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REVIEW

Large-scale infectious disease testing programs have little consideration for equity: findings from a scoping review

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Abstract

Objective: This scoping review aimed to identify how equity has been considered in large-scale infectious disease testing initiatives.

Study Design and Setting: Large-scale testing interventions are instrumental for infectious disease control and a central tool for the coronavirus 19 (COVID-19) pandemic. We searched Web of Science: core collection, Embase and Medline in June 2021 and followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses recommendations for scoping reviews. We critically analyzed the content of all included articles.

Results: Our search resulted in 2448 studies of which 86 were included for data extraction after screening. Of the included articles, 80% reported on COVID-19 -related screening programs. None of the studies presented a formal definition of (in)equity in testing, however, 71 articles did indirectly include elements of equity through the justification of their target population. Of these 71 studies, 58% articles indirectly alluded to health equity according to the PROGRESS-Plus framework, an acronym used to identify a list of socially stratifying characteristics driving inequity in health outcomes.

Conclusion: The studies included in our scoping review did not explicitly consider equity in their design or evaluation which is imperative for the success of infectious disease testing programs. © 2021 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Keywords: Scoping review; COVID-19; Equity; Inequity; Testing programs; HIV; H1N1; Ebola; PROGRESS-Plus framework; TIDieR-PHP

COVID-19, coronavirus disease 2019; HIV, human immunodeficiency virus; TB, tuberculosis; H1N1, influenza sub-type H1N1; EVD, Ebola virus disease.

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What is new?

Key findings

- There is a lack of explicit consideration equity in design and evaluation of large-scale infectious disease testing interventions.

What this adds to what is known?

- We evaluated the presence of explicit and implicit measures of equity in empirical literature on large-scale infectious disease testing programs.

What should change now?:

- Tools such as PROGRESS-Plus should be used in the design, implementation, and evaluation of large-scale infectious disease testing programs. Our key findings have implications for SARS-CoV-2 testing programs.

1. Introduction

It is essential to understand how coronavirus disease 2019 (COVID-19) testing campaigns are being offered in the current pandemic situation, to improve their equitable implementation. Racial and ethnic minority and marginalized communities have been disproportionately affected by COVID-19 [1–3] and improving equitable access to COVID-19 diagnostic testing and screening would be a vital step in reducing disease propagation [4]. Large-scale testing is instrumental for surveillance, directly informing measures of prevention, control, and mitigation of infectious diseases [5–8]. The goal of large-scale testing interventions is to reduce transmission rates through detection, treatment, isolation, and any other relevant control and prevention measures [9]. Testing programs often act as a link to care and support programs, which should be provided equitably, based on risk of infection and disease burden [10].

A proportionate universalism framework-based public health program would imply two components: a universal approach of support and services available to the population as a whole, accompanied by accessible targeted initiatives for those highly vulnerable and for those least likely to benefit from the universal program (Fig.) [11,12]. When applied to COVID-19 testing initiatives, a proportionate universalism approach could include a universal program for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) testing with concerted efforts to reach vulnerable groups less able to access the universal testing programs.

Equity is defined by the “absence of systematic disparities in health or in major social determinants of health between groups with different levels of underlying social advantages/disadvantages” [13,14] whereas health in-

equities refer to “differences in health status or in the distribution of health resources between different population groups, arising from the social conditions in which people are born, grow, live, work and age. They are unfair, avoidable, and could be reduced by the right mix of government policies [15,16].” This is an important concept for understanding the differences between (in)equity from the more general term (in)equality, two words that are often confused [17,18]. Health inequalities refer to the uneven distribution of health or health resources (i.e., clinics, healthcare providers, disease tests, infrastructure, clinical material) within or between populations. Inequality is primarily a descriptive term exempt from moral perspective [17–19]. In contrast, (in)equity involves a strong moral commitment to social justice as the politicized expression of (in)equality [18]. In light of these fundamental differences, equity-sensitive public health interventions require measures of health and social determinants of health specific and sensitive to the health issue at hand [20].

This review identifies if and how equity has been considered in large-scale infectious disease testing initiatives. Identifying examples of (in)equity in these initiatives can help guide the design of large-scale testing campaigns for the COVID-19 pandemic. To investigate the equitable implementation of testing programs we searched for programs implemented either in past outbreak, epidemic, or pandemic situations, or in the current context of COVID-19. We chose specifically to look at Human Immunodeficiency Virus (HIV), Ebola, Influenza subtype H1N1, and COVID-19 because of their notable emergence as large-scale infectious disease epidemics and pandemics of great public health concern in the past decade featuring human to human transmission.

2. Methods

We chose to conduct a scoping review approach as it enabled us to synthesize, with rigor, the state of knowledge about our research objective [21,22]. We have a detailed online protocol published elsewhere [23].

2.1. Search strategy

The search strategy was developed in consultation with librarians from the University of Montreal. We completed our electronic database query in June 2021 in Web of Science core collection, MEDLINE, and Embase. The following keywords were used to define our queries (Appendix B): “screening,” “mass testing,” “disease testing program,” “infectious disease testing,” “design,” “evaluation,” “planning,” “implementation,” “pandemic*,” “epidemic*,” “outbreak*,” “tuberculosis,” “HIV,” “human immunodeficiency virus,” “h1n1,” “SARS-COV-2,” “SARS-COV2,” “SARSCOV-2,” “SARSCOV,” “SARS-COV*,” “SARSCOV*,” “severe acute respiratory syndrome 2,” “severe acute respiratory syndrome cov,”

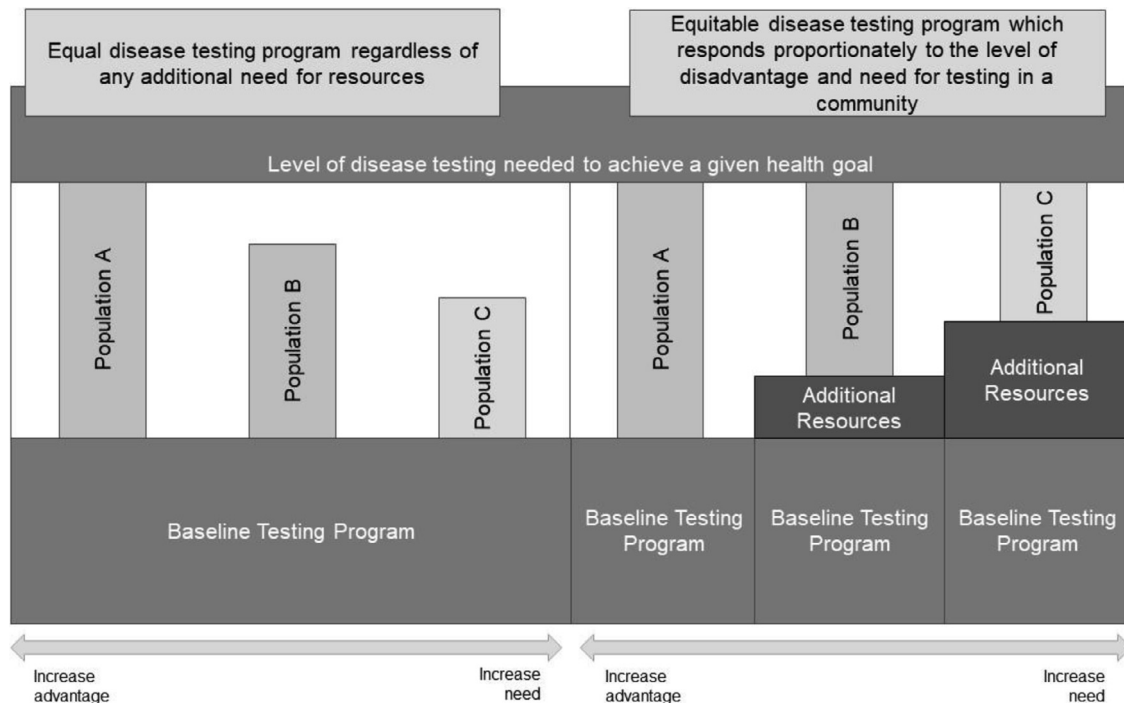


Fig. 1. Proportionate universalism versus equality based infectious disease testing program. This figure represents a conceptual representation of the concepts of equitable vs. equal population testing/screening interventions. For example: if Population A represents a population with strong health access and resources, Population B represents a population with some disparity in social determinants of health, and Population C represents a population with many disparities in social determinants of health. An equality-based testing program would provide equal services to all regardless of risk or access disadvantage for Population B and C, while a proportional universalism (equitable) testing program would provide additional resources customized to the needs of population B and C to help each of them reach a given testing goal.

“covid-19,” “covid,” “cov*,” “2019ncov*,” “Hcov-19,” “coronavirus,” “corona virus,” “ebola*,” “EVD”.

We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR) [24]. The inclusion criteria for articles were: (1) that the study focused on one of the following infectious diseases (Tuberculosis, HIV, Ebola, influenza subtype H1N1, or COVID-19), (2) included a description or evaluation of the design portion of a testing or screening program as long as some component of diagnostic testing was included, (3) were published in English, (4) were focused on programs implemented in the context of a pandemic, epidemic, or outbreak; and (5) were peer reviewed publications published after 2010, which signifies the year that the term “proportionate universalism” was coined in The Marmot Review [25].

2.2. Selection of studies

All identified studies were imported from Web of Science core collection, MEDLINE, and Embase into Covidence [26], a systematic review software, for screening of the titles, abstracts, and full texts. At least two of three involved reviewers (KO, LD, CD) independently assessed the relevance of titles and abstracts based on the inclusion and exclusion criteria. The second stage of review involved two of three reviewers independently identifying

potentially relevant publications based on a full article review. Any discordance in the process was discussed among all reviewers and if no consensus was reached, an additional reviewer (LT) was consulted.

2.3. Study characteristics and data extraction

After independent full text screening was conducted by at least two reviewers, data from the retained articles were extracted and assessed. The extraction sheet used for this component was pilot tested independently by two reviewers. Extracted data included the following descriptive elements such as: characteristics (title, authors, year), context (country, disease addressed), and the inclusion of considerations of health inequities or inequalities in the design of the intervention, the main results, and the discussion of the study. If the study considered health inequities, we extracted further information on which measures of equity were considered and if a specific tool or theoretical framework was used in the program design. Generally, a theoretical framework can be used to inform how a public health program is planned and what strategic and operational components were considered during the process of this planning [27]. We considered equity (explicit or implicit) in the (1) intervention rationale, (2) design, (3) choice of target population, and (4) final recommendations for future initiatives based on the PROGRESS-Plus frame-

work an acronym used to identify a list of socially stratifying characteristics driving inequity in health outcomes criteria [28]. Explicit inclusion of equity was defined as an article which included a formal definition, or framework to address the equitable implementation of a program and implicit was defined as a program which was targeted with justification based on risk of disease or increased adverse effects potential in a given group. The PROGRESS-Plus framework was developed and endorsed by the Campbell and Cochrane Equity Methods Group, to highlight a set of social determinants of health that drive variations in health outcomes and the inequalities among the social determinants of health gradient [28]. The categories referred to by the acronym are place of residence, race or ethnicity, occupation, gender, religion, educational level, socioeconomic status (SES), social capital, and Plus, which included three components: (1) personal characteristics associated with discrimination, (2) features of relationships, and (3) time-dependent relationships. Our goal, through the use of these tools, was to assess the presence or absence of the consideration of health inequities in the implementation or evaluation of testing programs.

