mass testing free of charge for its population** through improved public communications and the use of technology (Kuhn, 2020; Parodi et al., n.d.; Thompson, 2020).
		• Creative measures, including about **50 drive-through testing stations across the country**, where it takes only 10 minutes to go through the whole procedure. Test results are available within hours.
		   1. Test center consists of four trailerlike offices with white canopies in front. Doctors in full protective suits and goggles take the driver's temperature with an infrared thermometer and hand out a questionnaire to fill out. If you're running a fever and, in the doctor's opinion, may be at risk based on where you've been or whom you've contacted, you're eligible for a test. **Only the driver is tested — passengers are not.**
		   2. **Drivers advised to hit the recirculation button** so that if they are sick, they can keep their pathogens to themselves, in their car, and avoid infecting the medical personnel doing the testing.
		• This testing capability has enabled the country to identify patients early and minimize the harmful effects, health experts say. But this also led to South Korea having the second largest number of confirmed infections in the world after China, although this was superseded by Italy this week.
		• **It's much better to test and then quarantine a specific person** than to do a citywide or provincewide lockdown, which in certain ways prevents the virus from leaving the province but actually doesn't make the province any less likely to have high infection rates. Although, it requires **years of investment in complex health care infrastructure, including lab hardware and technicians to analyze samples, logistics for moving goods and providing services and information technology to keep supplies and data moving**. Any bottleneck or shortage of these elements can cost time and lead to more infections and deaths (Kuhn, 2020).

Measures	Note	Description
		• The problem is that "in South Korea, private institutions account for 90% of the medical system, and 90% of our testing capacity," especially laboratories to analyze samples. "So, we needed the support of the private sector." Now, **public and private sectors cooperate more efficiently**, having come together in voluntary collaboration. And the KCDC reorganized to respond more effectively to epidemics, including a branch specifically in charge of testing and diagnosing infectious diseases (Kuhn, 2020). o In the battle to contain the contagion, these labs have become the front line. South Korea has created a network of 96 public and private laboratories to test for coronavirus (Bicker, 2020)

Public health measures	Hand hygiene, resp etiquettes, social distancing	• Although China introduced strict social distancing and extensive monitoring of citizens South Korea applied gentle distancing policy. Without harming the principle of a transparent and open society a **response system that blends voluntary public participation** with creative applications of advanced technology was introduced (Park & Power, 2020)
		 • Dealing with the threat of coronavirus is the new norma (Bicker, 2020)l:
		   o Most people wear masks (if they can get hold of one).
		   o There are thermal imaging cameras in the entrances to major buildings.
		   o Bottles of hand sanitisers have been placed in lifts. There are even people dressed in costumes at subway entrances reminding you to wash your hands.
		 • Although some experts emphasize that South Korea's response is not perfect. South Korea does not have enough protective masks - it has started rationing them - and it is trying to hire more trained staff to process tests and map cases. **When testing in a country is limited, he said, the authorities have to take bolder actions to limit movement of people**. (Parodi et al., n.d.)

Case Management	Treatment
	
	Ready hospitals for surge, triage procedures
		• In addition to helping work out who to test, South Korea's data-driven system helps hospitals manage their pipeline of cases. People found positive are placed in self-quarantine and monitored remotely through a smartphone app, or checked regularly in telephone calls, until a hospital bed becomes available. When **a bed is available, an ambulance picks the person up and takes the patient to a hospital with air-sealed isolation room**s. All of this, including hospitalization, is free of charge. (Parodi et al., n.d.)
		 • Although there have been **missteps** too (Bicker, 2020):
		   o At least two patients died waiting for a hospital bed in Daegu, the worst affected city. The initial reaction was to quarantine everyone infected with the virus in a hospital bed, but now the doctors have learned to treat those with mild symptoms in residential centres and leave the clinical beds for those needing critical care.
		   o "We can't quarantine and treat all patients. Those who have mild symptoms should stay home and get treated."