We classified study design into the following categories: randomized control trial (RCT), non-randomized experimental study, cohort, cross sectional/prevalence/descriptive, case control, systematic review, qualitative study, case series, or other (e.g., editorial, case report, or protocol). In addition, we followed the Template for Intervention Description and Replication (TIDieR-PHP) checklist and guide to assess study coherence and program reporting and evaluation completeness [29]. The 12-item checklist includes categories: name, why, what (materials), what (procedure), who provided, how, where, when and how much, tailoring, modifications, how well (planned), how well (actual), and is an extension of the CONSORT checklist [29].

3. Results

3.1. Description of the studies

We initially identified 2449 references after duplicate removal with 86 peer reviewed studies being included in the final analysis after full text review (Appendix A). Most included articles were prevalence, descriptive, or cross-sectional studies ($n = 69$, 80%) (1–69*), seven were cohort studies (8%) (70–76*), the remaining studies included a modified stepped wedge (77*), a case report (78*), two commentaries (79,80*), an editorial (81*), a narrative review (82*), a protocol (83*), a retrospective single center report (84*), an RCT (85*), and one prospective clustered randomized trial (86*) (Table 1). The most common disease was COVID-19 ($n = 69$, 80%) (1,3,6–11,13–15,17–26,28,29,32–37,39–44,46–55,57–59,61–69,71,72,74–76,78–84*), while eleven studies were for HIV/AIDS (13%) (2,16,30,31,38,45,70,73,77,85,86*),

three for Ebola Virus Disease (3%) (5,56,60*), and three for H1N1 (3%) (4,12,27*).

The included studies were predominantly implemented in the WHO region of the Americas ($n = 42$, 49%) (2,9–13,15–18,20,22,24,26,29–33,35,36,41,43,44,47,50–53,55,56,58,60,61,64,66,67,69,71,79–81*), followed by the region of Europe ($n = 17$, 20%) (1,4,6–8,23,25,40,46,48,49,54,62,74,82,84,84*), Western Pacific ($n = 12$, 14%) (21,27,28,37,57,59,63,65,68,75,78,85*), South-East Asia ($n = 5$, 6%) (14,34,39,70,76*), Africa ($n = 8$, 9%) (5,19,42,45,73,77,83,86*), and Eastern Mediterranean ($n = 2$, 2%) (3,38*) (Table 1).

Hospitals and clinics were the prevailing testing jurisdiction of the described programs within our sample ($n = 53$) (1,2,4,7,9–14,16–18,20,21,23,25,26,32,33,36–39,43–50,56–61,63,64,66,67,71–73,75,77,78,80–82,84,86*). Five were implemented at the local health or municipal level (6,19,27,65,68*), while five others were scaled at the provincial/state level (5,31,70,83,85*), and one at the federal/national level (3*). Other study settings include nursing homes/assisted living ($n = 5$) (8,51–53,69*), prisons ($n = 4$) (22,29,40,62*), as well as NGO/Nonprofit organizations ($n = 1$) (74*), a school ($n = 1$) (55*), a military air force base ($n = 1$) (41*), a merchandise cargo ship ($n = 1$) (76*), a homeless shelter ($n = 1$) (35*), and an asylum seekers reception center ($n = 1$) (54*).

While some studies included individuals regardless of age ($n = 18$) (3–5,14,19,20,27,28,30,34,37,54,56,65,68,74,79,83*), most studies focused on an adult population ($n = 50$) (2,7,9,11,15–18,22–26,29,31–33,35,36,39–41,43–46,49–51,55,57,58,60–64,67,70–73,75–78,80,82,84,85*), while others specifically focused on elderly ($n = 7$) (6,8,42,51–53,69*) or children ($n = 7$) (45,47,48,55,59,66,81*). Some programs specifically focused on certain population subgroups based on characteristics such as drug use ($n = 2$) (70,73*), sexual orientation ($n = 2$) (31,70*), pregnancy status ($n = 5$) (1,10,12,13,38*), travel history ($n = 7$) (3,5,27,37,54,60,65*), place of residence such as prisons ($n = 4$) (22,29,40,62*) and nursing homes or assisted living ($n = 6$) (6,8,51–53,69*), as well as employment ($n = 18$) (6,8,11,15,21,22,32,35,40,52,53,55,62–64,69*).

Although most studies did not report any recruitment strategy ($n = 54$) (1,4,6,8–13,15,18,20–26,28–30,34–36,38–47,49,50,52,54–57,61,64,67–69,71–74,78,80–82*), some, to reach their target population, made use of specific enrollment strategies. These ranged from implementing a mandatory or systematic testing service to enter the country/area ($n = 5$) (5,27,37,65,76*), or to obtain sought health services (e.g., operations) ($n = 13$) (7,14,17,33,48,51,53,58,59,63,66,75,84*). Other strategies include targeted phone calls (3,83*), clinic opt-out screening (2,16,62,77*), active community outreach campaigns (19,31,70,77,86*), and incentivized recruitment (monetary or gift cards) (31,86*).

Table 1. Characteristics of the infectious disease testing studies included in the scoping review, published after 2010 (n = 86).

Study	WHO region	Objectives	Relevant findings
Disease Addressed: COVID-19			
<i>Abey Suriya 2020</i> Universal screening for SARS-CoV2 in pregnant women at term admitted to an East London maternity unit	European Region	The primary aim of our study was to evaluate the prevalence of SARS-CoV-2 in our obstetric population and determine the presence of asymptomatic disease. A secondary aim was to identify any relationship between patient demographics and SARS-CoV-2.	Of the women who were found to be SARS-CoV-2 positive, a high proportion (87.9%) were asymptomatic. These findings support the need for universal testing to enable targeted isolation and robust infectious control measures to mitigate outbreaks of SARS-CoV-2 in maternity units.
<i>Alinier 2020</i> Implementation of a drive-through testing clinic in Qatar for residents having recently returned from a country with a COVID-19 travel warning	Eastern Mediterranean Region	The aim of this article is to share our experience with the early implementation of a drive-through testing clinic using the invited persons vehicle as an isolation compartment during screening to minimize person-to-person contamination.	Collaboration among various key health, governmental, and travel industry partners was essential to the successful and rapid implementation of a COVID-19 drive-through testing clinic in the early days of the pandemic in Qatar.
<i>Aykaç 2021</i> Evaluation of the measures taken in nursing homes of the Istanbul Metropolitan Municipality during the COVID-19 pandemic	European Region	This article examines the measures taken against the COVID-19 pandemic in nursing homes under the responsibility of the Istanbul Metropolitan Municipality and discusses their efficacy.	Our research shows that the measures taken to address the COVID-19 pandemic in the nursing homes run by the Istanbul Hospice were timely and effective. Our data indicates that, if the finance and service structures of the nursing homes are met, and local authorities have control over the administrative organization, there will be no fatal outbreaks associated with COVID-19.
<i>Bernadou 2021</i> High impact of COVID-19 outbreak in a nursing home in the Nouvelle-Aquitaine region, France, March to April 2020	European Region	In this study, we monitored the epidemic dynamic in this nursing home and the infection prevention and control (IPC) measures implemented throughout this outbreak.	This outbreak confirmed the considerable health impact of SARS-CoV-2 transmission in a nursing home. In addition to the implementation of IPC measures, the early detection of cases through the screening of residents and staff is essential to identify asymptomatic and pre-symptomatic cases and limit the spread of the virus.
<i>Blumberg 2020</i> Universal Screening for COVID-19 in Children Undergoing Orthopaedic Surgery: A Multicenter Report	Region of the Americas	We sought to identify the incidence of COVID-19 among pediatric patients undergoing orthopedic surgery with a universal preoperative screening at 3 geographically unique tertiary care pediatric institutions.	Early results of universal preoperative screening for COVID-19 demonstrates a low incidence and high rate of asymptomatic patients. Health care professionals, especially those at higher risk for the virus, should be aware of the challenges related to screening based solely on symptoms or travel history and consider universal screening for patients undergoing elective surgery.
<i>Boffa 2020</i> Results of COVID-minimal Surgical Pathway During Surge-phase of COVID-19 Pandemic	Region of the Americas	The outcomes of patients treated on the COVID-minimal pathway were evaluated during a period of surging COVID-19 hospital admissions, to determine the safety of continuing to perform urgent operations during the pandemic.	A COVID-minimal pathway comprised of physical space modifications and operational changes may allow urgent cancer treatment to safely continue during the COVID-19 pandemic, even during the surge-phase.

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Table 1 (continued)

Study	WHO region	Objectives	Relevant findings
<i>Buhimschi 2020</i> Prevalence and Neighborhood Geomapping of COVID-19 in an Underserved Chicago Pregnant Population	Region of the Americas	We studied the prevalence and neighborhood distribution of patients who tested positive for COVID-19 after implementation of universal screening at an academic hospital providing obstetrical services to an underserved Chicago population.	The disproportionate hit of COVID-19 pandemic on the Hispanic and Black communities reflects in SARS-CoV-2 positivity rates in the obstetrical population... Allocation of appropriate educational and financial resources to vulnerable pregnant populations residing in disadvantaged Chicago neighborhoods is needed.
<i>Callaghan 2020</i> Screening for SARS-CoV-2 Infection Within a Psychiatric Hospital and Considerations for Limiting Transmission Within Residential Psychiatric Facilities- Wyoming, 2020	Region of the Americas	This report described the adaptation of standard IPC strategies in psychiatric facilities to meet patient and facility needs might prevent SARS-CoV-2 transmission.	Adaption of standard IPC strategies in psychiatric facilities to meet patient and facility needs might prevent SARS-CoV-2 transmission, and point prevalence surveys can be useful to assess the likely effectiveness of any adapted IPC measures.
<i>Nicolás 2021</i> A Prospective Cohort of SARS-CoV-2-Infected Health Care Workers: Clinical Characteristics, Outcomes, and Follow-up Strategy	Western Pacific Region	Our aim in this study is to describe the characteristics and outcomes of an active strategy of COVID-19 management of infected HCWs in a HaH Unit in coordination with the Human Resources and Occupational Health departments in the Hospital Clinic Barcelona, Spain.	Active screening for SARS-CoV-2 among HCWs for early diagnosis and stopping in-hospital transmission chains proved efficacious in our institution, particularly due to the high percentage of asymptomatic HCWs. Follow-up of HCWs in Hospital at Home units is safe and effective, with low rates of severe infection and readmission.
<i>Cho 2021</i> Response to the COVID-19 Outbreak in The Emergency Department Designed for Emerging Infectious Diseases in Korea	South-East Asia Region	This research aims to present statistics on patients based on the periodic progression of COVID-19. This study compares data of COVID-19 screening patients with general patients and presents the number of patients in correspondence with periodic events in ED designed to respond to mass outbreaks of infection.	Research in emergency department designs and operational programs should increase to combine research data with better ideas to respond not only during regular periods but also during periods of pandemic.
<i>Constantine 2021</i> Implementation of Drive-Through Testing for COVID-19 With Community Paramedics	Region of the Americas	We are not aware of previous efforts to use Mobile integrated health (MIH)/community paramedicine (CP) services to implement drive-through testing in pandemic scenarios. We report on our experience developing this testing strategy, as well as recommendations for communities that may wish to deploy a similar testing strategy.	In our health care system, we pivoted the traditional MIH/CP model to rapidly initiate remote drive-through testing for COVID-19 in pre-screened individuals. This model allowed us to test patients with suspected COVID-19 patients away from traditional health care sites and mitigate exposure to health care workers and other patients.
<i>Creput 2020</i> COVID-19 in Patients Undergoing Hemodialysis: Prevalence and Asymptomatic Screening During a Period of High Community Prevalence in a Large Paris Center	European Region	In this report, we describe our experience with COVID-19 in our center, in which 38 maintenance dialysis patients developed COVID-19.	Dialysis patients are a highly susceptible population and hemodialysis centers are a high-risk area in a COVID-19 epidemic. Unexplained lymphopenia and/or an increase in C-reactive protein level should lead physicians to the diagnosis of COVID-19 and should, when possible, be followed by diagnostic testing with universal reverse transcriptase-polymerase chain reaction, as well as the reinforcement of contamination barrier measures.