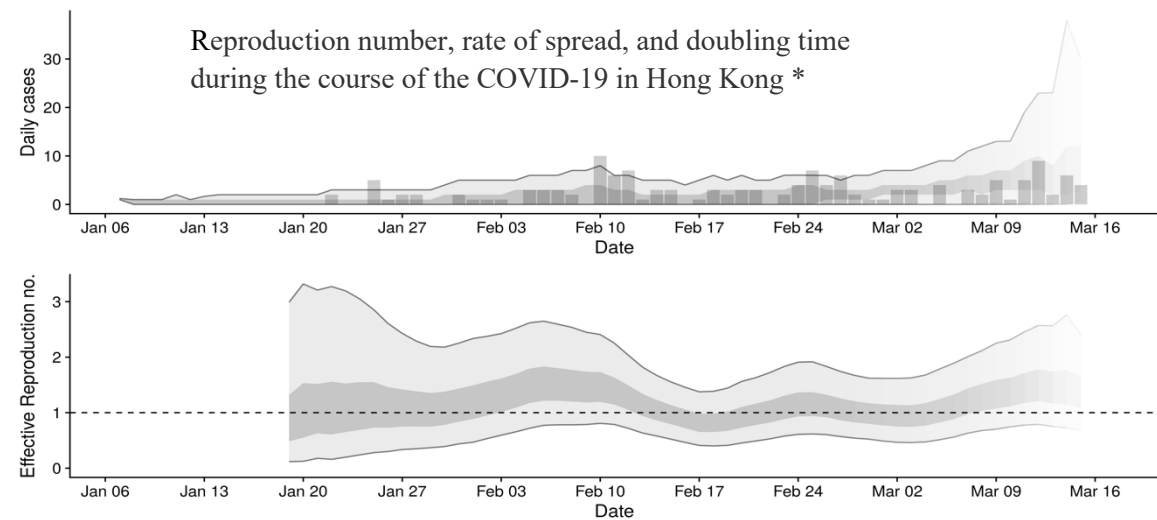| Measures	Note	Description
		o "We should change our end goal strategy to lower death rates. So other countries like Italy, that see huge numbers in patients, should also change their strategies as well."
Other note	Lab testing	• A **novel protocol was developed to be used as a primary screening platform for asymptomatic people to be tested for a real negative using** a real-time reverse-transcription PCR (rtPCR)-based assay composed of easy specimen self-collection from a subject via pharyngeal swab, Trizolbased RNA purification, and SYBR Green-based rtPCR**.** This protocol shows an accuracy and sensitivity limit of 1-10 virus particles as we tested with a known lentivirus. **The cost for each sample is estimated to be less than 15 US dollars. Overall time it takes for an entire protocol is estimated to be less than 4 hours.** We propose a cost-effective, quick-and-easy method for early detection of SARS-CoV-2 at any conventional Biosafety Level II laboratories that are equipped with a rtPCR machine (Won et al., 2020). • However, **the results should not be considered as a clinical diagnosis, which requires medical expertise and staff for proper diagnosis.** Those who already show obvious symptoms of COVID-19 should not rely on our detection protocol, but resort to certified hospital and health agencies. Our protocol should be useful when the purpose of the testing is to identify the negative people, who need to work, study, and sport normally (Won et al., 2020)
	Lessons learnt from previous outbreaks	• South Korea learned the risk of new infection and its ramifications from the experience of the Middle East Respiratory syndrome (Mers) back in 2015. To learn from the past and prepare systems in advance. that might be the true power to overcome this new kind of disaster (Bicker, 2020)

Hong Kong experience

Short overview: Sharing border with China, Hong Kong has a population 7.3 mln.

First case diagnosed January 23. As of As of March 20, 2020, Hong Kong had 256 confirmed cases including 4 deaths.

Reproduction number, rate of spread, and doubling time during the course of the COVID-19 in Hong Kong *

* A. Cases by date of report (bars) and estimated cases by date of onset. B. Time-varying estimate of the effective reproduction number. Light grey ribbon = 95% CI. Dark grey ribbon =IQR. Based on data from the 2020-03-17. Confidence in the estimated values is indicated by shading with reduced shading corresponding to reduced confidence.

Measures	Note	Description
Emergency response mechanisms	Includes country level coordination	Singapore and Hong Kong began inter-ministerial coordination within the first week of the COVID-19 outbreak. Intragovernmental coordination was improved because health authorities drew on their experiences of severe acute respiratory syndrome during, H5N1 avian influenza and H1N1 pandemic (Legido-Quigley et al., 2020)
Risk communication and public engagement		• All direct costs for treating patients are borne by the governments. • The key measures include a bundle of early recognition, isolation, notification, and molecular diagnostic for all suspected cases (Barron, 2020) • The Chief Executive, Mrs. Carrie Lim has convened the Steering Committee cum Command Center to tackle the COVID-19 situation that resulted in a decision to implement disease prevention and control measures including the following: Travel restrictions between the Mainland and Hong Kong, urging people to stay home for 14 days who have come from highly affected areas, giving advises to those who need to go out to use surgical masks for 14 days, identifying centers for quarantine, conducting worldwide procurement of surgical masks and other materials in order to ensure adequate supplies for tackling the disease (HKSR, 2020)

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Measures	Note	Description
Case finding, contact tracing and management	Active case finding, contact tracing and monitoring, quarantine of contact and isolation	• Hong Kong along with Taiwan and Singapore had all proactively implemented travel restrictions on passengers coming from the mainland, contravening the World Health Organization's [WHO] insistence that travel bans were not necessary (Cowling & Lim, 2020) • Quickly set up systems to try to identify and treat every case in their territory (Beaubien, 2020). Self-quarantine for 14 days for those who have been in China in the preceding 14 days (Cowling & Lim, 2020) • Holiday camps and newly constructed public-housing units that were still vacant were rapidly repurposed into quarantine facilities (Cowling & Lim, 2020) • Hong Kong developed **diagnostic tests and rapidly deployed them to labs at every major hospital** in the city (Beaubien, 2020) • All suspected cases were isolated in airborne infection isolation room (AIIR) for contact, droplet, and airborne precautions. Suspected cases were notified to Centre for Health Protection, Department of Health, and Hospital Authority (Cheng et al., 2020) • Use electronic wristbands to enforce quarantines and reduce the spread of the new coronavirus. Putting all arriving passengers under a two-week quarantine and medical surveillance (Saiidi, 2020) • Hong Kong declared a state of emergency on 25th of January, 2020 in response to growing concern over the spread of a coronavirus, announcing it will close schools for three weeks and impose a limited transportation ban (Kim, 2020)
Surveillance	Surveillance using existing resp disease surveillance systems and hosp. based surveillance	• Initially, only pneumonia patients without a microbiological diagnoses were tested, later surveillance has been broadened to include all inpatients with pneumonia and a purposively sampled proportion of outpatients and emergency attendees totaling about 1500 per day (Legido-Quigley et al., 2020) • Progressively stepped up infection control measures by **widening the clinical and epidemiological criteria of surveillance for early recognition and isolation of index case according to the evolving of epidemic** (Barron, 2020; Wang, Ng, & Brook, 2020)
Public health measures	incl hand hygiene, resp etiquettes, social distancing	• **Social distancing** was put into practice quickly. Schools remain closed through Easter. Normally bustling shopping streets, residents voluntarily stay at home. Many businesses and have either shuttered or asked employees to work from home, similarly civil servants were asked to work from home for the following month. Movie theaters, churches and basketball courts sit empty. Mass gatherings are canceled (Cao et al., 2020; Cowling & Lim, 2020)
Case Management	Treatment	• With total 40,000 hospital beds, some 1,000 are negative-pressure beds, allowing confirmed cases to be properly isolated (Cowling & Lim, 2020)

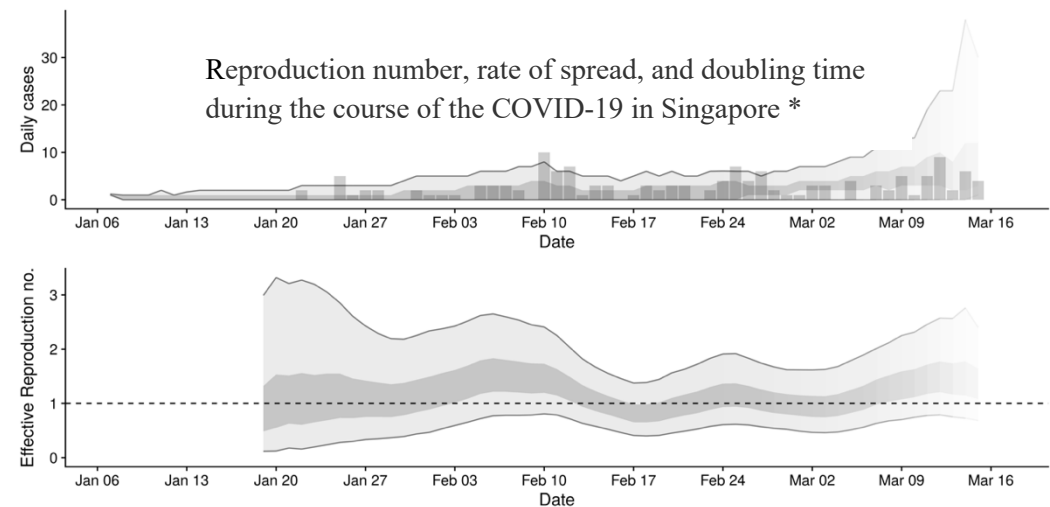| Measures	Note	Description
	Ready hospitals for surge, triage procedures	• Some practical suggestions for staff safety during emergency management of patients: All aerosol-generating procedures should be done in an airborne infection isolation room. Double-gloving might provide extra protection, Airway devices providing 6 L/min or more of oxygen are considered high- flow and is discourage use if an airborne infection isolation room is unavailable (Cheung, Ho, Cheng, Cham, & Lam, 2020)In Hong Kong, hospital supplies are running low but have not yet impacted clinical management (Legido-Quigley et al., 2020)
Infection prevention and control (IPC)	Staff training in IPC and clinical management	• With reference to experience in the outbreak of COVID19, almost 60% of nosocomial acquisition of a virus was HCWs, it is critically important to implement a proactive infection control measures, which must be planning ahead (Cheng et al., 2020) • Enhanced infection control measures with clearly illustration of the choice of **personal protective equipment (PPE)** were enforced. Regular open staff forums were held along with face-to-face education sessions to provide "right-on-time" infection control updates and address staff concern, if any. Practical training sessions of using PPE were performed by hospital infection control team. Hand hygiene compliance assessments were conducted regularly in our hospitals (Cheng et al., 2020) • Infection control measures were enhanced by implementation of standard, contact, droplets, and airborne precautions for suspected or confirmed cases. PPE was used among HCWs in performing **aerosol generating procedures (AGPs)** even though for caring patients without clinical features and epidemiological exposure risk in the general wards. Performance of AGPs such as endotracheal intubation, open suctioning, and use of high flow oxygen had been shown to be associated with the risk factors for nosocomial transmission of SARS-CoV among HCWs. • In addition, provision of surgical mask to all HCWs, patients, and visitors in clinical areas was implemented since day 5. Although wearing surgical mask alone was not clearly associated with protection of person from acquisition of SARS-CoV, wearing surgical mask by either HCWs or patients had shown to reduce the risk of nosocomial transmission of influenza pandemic. Hand hygiene among HCWs and patients were promoted and enforced. With these measures, there was zero nosocomial transmission of virus since the importation of first confirmed case since day 22 in Hong Kong(Cheng et al., 2020) • Vigilance in hand hygiene practice, wearing of surgical mask in the hospital, and appropriate use of PPE in patient care, especially performing AGPs are the key infection control measures to prevent nosocomial transmission of SARS-CoV-2 even before the availability of effective antiviral agents and vaccine (Cheng et al., 2020) • Patient were cared in a ward with 1 meter spacing between patients (Cheng et al., 2020)
Other note	Lessons learnt from previous outbreaks	• Despite mistrust of the government, which runs deep after nine months of often violent street demonstrations, faith in the public health system—one of the world's best—remains intact (Barron, 2020)
		• Hong Kong and Taiwan have been hailed for using those hard-won lessons to combat the new coronavirus—officially COVID-19 and a relative of SARS (Barron, 2020)