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Table 1 (continued)

Study	WHO region	Objectives	Relevant findings
<i>David 2020</i> Community-based screening and testing for Coronavirus in Cape Town South Africa: Short report	African Region	The overall aim was to slow down transmission through early identification and isolation of diagnosed cases.	Cape Town has targeted CST around cases in vulnerable communities. Implementation of CST was made easier by a pre-existing commitment to COPC, and also highlights the importance of COPC principles in transforming PHC. Designing a tool with sufficient predictive value and overcoming logistic issues were key challenges.
<i>deSandes-Freitas 2020</i> Lessons from SARS-CoV-2 screening in a Brazilian organ transplant unit	Region of the Americas	We will describe the experience of a single center of screening all inpatients and newly admitted patients to the Organ Transplant Unit.	We report a single-center experience using universal SARS-CoV-2 screening for all inpatients and newly admitted patients to an Organ Transplant Unit located in a region with significantly high community-based transmission.
<i>Duan 2020</i> Safety considerations during return to work in the context of stable COVID-19 epidemic control: an analysis of health screening results of all returned staff from a hospital	Western Pacific Region	We reported the results of health screening for COVID-19 among returned staff of a hospital and conducted a summary analysis to provide valuable experience for curbing the COVID-19 epidemic and rebound.	Asymptomatic infections are a major risk factor for returning to work. Extensive health screening combined with multiple detection methods helps to identify asymptomatic infections early, which is an important guarantee in the process of returning to work.
<i>Dunne 2021</i> COVID-19 Outbreaks in Correctional Facilities with Work-Release Programs: Idaho, July-November 2020	Region of the Americas	This report describes COVID-19 outbreaks in five IDOC facilities with work-release programs, ⁴ provides the mitigation strategies that IDOC implemented, and describes the collaborative public health response.	Correctional facilities operating work-release programs should implement measures to reduce SARS-CoV-2 transmission, including mass testing and working with public health officials to identify high-risk work sites. Incarcerated persons participating in work-release should be included in COVID-19 vaccination plans.
<i>Fassett 2020</i> Universal SARS-Cov-2 Screening in Women Admitted for Delivery in a Large Managed Care Organization	Region of the Americas	The objective of this study was to estimate the prevalence of SARS-CoV-2 infection through universal screening of a large ethnically diverse population of pregnant women admitted for labor and delivery in the KPSC health care system.	The findings suggest that in pregnant women admitted for delivery between April 6 and May 11, 2020 in this large integrated health care system in Southern California, prevalence of SARS-CoV-2 test positive was very low and all patients were asymptomatic on admission.
<i>Ferrari 2021</i> COVID-19 screening protocols for preoperative assessment of head and neck cancer patients candidate for elective surgery in the midst of the pandemic: A narrative review with comparison between two Italian institutions	European Region	The aim of our retrospective study was to describe the screening and surgical activities of two Northern Italian (one in Lombardy and the other in Veneto regions) referral Institutions for management of head and neck cancer (HNC) during the peak phase (mid-March to mid-April 2020) of the COVID-19 epidemic, detailing their respective institutional COVID-19 screening protocols, related outcomes, and diagnostic accuracy.	Dedicated screening protocols for COVID-19 allow to safely perform elective HNC surgery...Even during the peak of the epidemic phase, pharyngeal swab alone or a combination of symptom evaluation, generic blood tests, and chest CT were able to adequately select patients for surgery, apparently including only those without COVID-19.
<i>Gehrke 2021</i> Results of the first 1,000 procedures after resumption of elective orthopedic services following COVID-19 pandemic: Experiences of a high-volume arthroplasty center	European Region	This study aims to investigate the effectiveness of a screening questionnaire to identify high-risk patients for novel coronavirus-2019 (COVID-19) among those undergoing elective orthopedic surgery.	The use of guiding principles for resuming elective orthopedic surgery is safe without a higher risk for complications in selected cases.

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Table 1 (continued)

Study	WHO region	Objectives	Relevant findings
<i>Gilbert 2020</i> Immersion in an emergency department triage center during the Covid-19 outbreak: first report of the Liege University hospital experience	European Region	The main goal of the present study is to describe the role of this specific triage center for patients potentially infected with the novel coronavirus and to share our experience in the management of those Covid-19 suspected patients while retaining the usual treatment capabilities of emergency services for other usual patients.	Our experience suggests that triage centers for the assessment and management of Covid-19 suspected patients is an essential key strategy to prevent the spread of the disease among non-symptomatic patients who present to the EDs for care. This allows for a disease centered work-up and safer diversion of Covid-19 patients to specific hospital units.
<i>Goldberg 2020</i> Home-based Testing for SARS-CoV-2: Leveraging Prehospital Resources for Vulnerable Populations	Region of the Americas	Recognizing these inefficiencies and shortcomings, we designed an emergency medical services (EMS)-based SARSCoV-2 home testing and evaluation program in partnership with local ambulance agencies.	Facility-based SARS-CoV-2 testing requires that a patient physically present to a facility for a nasopharyngeal swap to be collected... By leveraging existing EMS infrastructure in new ways, our community has been able to keep almost 500 vulnerable patients in their home. Using EMS, we can strengthen the healthcare systems response to the evolving COVID-19 pandemic and support at-risk populations, including those that are underserved, homebound, and frail.
<i>Gruskay 2020</i> Universal Testing for COVID-19 in Essential Orthopaedic Surgery Reveals a High Percentage of Asymptomatic Infections	Region of the Americas	The present study seeks to report on the rate of positive diagnoses of COVID-19 in an orthopedic cohort undergoing essential orthopedic surgical procedures in New York City during March and April 2020 and to describe the postoperative course of asymptomatic and symptomatic patients. We hope to be able to use the lessons learned from these urgent cases to inform policies for evaluating patients undergoing an elective surgical procedure in the near future.	Importantly, the majority of these [screened] patients were asymptomatic. Using chest radiography did not significantly improve the negative predictive value of screening.
<i>Haidar 2021</i> Preprocedural SARS-CoV-2 Testing to Sustain Medically Needed Health Care Delivery During the COVID-19 Pandemic: A Prospective Observational Study	Region of the Americas	Our objectives here are to describe the implementation of the screening initiative, address the extent to which it met our objectives, describe barriers encountered, and report temporal trends of preprocedural SARS-CoV-2 PCR positivity rates over an 8-mo period during changes in COVID-19 incidence.	Implementing preprocedural PCR testing was complex and revealed low infection rates (0.24% overall), which increased during COVID-19 surges. Additional studies are needed to define the COVID-19 prevalence threshold at which universal preprocedural screening is warranted.
<i>Halalau 2020</i> Emergency Center Curbside Screening During the COVID-19 Pandemic: Retrospective Cohort Study	Region of the Americas	We describe in detail the curbside screening process and patient outcomes, including EC visits for evaluation, admissions, and mortality. We hope that this information will help other health systems implement similar processes early, safely, and efficiently.	Our curbside testing model encourages the incorporation of this model at other high-volume facilities during an infectious disease pandemic.

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Table 1 (continued)

Study	WHO region	Objectives	Relevant findings
<i>Jain 2021</i> Pediatric Emergency Department Challenges and Response to COVID-19	Region of the Americas	This article explores the challenges and response of one children's emergency medicine division related to surge planning, personal protective equipment, screening, testing, staffing, and other operational challenges, and de-scribes the impact and implications thus far.	The pandemic illustrates the need for constant preparedness for pediatric emergencies and disasters... COVID-19 has forced our teams to at-tempt frequent, small tests of change, rather than rely on larger improvement projects.
<i>Joshi 2020</i> Solving Community SARS-CoV-2 Testing With Telehealth: Development and Implementation for Screening, Evaluation and Testing	Region of the Americas	This study aims to describe the expansion and results of using a telehealth program to increase access to care while minimizing additional potential exposures during the early period of the COVID-19 pandemic.	Our model demonstrates how using telehealth for a referral to central testing sites can increase access to community-based care, decrease clinician exposure, and minimize the demand for personal protective equipment. The scaling of this innovation may allow health care systems to focus on preparing for and delivering hospital-based care needs.
<i>Karmarkar 2020</i> Timely intervention and control of a novel coronavirus (COVID-19) outbreak at a large skilled nursing facility San Francisco, California, 2020	Region of the Americas	To describe epidemiologic and genomic characteristics of a severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) out-break in a large skilled-nursing facility (SNF), and the strategies that controlled transmission.	Early implementation of targeted testing, serial PPSs, and multimodal IPC interventions limited SARS-CoV-2 transmission within the SNF [nursing facility].
<i>Kirshblum 2020</i> Screening Testing for SARS-CoV-2 upon Admission to Rehabilitation Hospitals in a High COVID-19 Prevalence Community	Region of the Americas	To determine the prevalence of patients who test positive for SARS-CoV-2 but were presumed to be COVID-19 negative at the time of admission to IRF in New Jersey. This knowledge is essential for adopting proper isolation and infection control practices.	Admission testing to post-acute centers for SARS-CoV-2 can help identify presymptomatic or asymptomatic individuals, especially in areas where COVID-19 is prevalent. Negative results, however, do not preclude COVID-19 and should not be used as the sole basis for patient management decisions.
<i>Kohns Vasconcelos 2021</i> SARS-CoV-2 testing and infection control strategies in European paediatric emergency departments during the first wave of the pandemic	European Region	The aim of this study was to describe the implementation of testing and infection control strategies and their evolution in paediatric emergency departments in Europe.	To allocate testing resources responsibly, we believe that specific testing criteria for the pediatric population are needed because both the individual risk of children to suffer from severe disease and to sustain transmission in the community differ from that in adults.
<i>Kwon 2020</i> Drive-Through Screening Center for COVID-19: a Safe and Efficient Screening System against Massive Community Outbreak	South-East Asia Region	Herein, we present the overall concept, advantages, and limitations of the COVID-19 drive through screening centers.	This [drive through testing] strategy could be implemented in other countries to cope with the global COVID-19 outbreak and transformed according to their own situations.
<i>Lee 2021</i> Bonuses and pitfalls of a paperless drive-through screening and COVID-19: A field report	Western Pacific Region	This field report described bonuses and pitfalls of drive-through screening for COVID-19.	Drive-through (DT) screening is a form of case detection which has recently gain preference globally. Proper implementation of this system can help remediate the outbreak.

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Table 1 (continued)

Study	WHO region	Objectives	Relevant findings
<i>Lewis 2021</i> Community-Associated Outbreak of COVID-19 in a Correctional Facility Utah, September 2020 January 2021	Region of the Americas	To describe an outbreak and how the correctional facility planned to test all the inmates in the block where they found the first case for COVID.	Quarantining and monitoring potentially exposed persons are important in preventing the... spread of SARS-CoV-2 infection in correctional facilities and other congregate settings. Vaccination of incarcerated persons might help prevent or limit the spread of infection in these facilities.
<i>Li 2021</i> Epidemiology, Infection Prevention, Testing Data, and Clinical Outcomes of COVID-19 on Five Inpatient Psychiatric Units in a large Academic Medical Center	Region of the Americas	In this retrospective cohort study, we describe the epidemiology, infection prevention strategies, and subsequent outcomes, including successful containment of an outbreak, in five psychiatric units that can serve as a model for optimizing future inpatient care during a pandemic wave.	Our study suggests that early implementation of triage, screening, extensive testing, and unit-specific interventions can help prevent and contain the spread of COVID-19 in inpatient psychiatric units and help facilitate safe delivery of care during a pandemic... Universal pre-admission testing and enhanced staff and patient infection prevention interventions led to low spread of COVID-19 in inpatient psychiatric units.
<i>Liu 2020</i> Characteristics and Effectiveness of the Coronavirus Disease 2019 (COVID-19) Prevention and Control in a Representative City in China	Western Pacific Region	We analyzed the clinical characteristics and epidemiological data of cases, and the process of adjustment of control measures in this district to show how these measures achieved control, and to provide a reference for countries and regions with ongoing community transmission.	We implemented strong control measures, such as city lock-down, travel restrictions, stay-at-home orders, designated hospitals and fever clinics, centralized isolation, tracing of high-risk people, and extensive RT-PCR screening in the first stage to control the spread of COVID-19 within 2 mo. When facing the second round of virus transmission, we only performed active tracing of high-risk people based on big data, centralized isolation, and extensive RT-PCR screening measures, and successfully stopped community transmission of COVID-19 with-out affecting people's normal work and lives. Our experience may serve as a reference for countries and areas with ongoing community transmission, helping them halt outbreaks or build long-term pandemic resilience.
<i>Luo 2021</i> Prevention of SARS-CoV-2 transmission from international arrivals: Xiaotangshan Designated Hospital, China	Western Pacific Region	We describe the structure and design of Xiaotangshan Designated Hospital, and the resources available to it. We also explain the function and operation of the designated hospital and discuss its effectiveness and value in responding to the pandemic and preventing the transmission of the virus from overseas travelers.	Xiaotangshan Designated Hospital accomplished its mission of responding to the threat of the reintroduction of the virus from a foreign country...the pandemic is not yet over and COVID-19 is still spreading globally; however, the flexible design of Xiaotangshan Designated Hospital means that it can be repurposed according to current conditions and reopened at any time.

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Table 1 (continued)

Study	WHO region	Objectives	Relevant findings
<p><i>Maechler 2020</i> Epidemiological and clinical characteristics of SARS-CoV-2 infections at a testing site in Berlin, Germany, March and April 2020 across-sectional study</p>	European Region	<p>We describe epidemiological and clinical characteristics and aim at identifying risk factors for SARS-CoV-2 detection during the first 6 wk of operation of a testing site. The site aimed to provide testing for the general population, and to reduce workload for the emergency departments. Because clinical manifestations range from absent or unspecific signs to severe acute respiratory distress.</p>	<p>In this young population, early-onset presentation of COVID-19 resembled flu-like symptoms, except for smell and/or taste dysfunction. Risk factors for SARS-CoV-2 detection were return from regions with high incidence and contact with confirmed SARS-CoV-2 cases, particularly when tests were administered within the first 2 wk after contact and/or onset of symptoms. Considering the threat posed by silent transmission through asymptomatic carriage, less restricted screening approaches may be crucial to interrupt transmission chains with potentially dramatic consequences. Targeted screening programmes at potential transmission hubs, such as personnel in long-term care facilities or schools, should encompass repeated sampling. Sentinel surveillance based on symptoms and/or absence from work, school or kindergartens could complement laboratory-based test strategies, speed up detection of clusters and trigger public health action, for example partial school closures, contact tracing and targeted testing.</p>
<p><i>Manauis 2020</i> Bracing for impact: operational up shots from the National Centre for Infectious Diseases Screening Centre (Singapore) during the COVID-19 outbreak</p>	South-East Asia Region	<p>This paper aims to describe our experiences in running the screening centre including the pre-outbreak preparatory phase, infrastructure planning to facilitate patient flow, and coordinating a whole hospital approach to support our wide net surveillance efforts.</p>	<p>This paper describe a team's experience running the screening centre including the pre-outbreak preparatory phase, infrastructure planning to facilitate patient flow, and coordinating a whole hospital approach to support our wide net surveillance efforts.</p>
<p><i>Marco 2021</i> Public health response to an outbreak of SARS-CoV2 infection in a Barcelona prison</p>	European Region	<p>An outbreak of SARS-CoV2 infection in a Barcelona prison was studied.</p>	<p>Generalised screening and the isolation and evaluation of the people infected were key measures. Symptom-based surveillance must be supplemented by rapid contact-based monitoring to avoid asymptomatic spread among prisoners and the community at large.</p>
<p><i>Marcus 2020</i> COVID-19 Monitoring and Response Among U.S. Air Force Basic Military Trainees Texas, March–April 2020</p>	Region of the Americas	<p>This report examines the first 7 wk (March 1–April 18) of implementation of nonpharmaceutical intervention (NPI) in Basic Military Training (BMT) at a U.S. Air Force base.</p>	<p>Despite documented outbreaks of COVID-19 in congregate settings, implementation of NPIs, including screening, testing, administrative measures, quarantine, isolation, and source control, can limit transmission of symptomatic COVID-19 and ensure continuity of critical activities.</p>
<p><i>Mash 2020</i> Re-organising primary health care to respond to the Coronavirus epidemic in Cape Town, South Africa</p>	African Region	<p>This report aimed to describe changes made in response to COVID-19 in a healthcare facility in Cape Town, South Africa.</p>	<p>The epidemic exposed intersectoral and intrasectoral fault lines, particularly access to social services at a time when they were most needed. Community screening and testing had to be refocused due to limited laboratory capacity and a lengthening turnaround time.</p>

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Table 1 (continued)

Study	WHO region	Objectives	Relevant findings
<i>McDougal 2021</i> Outbreak of coronavirus disease 2019 (COVID-19) among operating room staff of a tertiary referral center: An epidemiologic and environmental investigation	Region of the Americas	To investigate an outbreak of coronavirus disease 2019 (COVID-19) among operating room staff utilizing contact tracing, mass testing for severe acute respiratory coronavirus virus 2 (SARS-CoV-2), and environmental sampling.	We were able to mitigate this outbreak because of prompt identification of the index cluster, mass testing and swift interventions including reeducation about masking, maintaining social distancing, limiting capacity in communal areas, remaining off duty when feeling ill, and increased environmental cleaning. No additional cases have been identified since implementing these measures.
<i>McSwain 2020</i> Positive or Negative? Implementation Processes and Pitfalls of Preoperative SARS-CoV-2 Testing at a Single Academic Institution	Region of the Americas	The purpose of this paper is twofold: to present our current operational processes to achieve a high level of preoperative testing across our hospital system as well as present our patient- and institutional-related challenges with preoperative testing.	Given the rapidly changing nature of the virus as well as rapidly fluctuating levels of prevalence throughout individual cities and regions of the state, our need for streamlined, integrated testing will only continue.
<i>Molling 2020</i> Drive-through Satellite Testing: An Efficient Precautionary Method of Screening Patients for SARS-CoV-2 in a Rural Healthcare Setting	Region of the Americas	A community based United States health care system in the upper mid-west implemented a drive through testing site in an attempt to divert suspected cases of COVID-19 away from larger patient areas while protecting staff and patients. This commentary outlines the planning, work flow and challenges of implementing this drive through testing site in a rural community setting.	By testing patients at remote locations, it helped keep most of the symptomatic COVID-19 carriers out of the primary care facilities, and even some asymptomatic carriers. The drive-through testing site also created an efficient screening system to protect the entire community at large and support the efforts of the local county health department. The majority of the testing performed across the current health system in SWWI region were tested at the primary drive-through site.
<i>Mossa-Basha 2020</i> Policies and Guidelines for COVID-19 Preparedness: Experiences from the University of Washington	Region of the Americas	In this article, the authors discuss the processes that have been implemented at the University of Washington in managing the COVID-19 pandemic as well in preparing for patient surges, which may provide important guidance for other radiology departments who are in the early stages of preparation and management.	Radiology departments play a critical role in policy and guideline development both for the department and for the institutions, specifically in planning diagnostic screening, triage, and management of patients... radiology workflows, volumes, and access must be optimized in preparation for the expected surges in the number of patients with COVID-19.
<i>Muller 2020</i> Strategies for liver transplantation during the SARS-CoV-2 outbreak: Preliminary experience from a single center in France	European Region	Report strategies and preliminary results in liver transplant during the peak of the SARS-CoV-2 pandemic from a single center in France.	From this preliminary experience we conclude that efforts in resource planning, optimal recipient selection, and organ allocation strategy are key to maintain a safe LT activity. Transplant centers should be ready to readapt their practices as the pandemic evolves.
<i>Nelson 2020</i> SARS-Cov-2 viral and serological screening of staff in 31 European fertility units	European Region	The current study aimed to estimate the prevalence of active SARS-CoV-2 infection and seroconversion using paired NAAT and serological testing in all staff members in 30 fertility units and a head office across four countries before the resumption of routine clinical activity.	The low prevalence of seroconversion of fertility clinic staff highlights the need for continued comprehensive risk mitigation strategies and engagement with national endeavours to identify and isolate new cases and their contacts as we embark on the resumption of fertility services.

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Study	WHO region	Objectives	Relevant findings
<i>Neu 2020</i> COVID-19 in Pediatric Long-Term Care: How Infection Control and Prevention Practices Minimized the Impact of the Pandemic on Healthcare Providers and Residents	Region of the Americas	This report illustrates the implementation of prevention and mitigation procedures at our 54-bed pediatric LTCF and the prevalence of testing for COVID-19 among staff and residents as well as the outcomes for infection in these populations.	The outcomes for COVID-19 infection among pediatric LTC staff and residents are in stark contrast to the data available for the adult providers and residents in adult nursing homes. Implementation and change in infection control practices and procedures resulted in much fewer cases of COVID-19 infection in our pediatric LTC residents.
<i>Nogami 2020</i> Impact of the COVID-19 epidemic at a high-volume facility in gynecological oncology in Tokyo, Japan: a single-center experience	Western Pacific Region	Our hospital began screening patients via pre-admission reverse transcriptase-polymerase chain reaction (RT-PCR) for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and chest computed tomography (CT). We summarized and presented our experience.	Postponing treatment was the most common [side effect of COVID-19], therefore, treatment of ovarian tumors and ovarian cancer was considered to be the most likely to be affected among gynecological diseases.
<i>O'Shea 2021</i> Pandemic Planning in Homeless Shelters: A Pilot Study of a Coronavirus Disease 2019 (COVID-19) Testing and Support Program to Mitigate the Risk of COVID-19 Outbreaks in Congregate Settings	Region of the Americas	Our objective was to describe our experience with shelter facility restructuring, daily symptom screening, and rapid testing to mitigate the risk of COVID-19 in the homeless shelter setting in Hamilton, Ontario, Canada.	Shelter restructuring to allow physical distancing, testing, and isolation can decrease outbreaks in shelters.
<i>Pai 2020</i> Responding to the COVID-19 Pandemic: A New Surgical Patient Flow Utilizing the Preoperative Evaluation Clinic	Region of the Americas	To present a multidisciplinary quality improvement team used Define, Measure, Analyze, Improve, and Control methodology to understand the issues, identify solutions, and streamline patient flow.	The study institution has extended a new process to all surgical patients, warranting facility readiness for the resumption of elective surgery.
<i>Pini 2020</i> Is it Possible to Safely Maintain a Regular Vascular Practice During the COVID-19 Pandemic?	European Region	The present study aimed to evaluate the protocol adopted during the emergency phase of the COVID-19 pandemic to maintain elective activity in a vascular surgery unit while minimising the risk of contamination to both patients and physicians and the ICU resources necessary to maintain such activity.	A dedicated protocol allowed maintenance of regular elective vascular surgery activity during the emergency phase of the COVID-19 pandemic, with no contamination of patients or physicians and minimal need for IC resources.
<i>Podboy 2020</i> Implementation and Impact of Universal Preprocedure Testing of Patients for COVID-19 Before Endoscopy	Region of the Americas	In this report we assessed the outcomes and impact of our first 8 wk of preprocedural screening and testing for COVID-19.	Our study indicates that preprocedural testing of endoscopy patients for COVID-19 in low-prevalence areas has a low yield, but offers many additional significant benefits, which should be considered by centers contemplating adopting this process.