Singapore experience

Short overview: Singapore is an independent city-state 3400 km (2125 miles) from Wuhan, but as a major air hub had an average of 330 000 visitor arrivals from China each month in 2019. Of the five million people who left Hubei before Chinese New Year, over 10,000 flew to Singapore.

First case diagnosed January 23. As of Mar. 20, the city-state had 385 cases and zero deaths.

Reproduction number, rate of spread, and doubling time during the course of the COVID-19 in Singapore *

* A. Cases by date of report (bars) and estimated cases by date of onset. B. Time-varying estimate of the effective reproduction number. Light grey ribbon = 95% CI. Dark grey ribbon =IQR. Based on data from the 2020-03-17. Confidence in the estimated values is indicated by shading with reduced shading corresponding to reduced confidence.

Measures	Note	Description
Emergency response mechanisms	Includes country level coordination	• Singapore promptly shifted its public health response level to "enhanced preparedness" (Wong, Leo, & Tan, 2020) • Ministerial press conferences. Whole-of-nation response measures both pre-planned and innovated, were put in place across government, public and private organizations, and communities and residences (Lewis & Yap, 2020) • Singapore and Hong Kong began inter-ministerial coordination within the first week of the COVID-19 outbreak. Intragovernmental coordination was improved because health authorities drew on their experiences of severe acute respiratory syndrome during, H5N1 avian influenza and H1N1 pandemic (Legido-Quigley et al., 2020)
Risk communication and public engagement		• Traditional communication channels are inadequate. Singapore has been utilizing print, broadcast, websites, and social messaging platforms such as WhatsApp, Twitter, Telegram, and Facebook on a daily basis since the first imported case was identified to keep the population informed and advised about what to do to reduce the risk of infection (Wong et al., 2020) • Public education includes messages on regular handwashing and seeking medical treatment early and staying at home when unwell. The use of masks was only encouraged for ill persons to prevent them from infecting others. The government distributed four masks to every household (Lee, Chiew, & Khong, 2020)