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Table 1 (continued)

Study	WHO region	Objectives	Relevant findings
<i>Pseudos 2021</i> Halting a SARS-CoV-2 outbreak in a US Veterans Affairs nursing home	Region of the Americas	To discuss our experience in facing a COVID-19 outbreak in our US Veterans Affairs (VA) affiliated nursing homes.	In conclusion, SARS-CoV-2 infection can spread rapidly within skilled nursing facilities and can potentially cause high morbidity and mortality. Swift detection by rapid RT-PCR testing of all asymptomatic carriers (residents and employees via universal testing) and implementation of strict infection control and isolation measures are pivotal in containing and thus eliminating a COVID-19 outbreak.
<i>Roxby 2020</i> Outbreak Investigation of COVID-19 Among Residents and Staff of an Independent and Assisted Living Community for Older Adults in Seattle, Washington	Region of the Americas	To conduct surveillance for SARS-CoV-2 and describe symptoms of COVID-19 among residents and staff of an independent/assisted living community.	Compared with skilled nursing settings, in assisted/independent living communities, early surveillance to identify asymptomatic persons among residents and staff, in combination with adherence to recommended preventive strategies, may reduce viral spread.
<i>Roxby 2020</i> Detection of SARS-CoV-2 Among Residents and Staff Members of an Independent and Assisted Living Community for Older Adults; Seattle, Washington, 2020	Region of the Americas	Described a mass testing campaign at an assisted living community after one of the residents tested positive.	Symptom-based screening might not identify SARS-CoV-2 infections in independent and assisted living facility residents, underscoring the importance of adhering to CDC guidance to prevent COVID-19 transmission in senior living communities.
<i>Shah 2021</i> An Algorithm for Ramp Up of Ophthalmic Elective Surgeries Post-COVID-19	Region of the Americas	To describe the protocol for screening asymptomatic patients before proceeding to elective ophthalmic surgery.	Out of the 360 asymptomatic patients tested, two patients (0.6%) tested positive for SARS-CoV-2, which required the cancellation of their surgeries. Because of the possibility of positive COVID-19 status in asymptomatic patients and the risk this poses to other patients and staff, testing all asymptomatic patients for SARS-CoV-2 before elective surgeries is highly recommended.
<i>Shi 2021</i> Management and implementation strategies of pre-screening triage in children during coronavirus disease 2019 pandemic in Guangzhou, China	Western Pacific Region	To explore the effect of the implementation and management strategy of pre screening triage in children during COVID-19.	The effective strategies for pre-screening triage have an essential role in the prevention and control of hospital infection.
<i>Siedner 2020</i> Protocol: Leveraging a demographic and health surveillance system for Covid-19 Surveillance in rural KwaZulu-Nata	Western Pacific Region	To conduct active Covid-19 surveillance and to estimate the health and non-health impacts of the Covid-19 epidemic in rural South Africa and to support the local public health response by the Department of Health (DoH) through screening, testing, case notification and linking Covid-19 cases to care.	Widespread SARS-CoV-2 testing for surveillance and case identification has been established as a major priority in the epidemic response. Although testing capacity has been limited in many areas of the world, HDSS provide a pre-existing structure in resource-limited settings that is purpose-built for surveillance, with both expertise and infrastructure for conducting population-based surveys.

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Table 1 (continued)

Study	WHO region	Objectives	Relevant findings
<i>Subramaniam 2020</i> Screening of COVID-19 suspect cases in a Cargo Ship: A rare field experience	South-East Asia Region	To (1) screen the COVID-19 suspect cases systematically in the vessels. To (2) identify the gaps (if any) during the process of collection, transport, and reporting of the results of samples of COVID-19 Suspect cases. (3) To know the process of risk communication to the stakeholders and media. (4) To share the field experience with other seaports for enhancing their knowledge on safe and systematic screening of COVID-19 Suspect cases in vessels.	Pre-arrival e-mail follow-up and arrangements like coordination meeting with the stakeholders led to proper planning. Systematic screening and proper liaison with State Health team helped in the early diagnosis of the suspects. Proper and early risk communication to the stakeholders and media prevents panic, facilitates good support and prevents communication of maleficious information to the public.
<i>Szenes 2021</i> Stepwise Strategic Mitigation Planning in a Pediatric Oncology Center During the COVID-19 Pandemic	Region of the Americas	We describe the pragmatic steps taken to screen, test, and manage pediatric patients over time during the initial stages of the pandemic.	Prioritizing and optimizing of patient caregiver screening, case isolation, and ultimately COVID-19 surveillance testing have paved the way toward a new beginning where the active management of COVID positive patient flow using centrally accessible testing dash-boards, segregated treatment areas, and dedicated personnel can be realized, allowing for a much needed and highly anticipated shift in focus from pandemic mitigation to the restoration of full cancer care activities.
<i>Tang 2020</i> Serologic Detection of SARS-CoV-2 Infections in Hemodialysis Centers: A Multicenter Retrospective Study in Wuhan, China	Western Pacific Region	The current study was designed to evaluate the prevalence of SARS-CoV-2 infection based on both nucleic acid testing (NAT) and antibody testing in Chinese patients receiving MHD.	Serologic testing may help evaluate the overall prevalence and understand the diversity of clinical courses among patients receiving MHD who are infected with SARS-CoV-2.
<i>Turunen 2021</i> COVID-19 outbreak at a reception centre for asylum seekers in Espoo, Finland	European Region	The aim of the universal screening was to perform case finding, to determine the extent of the outbreak, and to inform future public health response in reception centres and similar environments. Furthermore, we aimed to study how symptoms developed over time in those who were asymptomatic at the time of testing.	In this large COVID-19 outbreak, voluntary mass screening provided valuable information about its extent and helped guide the public health response. Comprehensive quarantine and isolation measures were likely instrumental in containing the outbreak.
<i>Urban 2020</i> Implementation of Preoperative Screening Protocols in Otolaryngology During the COVID-19 Pandemic	Region of the Americas	Here, we describe the preoperative testing protocols implemented by our department and institution. We also provide a retrospective review of otolaryngologic surgical patients from our center to analyze the testing results and the effects on surgical timing.	Preoperative screening is a critical aspect of safe surgical practice in the midst of the wide-spread pandemic. Rapid implementation of universal point-of-care screening is possible without major workflow adjustments or operative delays.
<i>Volpp 2021</i> Minimal SARS-CoV-2 Transmission After Implementation of a Comprehensive Mitigation Strategy at a School New Jersey, August 20–November 27, 2020	Region of the Americas	Reporting on a program in schools that tested students, staff and teachers for COVID-19 twice a week.	Comprehensive mitigation approaches including frequent testing and universal masking can help prevent outbreaks in in-person high school settings even when community transmission is ongoing.

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Table 1 (continued)

Study	WHO region	Objectives	Relevant findings
Wang 2020 Providing uninterrupted care during COVID-19 pandemic: experience from Beijing Tiantan Hospital	Western Pacific Region	We, therefore, would like to share our hospital-wide prevention and management policy during this pandemic to help other healthcare systems to function in this crisis.	A comprehensive policy is helpful to protect the employee from infection and to provide quality and uninterrupted care to all who need these, including patients with acute ischaemic stroke.
Wilburn 2021 COVID-19 within a large UK prison with a high number of vulnerable adults, march to June 2020: An outbreak investigation and screening event	European Region	To describe the public health response to COVID-19 within a large prison with a high number of clinically vulnerable residents.	The findings were consistent with the hypothesis of a propagating outbreak with decreasing incidence since the peak date of onset. COVID-19 transmission within a high-risk setting was quickly contained, and an explosive outbreak was prevented through a multi-agency public health response.
Xia 2021 How to restore medical services in the ophthalmic department in the post-pandemic period of COVID-19	Western Pacific Region	To guide the ophthalmology department of medical institutions to recover from the post-pandemic period of COVID-19, we designed relevant prevention and control strategies formulated by the National Health Committee, combined with our practical work of hospital pandemic management.	Ultimately the ophthalmic ward was free of infection with the novel coronavirus. These showed that our prevention strategies were effective for ophthalmology department to defending COVID-19 in the process of recovering medical services.
Yau 2020 COVID-19 Outbreak in an Urban Hemodialysis Unit	Region of the Americas	We report the dynamics and course of a recent COVID-19 outbreak affecting patients and staff at an urban hemodialysis unit.	Universal SARS-CoV-2 testing and universal droplet and contact precautions in the setting of an outbreak appeared to be effective in preventing further transmission.
Zhao 2020 Evidence-Based Framework and Implementation of China's Strategy in Combating COVID-19	Western Pacific Region	This article aims to use empirical data from all cases from a prefecture-level city of China to introduce and examine the feasibility and efficiency of the screening and isolation strategies and how these were essential in combatting the COVID-19 outbreak.	This study has fully confirmed that controlling the COVID-19 outbreak through screening and isolation is effective, efficient, and essential. The evidence-based framework and implementation of China's strategy to combat COVID-19 can explain how China contained the COVID-19 outbreak in a short time period. This study offers important references and implications for containing the COVID-19 pandemic in the global community.
Disease Addressed: Ebola (EVD)			
Awoonor-Williams 2021 Self-reported challenges to border screening of travelers for Ebola by district health workers in northern Ghana: An observational study	African Region	The objective of this study was to assess not only the volume of screening conducted and the resulting number of suspected cases identified, but also to identify the challenges associated with implementing EVD screening along the border of the UER in northern Ghana.	Screening for Ebola remains sub-optimal at the entry points in northern Ghana due to several systemic and structural factors. Given the likelihood of future infectious disease outbreaks, additional attention and support are required if Ghana is to minimize the risk of travel-related spread of illness.

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Study	WHO region	Objectives	Relevant findings
<i>Sugalski 2015</i> Development and Use of Mobile Containment Units for the Evaluation and Treatment of potential Ebola Virus Disease (EVD) Patients in United States Hospital	Region of the Americas	This article discusses the development and use of a mobile containment unit in an extended treatment area as a novel approach to isolation and screening of potential EVD patients.	Space restrictions within the hospital, limited advanced notice of patient arrival, staff and patient safety, and patient privacy issues, made adaptation of Western Shelters, originally designed for disaster response, for use as a mobile containment unit a viable option. They are ideal for the isolation, screening, and treatment of potential EVD patients at this hospital. We present our experience as a possible alternative for hospitals to manage patients with highly communicable and potentially lethal infectious diseases.
<i>Wadman 2015</i> Emergency Department Processes for the Evaluation and Management of Persons Under Investigation for Ebola Virus Disease	Region of the Americas	We describe a process using the expertise and experience of biocontainment unit and ED personnel to develop processes for the identification, isolation, and care of the patient under investigation presenting to the ED.	ED processes for the safe and timely evaluation and management of the person under investigation for Ebola virus disease are presented with the ultimate goals of protecting providers and ensuring a consistent level of care while confirmatory testing is pending.
Disease Addressed: Influenza subtype H1N1			
<i>Ausset 2012</i> Clinical, virological and epidemiological assessment of 2009 influenza A (H1N1) pandemic in a Belgian university Hospital	European Region	The main objectives of this study were to identify patients admitted to ED for ILI syndrome and to analyze the characteristics of hospitalized patients for respiratory infections and of virologically confirmed patients for (2009) H1N1 infection. We also assessed the impact on hospital care such as: ward isolation process, personal protective equipment (PPE) consumption and antiviral therapy.	The impact of (2009) H1N1 pandemic influenza remained limited, except for ICU patients requiring ECMO. Implementation of screening, isolation, and virological diagnosis processes led to significant improvement of patient management. They found the screening/ isolation and virological process to be time and resource consuming, but contributed to better outcomes.
<i>Eppes 2012</i> Telephone triage of influenza-like illness during pandemic 2009 H1N1 in an obstetric population	Region of the Americas	Our study sought to determine the outcomes of a protocol beginning with telephone triage for evaluation and treatment of ILI in pregnant women. We hypothesized that the introduction of this system would decrease in person in-hospital evaluation without incurring additional morbidity.	This triage system (which included PCR screening) improved efficiency of re-source utilization without incurring apparent influenza-like illness morbidity.
<i>Gunaratnam 2014</i> Airport arrivals screening during a pandemic (H1N1) 2009 influenza in New South Wales, Australia	Western Pacific Region	To examine the effectiveness of airport screening in New South Wales (NSW) during pandemic (H1N1) 2009 influenza.	Airport screening was ineffective in detecting cases of influenza A(H1N1)pdm09 in NSW. Its future use should be carefully considered against potentially more effective interventions, such as contact tracing in the community.