Measures	Note	Description
		• Daily updates from the Ministry of Health and advisories across all sectors. • Parallel messaging through non-tech platforms (e.g. cartoons, print-media, posters). • Rebuttal of fake news (Lewis & Yap, 2020). The ministry of health website along daily updates provides clarification on misinformation • Active engagement of many specific groups ranging from health care professionals to taxi drivers through conventional approaches as well as through social media and town hall meetings (Wong et al., 2020) • The prime minister's personal engagement with the public, his speech after the government announced its outbreak alert that resulted in panic was vital (Barron, 2020) • Assurance that all health care related to the disease would be free (Beaubien, 2020) • Live forum of experts that included open discussion with questions from the public (Lee, Gan, Soon, & Jeyakumar, 2020)
Case finding, contact tracing and management	Active case finding, contact tracing and monitoring, quarantine of contact and isolation	• Singapore, along with Taiwan and Hong Kong proactively implemented travel restrictions on passengers coming from the mainland, contravening the World Health Organization's [WHO] insistence that travel bans were not necessary (Barron, 2020) • On January 3, started temperature screening at its airport of all travelers arriving from Wuhan. • The range of public health measures that were instituted and rapidly escalated included aggressive contact tracing and quarantine of close contacts of confirmed cases (namely persons who had spent a prolonged period within 2 m of a confirmed case), travel advisories and then entry restrictions on people traveling from Hubei, and on January 31, entry restrictions on people who had traveled to China in the preceding 14 days. • Returners from China were placed under a 14-day compulsory leave of absence from work • All confirmed cases are isolated until 2 consecutive respiratory samples for RT-PCR become negative over 2 days. • Close contacts are identified and those individuals without symptoms are quarantined for 14 days from last exposure (Wong et al., 2020) • Contact tracing of cases and their contacts, mobilizing not only Ministry of Health staff but also members of the police and other partners (Lewis & Yap, 2020). Hunting down every possible contact of those infected. The process, which operates 24/7, starts with patient interviews, and has also involved police, flight manifests and a locally developed a test for antibodies, which linger even after an infection clears (Barron, 2020) • Mass fever screening through thermal temperature scanners is widely instituted at entry to public buildings, such as offices, hotels, community centres and places of worship (Lee, Chiew, et al., 2020) • Singapore detects almost three times more cases than the global average due to its strong disease surveillance and fastidious contact tracing (Niehus, Salazar, Taylor, & Lipsitch, 2020)

Measures	Note	Description
		• Anyone flouting the quarantine for the first time may be fined up to $10,000 (7.300 USD), jailed up to six months, or both. The penalty is higher for subsequent breaches.
Surveillance	Surveillance using existing resp disease surveillance systems and hosp. based surveillance	• On January 2, 2020 (on the third day after China informed the WHO of a novel virus) Singapore's Ministry of Health alerted all physicians to identify any patient with pneumonia and a recent travel history to Wuhan (Wong et al., 2020) • On January 2, 2020, days after the first report of the disease from China, the MoH developed a local case definition and advised all physicians to be vigilant for suspected COVID-19. The case definition was updated five times (Ng et al., 2020) • An enhanced surveillance system was set up to detect COVID-19 among all cases of pneumonia in hospital and primary care, severely-ill patients in hospital intensive care units and deaths with possible infectious cause, influenza-like illness (ILI) in sentinel primary care clinics. Finally, doctors were also allowed to test patients whom they viewed with suspicion for clinical or epidemiological reasons (Barron, 2020; Jombart et al., 2020; Lewis & Yap, 2020) • Physicians are mandated to report all suspected and confirmed COVID-19 patients through a centralized disease notification system (Ng et al., 2020) • After an initial increase in locally transmitted cases, the number of newly identified cases decreased after approximately 1 month, determined by symptom onset dates. This decrease is likely a result of the early implementation of surveillance and detection measures while the numbers of patients were still small and individual-level containment was possible; a larger number of cases would have driven community transmission. Singapore had highest surveillance capacity among all other countries. If other countries had similar detection capacities, the global number of imported cases detected would be 2.8 times higher than the observed current number (Ng et al., 2020)
Public health measures	incl hand hygiene, resp etiquettes, social distancing	• Daily messages to the public from a government WhatsApp group and constant messaging on handwashing and what to do if unwell. • Singapore has not implemented school closures or other major social distancing measures, as there is no evidence of widespread community transmission, and rates of COVID-19 infection among children remain low (Lee, Chiew, et al., 2020). Precautionary measures such as reducing mixing across classes or schools have been implemented to limit possible disease transmission (Ng et al., 2020) • All ticketed cultural, sports and entertainment events, with 250 participants or more, were cancelled. For all other mass gatherings including private functions and religious services, organisers were advised to put in place the following precautions: Reduce the scale of events to below 250 participants where possible; Reduce the crowding of participants and improve ventilation. Put in place temperature and health screening measures, as well as turn away persons who are

Measures	Note	Description
		unwell; and put in place measures to facilitate contact tracing if needed, such as obtaining contact details of participants (MoH Singapore, 2020)
Case Management	Treatment Ready hospitals for surge, triage procedures	• A network of more than 800 Public Health Preparedness Clinics (PHPCs) was activated to enhance management of respiratory infections in the primary care setting, with subsidies extended to Singapore residents to incentivize them to seek care at these PHPCs. As early COVID-19 disease is mild and undifferentiated, medical practitioners were instructed to provide extended medical leave of up to five days for patients with respiratory symptoms. This allowed possible COVID-19 cases to self-isolate at home to reduce the number of undetected cases seeding community transmission. Those with persistent or worsening symptoms are advised to return to the same doctor for evaluation and referral for testing. **Movement of patients and doctors between healthcare institutions was also limited to prevent multiple institutions from being affected at the same time** (Lee, Chiew, et al., 2020) • Although published reports to date have identified preexisting chronic noncommunicable diseases as being a risk factor for clinical deterioration, the experience to date in Singapore is that patients without significant comorbid conditions can also develop severe illness (Wong et al., 2020) • Most of ICU beds were single rooms (infrastructure after 2003 SARS) • Infection control not only involved strict adherence to personal protective equipment for the individual, but also involved **changes in group dynamics -** avoiding potential spread between teams (Liew et al., 2020) • Train non-ICU acute medical staff dealing with critically ill patients prior to ICU admission, especially for resuscitation (Liew et al., 2020) • ECMO use. Prepared cohort of all COVID-19 patients in the ICU and have a satellite team to help in management (Liew et al., 2020) • **Staff morale took an early hit due to multiple factors,** including increased workload due to implementation of strict infection control measures, **uncertainty over the effectiveness of personal protective equipment,** anxiety over the lethality of any infection, concern for the well-being of their family members (Liew et al., 2020)
Societal response	Development of all-of-society & business continuity plans	• To make quarantine less onerous, the government offers self-employed people $100 Singapore dollars ($73) per day. The money goes to their employers if they are salaried while employers are prohibited from detracting quarantine days from staffers' annual leave. This allowance is not given to tourists.
Other note	Lessons learnt from previous outbreaks	• Since its **experience with the SARS** outbreak in 2003 when 238 people were infected, including several health care professionals, and 33 patients died, Singapore has been systematically **strengthening its ability to manage another emerging infectious disease outbreak**. These include the construction of a new purpose-built National Centre for Infectious Diseases (a 330-bed purpose built infectious diseases management facility) and National Public Health Laboratory; scaled up of testing capacity rapidly covering to all public hospitals in Singapore, that is able to handle

Measures	Note	Description
		2,200 tests a day for a population of 5.7m; significant expansion in the number of negative-pressure isolation beds throughout the public hospital system; stockpiling of personal protective equipment (PPE) and masks; establishment of formal platforms for multi-Ministry and cross-agency coordination; development of a strong capability to perform contact tracing quickly and at scale; training of health professionals including in the correct use of PPE; and building more biosafety level 3 laboratories. In addition, as part of Singapore's major investments in biomedical science and clinical research and translation capabilities, a significant focus has been placed on building expertise in infectious diseases (Wong et al., 2020) • Singapore's response may not be directly translatable elsewhere. Since independence in 1965, it has been ruled by a single party that maintains tight control and is rarely subject to public criticism. Amid the coronavirus outbreak, quarantine and isolation protocols are strictly enforced (Barron, 2020) • However, **several challenges** lie ahead. Firstly, the longer the outbreak persists, the more chains of community transmission and missed cases are present, and the **more difficult it will be to link cases and contain spread**. Contact tracing and quarantine are **resource-intensive activities and may not be sustainable in the long run**. Secondly, some individuals who continue to work or attend social functions while symptomatic are driving disease spread, leading to substantial community transmission. Thirdly, with global spread, the force of infection from imported cases will be substantial, leading to new waves of infection (Lee, Chiew, et al., 2020)

Taiwan experience

Short overview: An island of 23 million, Taiwan had 2.7 mln visitors from China in 2019. First case diagnosed January 20. As of March 20, 135 cases and 2 death cases.

| Measures	Note	Description
Emergency response mechanisms	Includes country level coordination	• Following SARS in 2003, Taiwan established a central command center for epidemics. By Jan. 20, it was coordinating the government's response to the coronavirus. It quickly compiled a list of 124 "action items," including border controls, school and work policies, public communication plans and resource assessments of hospitals (Barron, 2020; Wang et al., 2020) • The center for epidemics took an active role in resource allocation, including setting the price of masks and using government funds and military personnel to increase mask production (Barron, 2020)
Risk communication and public engagement		• The vice president of Taiwan, a prominent epidemiologist, gave regular public service announcements broadcast from the office of the president and made available via the internet. These announcements included when and where to wear a mask, the importance of handwashing, and the danger of hoarding masks to prevent them from becoming unavailable to frontline health workers (Wang et al., 2020) • The government was able to reassure the public by delivering timely, accurate, and transparent information regarding the evolving epidemic (Wang et al., 2020). The press-conferences were held daily, sometimes more than once a day (Piper, 2020) • Could be established an alert system to inform public on cases in certain areas, so if someone visited or lives in that area will be alerted and in case of symptoms inform health official, not visiting facility to spread the disease (Piper, 2020)
Case finding, contact tracing and management	Active case finding, contact tracing and monitoring, quarantine of contact and isolation	• Taiwan, along with Hong Kong, and Singapore had all proactively implemented travel restrictions on passengers coming from the mainland, contravening the World Health Organization's [WHO] insistence that travel bans were not necessary (Barron, 2020) • Right after China announced about unknown virus arrivals from Wuhan were subject to health screenings (Barron, 2020). Within a week, they expanded their surveillance net to include anyone who had traveled to Wuhan in the previous two weeks (Sternberg, 2020) • Leveraged its national health insurance database and integrated it with its immigration and customs database to begin the creation of big data for analytics. It generated real-time alerts during a clinical visit based on travel history and clinical symptoms to aid case identification. It also used new technology, including QR code scanning and online reporting of travel history and health symptoms to classify travelers' infectious risks based on flight origin and travel history in the past 14 days. Persons with low risk (no travel to level 3 alert areas) were sent a health declaration border pass via SMS (short message service) messaging to their phones for faster immigration clearance; those with higher risk (recent travel