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Table 1 (continued)

Study	WHO region	Objectives	Relevant findings
Disease Addressed: Human Immunodeficiency Virus (HIV)			
<i>Burrell 2018</i> Implementation of a Collaborative HIV and Hepatitis C Screening Program in Appalachian Urgent Care Settings	Region of the Americas	The purpose of our study was to implement an electronic medical record (EMR)-based HIV and HCV screening program at three of our local urgent care clinics with the primary objective of using BPAs to enhance a provider's likelihood of ordering a test in patients eligible for HIV and HCV screenings. A secondary objective was to increase the overall number of tests ordered, adapting from very minimal to routine testing practices.	Introducing an EMR-based screening program is an effective method to identify and screen eligible patients for HIV and HCV in Appalachian urgent care settings where universal screenings are not routinely implemented.
<i>Gouse 2016</i> HIV testing and sero-prevalence among methamphetamine users seeking substance abuse treatment in Cape Town	African Region	The aims of this preliminary investigation were to establish whether routine provider-initiated HIV testing in a drug treatment facility is feasible, to report the HIV sero-prevalence of methamphetamine users seeking drug treatment, and to determine whether demographic and substance use characteristics are associated with HIV status.	Our study suggests that integrating routine HIV testing into substance abuse treatment is feasible in a community-based health centre. The low HIV prevalence among this sample of treatment-seeking methamphetamine users highlights the potential benefits of supporting expanded efforts to optimise HIV prevention with this young adult population.
<i>Graham 2020</i> A Novel HIV-1 RNA Testing Intervention to Detect Acute and Prevalent HIV Infection in Young Adults and Reduce HIV Transmission in Kenya: Protocol for a Randomized Controlled Trial	African Region	The Tambua Mapema Plus study aims to (1) test 1500 young adults (aged 18–39 yrs) identified by an AHI screening algorithm for acute and prevalent (i.e., seropositive) HIV, linking all newly diagnosed HIV-infected patients to care and offering immediate treatment; (2) offer assisted HIV partner notification services to all patients with HIV, testing partners for acute and prevalent HIV infection and identifying local sexual networks; and (3) model the potential impact of these two interventions on the Kenyan HIV epidemic, estimating incremental costs per HIV infection averted, death averted, and disability-adjusted life year averted using data on study outcomes.	The Tambua Mapema Plus study will provide foundational data on the potential of this novel combination HIV prevention intervention to reduce ongoing HIV transmission in Kenya and other high-prevalence African settings.

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Study	WHO region	Objectives	Relevant findings
<i>Gustafson 2020</i> Routine HIV testing in acute care hospitals: Changing practice to curb a local HIV epidemic in Vancouver, BC	Region of the Americas	We describe results and lessons learned from implementation of this routine testing initiative and the effort to cement a sustained change to policy and practice.	This study provides practice-based evidence of the feasibility, acceptability, and effectiveness of implementing a recommendation for routine HIV testing among inpatient and emergency department admissions, as well as the ability to normalize and sustain this change. Routine hospital-based HIV testing can increase diagnoses of acute HIV infection and facilitate earlier initiation of antiretroviral treatment.
<i>Jennings 2018</i> A Pilot Study to Increase the Efficiency of HIV Outreach Testing Through the Use of Timely and Geolocated HIV Viral Load Surveillance Data	Region of the Americas	We designed a pilot project to test the effectiveness of using HIV community viral load to target places for the identification of newly HIV-infected individuals and those who were virally unsuppressed, with the ultimate goal of informing public health practice focused on decreasing HIV transmission.	These results suggest that using community viral load to increase the efficiency of HIV outreach testing is feasible and may be effective in identifying more HIV positives. The pilot project provides a model for other public health practice demonstration projects.
<i>Johnson 2020</i> Combating Stigma Through HIV Self-Testing: New York State's HIV Home Test Giveaway Program for Sexual Minorities	Region of the Americas	The NYS HHTG intends to (1) promote HIV screening among MSM/TG/GNC individuals who have sex with men and (2) identify individuals with undiagnosed HIV infection. This study describes the NYS HHTG (outside of NYC) and reports key findings from its evaluation.	Media campaigns were effective in promoting HIV testing among priority populations and reaching individuals who have never been tested for HIV.
<i>Mahmud 2013</i> Prevalence of HIV in Pregnant Women Identified with a Risk Factor at a Tertiary Care Hospital	Eastern Mediterranean Region	The objective of the study was to see prevalence of HIV in pregnant women identified with a risk factor at a tertiary care hospital.	A simple Risk Assessment Questionnaire can help us in identifying women who need HIV screening. Sexual transmission still remains the commonest cause of HIV transmission.
<i>Piyaraj 2018</i> The finding of casual sex partners on the internet, methamphetamine use for sexual pleasure, and incidence of HIV infection among men who have sex with men in Bangkok, Thailand: an observational cohort study	South-East Asia Region	This study aims to determine the associations between finding casual sex partners on the internet and incident methamphetamine use and HIV infection.	Virtual HIV prevention education, drug use harm reduction, and biomedical HIV prevention methods, such as pre-exposure prophylaxis, could help to reduce or revert the HIV epidemic among MSM in Bangkok.
<i>Ramirez-Avila 2012</i> Routine HIV Testing in Adolescents and Young Adults Presenting to an Outpatient Clinic in Durban, South Africa	African Region	Our objective was to evaluate the proportion of adolescents (12–17 yrs) and young adults (18–24 yrs) who underwent HIV testing and the prevalence among those tested in an urban adult outpatient clinic with a routine HIV testing program in Durban, South Africa.	Although the HIV prevalence is high among youth participating in an adult outpatient clinic routine HIV program, the uptake of testing is low, especially among 12–17 yr old males. There is an urgent need to offer targeted, age-appropriate routine HIV testing to youth presenting to outpatient clinics in epidemic settings.

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Table 1 (continued)

Study	WHO region	Objectives	Relevant findings
Wechsberg 2014 The biobehavioral Women's Health CoOp in Pretoria, South Africa: study protocol for a cluster-randomized design	Western Pacific Region	The aim of this study is to assess the relative impact of adding the Women's Health CoOp (WHC) to standard Test, Treat, and Retain (TTR) practices on the numbers of HIV-positive, AOD-using women who receive medical evaluations (e.g., CD4, viral load), initiate treatment, remain in treatment, and have suppressed viral load. It will also assess the relative impact of adding the WHC to TTR practices on reductions in risk behaviors (e.g., alcohol or other drugs (AOD) use, not using condoms, victimization) among all women, regardless of their HIV status.	The biobehavioral intervention in this study merges an efficacious behavioral HIV prevention intervention for women with biomedical prevention through HIV treatment as prevention using a Seek, Test, Treat and Retain strategy. This combination biobehavioral intervention is designed to (1) improve the quality of life and reduce HIV infectiousness among women who are HIV positive, and (2) reduce HIV risk behaviors among women regardless of their HIV status. If efficacious, this intervention could help control the HIV epidemic in South Africa.
Zang 2016 Cost-Effectiveness of the "One4All" HIV Linkage Intervention in Guangxi Zhuang Autonomous Region, China	Western Pacific Region	To determine the incremental cost-effectiveness of the One4All intervention delivered at county hospitals in Guangxi, China, compared to the current standard of care (SOC).	The One4All intervention should be considered an integral component of a comprehensive HIV prevention and treatment strategy that would also include more active modes of HIV testing to reach undiagnosed populations at earlier stages of disease progression, and in marginalized or hard-to-reach populations, as well as efforts to optimize ART engagement.

ART: Anti retroviral therapy; COPC: Community-orientated primary care; CST: Community-based screening and testing; HCV: Hepatitis C Virus; HCW: Healthcare worker; IDOC: Idaho department of corrections; KPSC: Kaiser Permanente Southern California; MHD: Maintenance hemodialysis; PHC: Primary health care; SWWI: Southwest Wisconsin; LTCF: Long-term care facility; HDSS: Health and demographic surveillance systems.

^a May not add up to 100%.

3.2. Consideration of health equity, PROGRESS-Plus: measures of (in)equity

Measures of equity/inequity were assessed based on the PROGRESS-Plus framework. None of the 86 included studies evaluated whether the intervention reduced health inequity or inequalities as a program objective, nor did they include a formal definition of equity/inequity (or framework). Elements of health equity were indirectly addressed in 71 studies (Table 2), largely through the use of targeted interventions. Of these 71 studies, 59 (69%) included at least one category of PROGRESS-Plus in the justification, methods, results or discussion of the paper, while only 41 of the 71 (58%) articles indirectly alluding to health equity addressed a PROGRESS-Plus category in all relevant sections of their article (Table 2): from the introduction to the discussion and conclusion. The target populations were most often described as disadvantaged subgroups of the population who bore the largest burden of disease and/or who were at increased risk of infection. For example, two articles, one which focused on HIV/AIDS (31*) and one on COVID-19 (22*), targeted their programs toward gay, bisexual, and other men who have sex with men (MSM) who are disproportionately affected by the HIV/AIDS epidemic

and incarcerated persons who face additional exposure and risk of infection by living in a congregate house setting, respectively.

4. Discussion

The articles included in the present scoping review cover a large range of testing strategies, target populations, and testing jurisdiction across WHO regions [30,31]. In the contexts of outbreaks or epidemics, none of the 86 articles included an explicit application of equity considerations. Indeed, this is despite the wide recognition that existing health inequities influence the morbidity and mortality of a given disease and therefore, have the potential to further exacerbate existing disparities within and between populations [32–34]. In order for a testing strategy to be effective, testing needs to be accessible to all, including those most in need who are often also the most disadvantaged [25].

Targeting a testing intervention to certain population groups, based on need or risk is a form of equity consideration. Seventy-one of the included studies did indirectly include notions of equity through their justification of spe-

cific target population, either because of a higher risk of being infected (e.g., HIV/AIDS and drug users or MSM (70,73*), prisoners (22,29,40,62*) or health care workers (6,8,11,15,21,32,43,46,52,53,57,63,64,69,72*) or of complications (e.g., COVID-19 and elders (6,8,42,51–53,69*), patients (7,9,11,15–18,20,21,23,26,32,33,36,39,43,44,48–50,52,53,58,61,63,64,66,67,71,75,78,80,82,84*), or tailored to reach population subgroups overlooked/not reached by existing programs (19,86*). Noticeably, only 5 out of the 86 studies targeted population subgroups based on social determinants of health (e.g., homelessness, sex workers, or other particularly vulnerable populations (19,24,35,73,86*)) rather than age (e.g., elderly: $n = 7$ [6,8,42,51–53,69*]), or general work place testing programs ($n = 16$) (6,8,11,15,21,22,32,35,40,52,53,55,62–64,69*). The listed studies as well as any future studies would greatly benefit from applying an equity lens and/or formal equity framework to testing interventions; from planning to evaluation. This would optimize efforts to reduce inequitable health outcomes in disadvantaged groups in the context of outbreaks, epidemics, and pandemics.

To our knowledge, no prior reviews have examined the equitable access, delivery, or design of COVID-19 screening programs. It is largely recognized that targeted actions toward specific communities or groups imply labelling, potentially leading to stigma, and increases the risk of missing numerous infections in particularly vulnerable population groups [11,12,35,36]. The current pandemic is exacerbating health inequities and screening programs need to be designed accordingly to address these inequities, which are also central to mitigating disease spread [37–39]. An example of an approach that could be used in combination with existing screening infrastructure to increase equitable access to COVID-19 screening consists of the deployment of rapid antigen testing kits for in-home testing for those with faced with mobility or geographic restrictions or work and/or family obligations that do not easily coincide with testing program schedules [3].

Numerous tools exist to support incorporating equity values within public health interventions and programs [40–42]. These tools should be used both during the design, implementation, and evaluation process, as the link between equity intention and action remains challenging [43]. TIDieR-PHP was developed to enable consistent reporting of Population Health and Policy (PHP) interventions to promote transparency and transferability of findings to diverse settings. PHP interventions are crucial to addressing disparities in social and economic determinants of health [44]. This tool, when used in combination with the PROGRESS-Plus framework, should ensure that practitioners and researchers are thinking critically about what health inequities they are addressing, how they are being measured and considered consistently throughout the program design, implementation, and evaluation process. To ensure that public health interventions are developed and

implemented around the concept of equity, strong health policies and educational goals of healthcare professionals need to be on the public political and economic agenda [45].

Recommendations towards improving the inclusion of health equity in large-scale testing interventions

- Use tools such as PROGRESS-Plus framework to ensure explicit inclusion of health equity when in the process of designing, implementing, and/or evaluating interventions.
- Promote the use of TIDIER-PHP to systematically review public health programs and promote replicability of existing equitable programs to other settings.

4.1. Limitations

There are several limitations in this study. First, there could be possible gaps in our search strategy which may have excluded some relevant articles either due to the selection of keywords, databases, or the exclusion of some additional search methodologies. We may have omitted some relevant studies published in other languages which could have biased the geographic scope of our results. Additionally, due to our specific interest in examining these concepts in the context of peer-reviewed scientific literature we excluded grey literature, which can be an important source of public health information and potentially prevented the analysis of relevant cases that were not published in scientific journals. Furthermore, the assessment of implicit equity during the data extraction process was based on the subjective interpretation of the reviewers. Though we had clear guidelines on what to look for, it is possible that some articles had target populations with an equity or equality lens, but were not captured in this review because of the way the information was presented.

4.2. Conclusion

The results of this scoping review highlight the overall lack of consideration of equity in the design of large-scale testing interventions. This is a particularly concerning issue as social and economic inequities continue to be exacerbated by COVID-19 and there has been limited research to date that discusses how COVID-19 screening programs have been designed with equity in mind [1–3]. To achieve equity in screening and to optimize the role of testing in disease prevention and control, strategies should ensure that the probability of being tested is proportionate to the risk of being affected by the disease [25,46]. We urge practitioners, decision makers, and researchers to

Table 2. Results of equity appraisal using concepts of implicit/explicitly defined equity and PROGRESS-plus categories.

Characteristic	No (%) n = 86	References	Text illustrations
<i>Type of equity consideration included in article (explicit, implicit, or none)</i>			
Implicit	71 (83%)	Abey Suriya 2020 Burrell 2018 Aykaç 2021 Creput 2020 Bernadou 2021 Blumberg 2020 Boffa 2020 Buhimschi 2020 Callaghan 2020 Eppes 2012 Fassett 2020 Cho 2021 Constantine 2021 Gustafson 2020 Haidar 2021 Halalau 2020 David 2020 deSandes-Freitas 2020 Duan 2020 Dunne 2021 Goldberg 2020 Gilbert 2020 Gouse 2016 Graham 2020 Gruskay 2020 Lee 2021 Lewis 2021 Li 2021 Jain 2021 Jennings 2018 Johnson 2020 Joshi 2020 Karmarkar 2020 Kirshblum 2020 Kwon 2020 O’Shea 2021 Pai 2020 Mahmud 2013 Manauis 2020 Marco 2021 Marcus 2020 Mash 2020 McDougal 2021 Ramirez-Avila 2012 Molling 2020 Mossa-Basha 2020 Muller 2020 Nelson 2020 Neu 2020 Nicolás 2021 Pini 2020 Piyaraj 2018 Podboy 2020 Psevds 2021 Roxby 2020 Roxby 2020 Tang 2020 Turunen 2021	“Hemodialysis attendance, including travel to and from the center, entails close interaction with individuals who may be infected with SARS-CoV-2. Concerns regarding viral acquisition are heightened because hemodialysis recipients have multiple risk factors for severe COVID-19” - <i>Yau 2020</i> “Although 37% of men and women between the ages of 15 and 49 have been tested for Human Immunodeficiency Virus (HIV), testing rates are much lower among key populations, such as female sex workers or women who use alcohol or other drugs (AOD). This is problematic because HIV prevalence among female sex workers exceeds 50% in some areas, 65% in South Africa and HIV prevalence among women who use AOD but are not sex workers is often greater than 30% despite the high prevalence of HIV, only 60% of female sex workers are reached by current HIV prevention programs (e.g., HIV testing, condom distribution). This relatively low rate of HIV testing in this key population represents a missed public health opportunity” - <i>Wechsberg 2014</i> “Multiple factors place resource-limited settings at considerable risk of epidemics of respiratory disease [...]. The study area covers approximately 850 km ² , it is largely rural with one town of approximately 30,000 residents, and among the lowest-ranked areas in South Africa in terms of socioeconomic status.” - <i>Siedner 2020</i> “Many prison residents are at higher risk of severe COVID-19 and death due to significant comorbidities, and advanced age in some prisons” - <i>Wilburn 2021</i> “Newark is home to a diverse immigrant population, including many from the West African countries affected by the current Ebola Virus Disease (EVD) outbreak, and many of these immigrants use UH for their health care.” - <i>Sugalski 2015</i>

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Table 2 (continued)

Characteristic	No (%) n = 86	References	Text illustrations
		Urban 2020 Volpp 2021 Wang 2020 Shah 2021 Shi 2021 Siedner 2020 Sugalski 2015 Szenes 2021 Wechsberg 2014 Wilburn 2021 Xia 2021 Yau 2020 Zang 2016	
None	15 (17%)	Alinier 2020 Ausselet 2012 Awoonor-Williams 2021 Ferrari 2021 Gehrke 2021 Gunaratnam 2014 Liu 2020 Luo 2021 Maechler 2020 McSwain 2020 Nogami 2020 Kohns Vasconcelos 2021 Wadman 2015 Subramaniam 2020 Zhao 2020	NA
<i>Progress-Plus</i>			
Any PROGRESS-Plus factor ^a	Included in some - not all section:	Burrell 2018	NA
Total: 71 (83%)	30 (42%)	Aykac 2021 Creput 2020 Blumberg 2020 Callaghan 2020 Cho 2021 Constantine 2021 Gustafson 2020 Haidar 2021 Halalau 2020 deSandes-Freitas 2020 Dunne 2021 Gilbert 2020 Lee 2021 Lewis 2021 Joshi 2020 Kwon 2020 Manauis 2020 Marcus 2020 Mash 2020 Nelson 2020 Podboy 2020 Psevdos 2021 Roxby 2020a Urban 2020 Volpp 2021 Wang 2020 Shah 2021 Siedner 2020 Wilburn 2021	

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Table 2 (continued)

Characteristic	No (%) n = 86	References	Text illustrations
	Included in all sections: 41 (58%)	Abey Suriya 2020 Bernadou 2021 Boffa 2020 Buhimschi 2020 Nicolás 2021 David 2020 Duan 2020 Eppes 2012 Fassett 2020 Goldberg 2020 Gouse 2016 Graham 2020 Gruskay 2020 Jain 2021 Jennings 2018 Johnson 2020 Karmarkar 2020 Kirshblum 2020 Li 2021 Mahmud 2013 Marco 2021 McDougal 2021 Molling 2020 Mossa-Basha 2020 Muller 2020 Neu 2020 O'Shea 2021 Pai 2020 Pini 2020 Piyaraj 2018 Ramirez-Avila 2012 Roxby 2020b Shi 2021 Sugalski 2015 Szenes 2021 Tang 2020 Turunen 2021 Wechsberg 2014 Xia 2021 Yau 2020 Zang 2016	
<i>Progress-Plus - Categories</i>			
Place of residence Total: 21 (30%)	Mentioned in some Sections- not all: 9(13%)	Burrell 2018 Ayakac 2021 Callaghan 2020 Gustafson 2020 Dunne 2021 Joshi 2020 Marcus 2020 Roxby 2020a Siedner 2020	<p>“Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the novel coronavirus responsible for causing coronavirus disease 2019 (COVID-19), has particularly affected those in congregate settings, such as nursing homes, prisons, and homeless shelters. In Canada, several outbreaks have been documented in homeless shelters. Preventing and minimizing outbreaks in shelter settings using limited resources protects residents and staff within shelters as well as those who they may interact with in the broader community” - <i>O'Shea 2021</i></p> <p>“Skilled nursing facility (SNF) staff care for medically fragile residents, often in settings with limited infection prevention and control (IPC) capacity. Given the substantial morbidity and mortality during novel coronavirus disease 2019 (COVID-19) outbreaks in SNFs nationwide, SNFs are a high priority for outbreak prevention and control” - <i>Karmarkar 2020</i></p> <p>“Due to the overcrowded nature of prisons where social distancing is less achievable, COVID-19 will likely spread faster and cause explosive outbreaks if not quickly controlled” - <i>Wilburn 2021</i></p> <p>“A military training base [...] congregate living is prone to infectious disease outbreaks” - <i>Marcus 2020</i></p>

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Table 2 (continued)