Measures	Note	Description
		to level 3 alert areas) were quarantined at home and tracked through their mobile phone and gov issued cell phones to ensure that they remained at home during the incubation period (Wang et al., 2020) • Citizens' household registration system and the foreigners' entry card allowed the government to track individuals at high risk because of recent travel history in affected areas (Wang et al., 2020) • The toll-free number 1922 served as a hotline for citizens to report suspicious symptoms or cases in themselves or others; as the disease progressed, this hotline has reached full capacity, so each major city was asked to create its own hotline as an alternative (Wang et al., 2020) • The government addressed the issue of disease stigma and compassion for those affected by providing food, frequent health checks, and encouragement for those under quarantine(Wang et al., 2020) • To ensure compliance, the government has enforced strict penalties against anyone who breaks an isolation order, including fines up to about $33,200 (Cowling & Lim, 2020) • People leave close to each other in Asia, that makes it easier and faster to track contacts (Piper, 2020)
Surveillance	Surveillance using existing resp disease surveillance systems and hosp. based surveillance	• Enhanced COVID-19 case finding by proactively seeking out patients with severe respiratory symptoms (based on information from the National Health Insurance [NHI] database) who had tested negative for influenza and retested them for COVID-19; 1 was found of 113 cases.
Public health measures	incl hand hygiene, resp etiquettes, social distancing	• In Taiwan schools the students do not disperse and rotate from class to class. Instead the teachers rotate. (If students travel from class to class (like in US) if one student gets sick the whole school is infected). Therefore, according to the action plan when a student gets sick, school administrators can cancel the class. If two students in a school get sick, the school closes down. If a third of the schools in the community are closed, all the schools shut down (Sternberg, 2020) • Organizers of mass events were encouraged to defer or cancel events; some religious institutions suspended services (Cowling & Lim, 2020)

Annex 3 Triage Algorithm from China

Picture 1. West China Hospital Emergency Management Plan During the COVID-19 Epidemic with estimates of ED Workload, PPE shortage
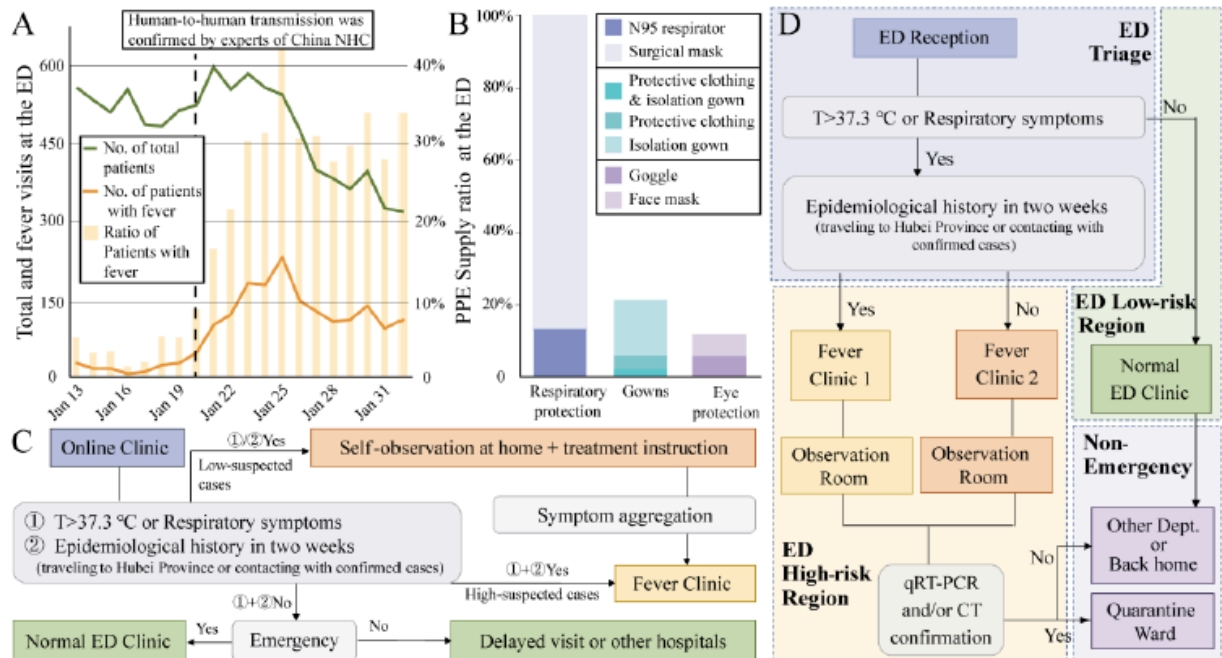
Legend:

A. The daily number and ratio of fever visits at the ED from January 13 to February 1, 2020

B. The PPE supply ratio at the ED of West China Hospital on January 25.

C. The illustration of online clinic triage of West China Hospital.

D. The illustration of ED triage and region separation.

Annex 4 Critical care issues and solutions for Covid-19 (Liew et al., 2020)

Issues	Principles	Solutions
Infection control	1. Avoidance of cross-contamination among HCW 2. Education and re-education on personal protective equipment and use of powered air-purifying respirators 3. Provision for workflows to cater to special groups, such as pregnant women with acute respiratory illness who are in labour 4. Enhanced surveillance for infection in HCW 5. Strong emphasis on good hand hygiene for all 6. Robust visitor screening and management	• A dedicated roster to segregate "clean" and isolation teams, and to provide for stand-by • Provision of clean scrubs for HCW to change into before duty; showering facilities at the end of shift • Education and re-education on personal protective equipment and use of powered air-purifying respirators, especially for isolation teams • Allow isolation teams to have a **2-week off-duty observation period ("wash-out" period), after every period of ward cover if manpower allows** • Mandatory reporting of twice daily temperature monitoring by all HCW • Advance declaration of leave and overseas trips by HCW • Screening questions are regularly updated as case definitions evolve over time, especially for known clusters of infection in the community • Provision of thermal scanners at the doorstep to screen for fever • Maintaining a hospital visitor log to allow for
Dissemination of information to HCW	1. Robust system of dissemination of information (changing policies, workflows, etc.) 2. Email and meetings alone are insufficient to operationalize urgent changes on the ground 3. Clinical discussions of confirmed cases within the ICU community	• Utilization of secure and approved platforms such as institutional email and messaging applications to inform various job groups and teams of rapidly evolving workflows and policies • Utilization of secure videoconferencing applications to hold inter-institution and inter-department meetings and educational sessions • Utilization of secure and approved applications such as messaging and videoconferencing applications to conduct clinical discussions of cases and the sharing of experience
Resuscitation and code blue response	1. Provide clear guidelines on personal protective equipment and use of powered air-purifying respirators in ISO wards and normal wards during resuscitation 2. Provide inter-professional simulation of resuscitation scenarios for suspected or confirmed cases	• Simulation practice with personal protective equipment and use of powered air-purifying respirators will help identify gaps in the wards and prepare ISO teams for such scenarios • Simulation with limited team members per scenario, for example, 4 members per team, to allow acclimatization of HCW to perform resuscitation in smaller teams • Checklists for preparation of drugs and pre-prepared trolleys for equipment, for intubation, line setting and other procedures, to minimize staff movement and enhance efficiency • Creative ways to improve communications during resuscitation, such as utilization of a printed "Call Airway Team" card for difficult intubations, using a communication whiteboard in the patient room and using walkie-talkies to relay messages to staff outside the room for equipment and help
Advanced ICU services	1. To provide clear thresholds for transfers of	• Early transfer of deteriorating cases is recommended. Provision of thresholds for transfer and workflows for

Issues	Principles	Solutions
	deteriorating cases for extracorporeal membrane oxygenation (ECMO) 2. To provide efficient and safe delivery of ICU bronchoscopy	non- extracorporeal membrane oxygenation (ECMO) centres • Use of disposable bronchoscopes for bronchoscopy and percutaneous tracheostomy
Psychological stress and burnout of HCW	1. To provide emotional support, encouragement and appreciation to HCW 2. Reduce stigmatization of HCW by ill-informed members of the public	• Special provision of meals and drinks to boost morale; laundry service for used scrubs • Provision of regular updates of the local situation and status by the government and institution leadership • Frequent encouragement of HCW by divisional heads and senior leaders via emails, messaging apps and social media platforms, allowing staff to remain engaged • Timely articles and courageous stories of frontline staff • Appropriate media coverage of HCW at the frontline to increase empathy and reduce stigmatization

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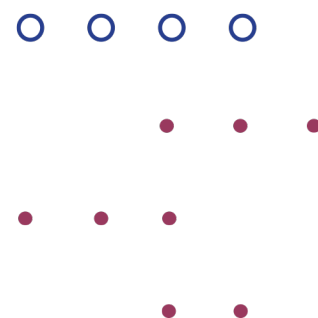
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