Characteristic	No (%) n = 86	References	Text illustrations
	Mentioned in all sections: 12 (17%)	Bernadou 2021 Buhimschi 2020 David 2020 Gouse 2016 Li 2021 Jennings 2018 Johnson 2020 Karmarkar 2020 O'Shea 2021 Molling 2020 Neu 2020 Turunen 2021	
Occupation Total: 35 (49%)	Mentioned in some Sections- not all: 19 (27%)	Aykac 2021 Blumberg 2020 Cho 2021 Constantine 2021 Haidar 2021 Dunne 2021 Gilbert 2020 Joshi 2020 Kwon 2020 Manauis 2020 Marcus 2020 Nelson 2020 Podboy 2020 Psevdos 2021 Urban 2020 Volpp 2021 Wang 2020 Shah 2021 Wilburn 2021	<p>“Many urgent time-sensitive otolaryngology procedures require instrumentation of the airway, which risks aerosolization of respiratory secretions and possible transmission of SARS-CoV-2 to all staff present in the operating room” - <i>Urban 2020</i></p> <p>“Endoscopy room staff may be at increased risk for acquiring infection, because COVID-19 is detectable in the gastrointestinal tract and endoscopy is an aerosol-generating procedure.” - <i>Podboy 2020</i></p> <p>“It is well known that healthcare personnel (HCP) are at increased risk for acquiring SARS-CoV-2 in the United States” - <i>McDougal 2021</i></p>
	Mentioned in all sections: 16 (23%)	Bernadou 2021 Duan 2020 Gruskay 2020 Karmarkar 2020 Kirshblum 2020 O'Shea 2021 Marco 2021 McDougal 2021 Mossa-Basha 2020 Nicolás 2021 Pini 2020 Roxby 2020b Sugalski 2015 Szenes 2021 Wechsberg 2014 Xia 2021	
Gender/Sex Total: 6 (8%)	Mentioned in all sections: 6 (8%)	Abeyuriya 2020 Buhimschi 2020 Johnson 2020 Piyaraj 2018 Wechsberg 2014 Zang 2016	<p>“Gay, bisexual, and men who have sex with men (MSM) are disproportionately affected by the HIV/AIDS epidemics more than any other group” - <i>Johnson 2020</i></p>
Race/Ethnicity Total: 5 (7%)	Mentioned in some Sections- not all: 1 (1%)	Psevdos 2021	<p>“African Americans contracting SARS CoV-2 at higher rates and are more likely to die” - <i>Psevdos 2021</i></p> <p>“High HIV prevalence in South Africa. Gender inequality issues continue to drive the HIV epidemic in South Africa, where Black African women bear the greatest HIV burden. Limited access to services; little capacity to negotiate sex and condom use; and other legal, social, and economic inequities make women highly vulnerable to HIV infection” - <i>Wechsberg 2014</i></p>

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Table 2 (continued)

Characteristic	No (%) n = 86	References	Text illustrations
	Mentioned in all sections: 4 (6%)	Buhimschi 2020 Johnson 2020 Sugalski 2015 Wechsberg 2014	
Socioeconomic status Total: 5 (7%)	Mentioned in some Sections- not all: 1 (1%)	Siedner 2020	“Covid-19 surveillance in a rural, resource-limited setting with very high prevalence of HIV and tuberculosis, among the lowest-ranked areas in South Africa in terms of socioeconomic status” - <i>Siedner 2020</i> “Community screening and testing was guided by the following principles: (1) presence of cases and (2) social vulnerability of community [...] This approach was preferred to general community screening as it was likely to yield more cases and be more efficient.” - <i>David 2020</i>
	Mentioned in all sections: 4 (6%)	Buhimschi 2020 David 2020 Gouse 2016 Johnson 2020	
Plus Total: 52 (73%)	Mentioned in some sections - not all: 21 (30%)	Burrell 2018 Aykan 2021 Creput 2020 Blumberg 2020 Cho 2021 Gustafson 2020 Haidar 2021 Halalau 2020 deSandes-Freitas 2020 Dunne 2021 Lee 2021 Lewis 2021 Joshi 2020 Manuais 2020 Mash 2020 Nelson 2020 Podboy 2020 Pseudos 2021 Wang 2020 Siedner 2020 Wilburn 2021	“Children in pediatric long-term care (LTC) facilities are commonly infected with respiratory tract viruses as they have many high-risk co-morbidities and require significant interactions with the healthcare team.” - <i>Neu 2020</i> “Although youth (12–24 yrs) in Sub-Saharan Africa have a high HIV risk, many have poor access to HIV testing services and are unaware of their status. Youth (12–24 yrs) are disproportionately affected by the HIV epidemic in sub-Saharan Africa.” - <i>Ramirez-Avila 2012</i> “Patients who underwent surgeries during the incubation period could progress to respiratory failure or multi-organ dysfunction postoperatively, experiencing a higher morbidity and mortality rate.” - <i>Pai 2020</i> “Prior reports have illustrated the unique burden of COVID-19 in psychiatric settings that resulted in outbreaks leading to patient morbidity and mortality. Psychiatric patients are more vulnerable to contracting infectious disease in the community due to the adverse impact of social determinants of health” - <i>Li 2021</i>
	Mentioned in all sections: 31 (44%)	Abey Suriya 2020 Bernadou 2021 Boffa 2020 Buhimschi 2020 Eppes 2012 Fassett 2020 Goldberg 2020 Gouse 2016 Graham 2020 Gruskay 2020 Li 2021 Jain 2021 Johnson 2020 Karmarkar 2020 Kirshblum 2020 Pai 2020 Mahmud 2013 Ramirez-Avila 2012 Mossa-Basha 2020 Muller 2020 Neu 2020 Pini 2020 Roxby 2020b Tang 2020	

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Table 2 (continued)

Characteristic	No (%) n = 86	References	Text illustrations
		Turunen 2021 Shi 2021 Sugalski 2015 Szenes 2021 Wechsberg 2014 Xia 2021 Yau 2020	

^a May not add up to 100%.

explicitly include equity measures when designing and implementing COVID-19 large-scale testing interventions.

CRediT author statement

Katarina Ost: Conceptualization, Methodology, Formal Analysis, Writing - original draft preparation. Louise Duquesne: Methodology, Formal Analysis, Writing - original draft preparation. Claudia Duguay: Methodology, Formal Analysis, Writing - original draft preparation. Isadora Mathevet: Methodology. Lola Travers: Methodology. Valéry Ridde: Conceptualization, Methodology, Supervision, Funding Acquisition. Kate Zinszer: Conceptualization, Methodology, Supervision, Project Administration. All Authors were involved in the Writing-Reviewing and Editing of this manuscript.

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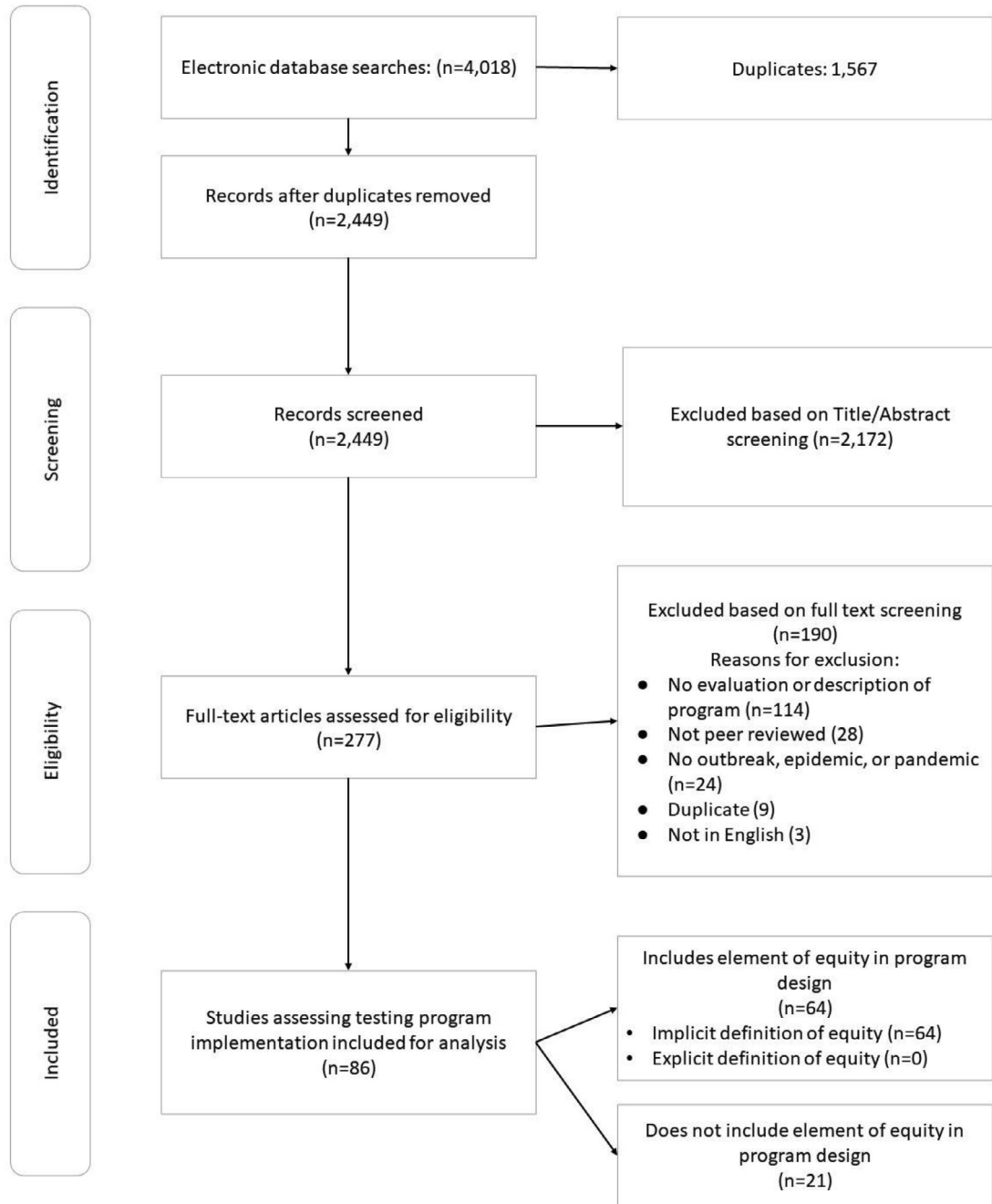
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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.jclinepi.2021.11.030](https://doi.org/10.1016/j.jclinepi.2021.11.030).

Appendix A. PRISMA diagram for selection of articles for data extraction



Appendix B. Queries in the electronic databases Web of Science core collection, Embase, and MEDLINE (filled in on 03/06/2021)

Embase:	
January 1, 2010 to June 3, 2021; n = 1226	
Key Words	
1.	(screening or “mass testing” or “disease testing plan*” or “disease testing program*” or “infectious disease testing”) .ab,kw,ti.
2.	(design or evaluation or planning or implementation) .ab,kw,ti.
3.	(pandemic* or epidemic* or outbreak*) .ab,kw,ti.
4.	(tuberculosis or HIV or “human immunodeficiency virus” or h1n1 or “SARS-COV-2” or “SARS COV2” or “SARSCOV-2” or SARSCOV or “SARS- COV*” or SARSCOV* or “severe acute respiratory syndrome 2” or “severe acute respiratory syndrome cov” or “covid-19” or covid or ncov* or 2019ncov* or “Hcov-19” or coronavirus or “corona virus” or ebola* or EVD) .ab,kw,ti.

EMTREE terms

5.	(Mass Screening OR Mandatory Testing OR screening) .sh.
6.	(Disease Outbreaks OR Epidemics OR Pandemics OR pandemic OR epidemic OR outbreak) .sh.
7.	(Coronavirus Infections OR COVID-19 OR SARS-CoV-2 OR Tuberculosis OR Influenza A Virus, H1N1 Subtype OR HIV OR Hemorrhagic Fever, Ebola OR Ebolavirus OR HIV infections* OR AIDS Serodiagnosis OR HIV infections*) .sh.

Medline:

January 1, 2010 to June 3, 2021; n = 1200	
Key Words	
8.	(screening or “mass testing” or “disease testing plan*” or “disease testing program*” or “infectious disease testing”) .ab,kw,ti.
9.	(design or evaluation or planning or implementation) .ab,kw,ti.
10.	(pandemic* or epidemic* or outbreak*) .ab,kw,ti.
11.	(tuberculosis or HIV or “human immunodeficiency virus” or h1n1 or “SARS-COV-2” or “SARS COV2” or “SARSCOV-2” or SARSCOV or “SARS- COV*” or SARSCOV* or “severe acute respiratory syndrome 2” or “severe acute respiratory syndrome cov” or “covid-19” or covid or ncov* or 2019ncov* or “Hcov-19” or coronavirus or “corona virus” or ebola* or EVD) .ab,kw,ti.

MeSH terms

12.	(Mass Screening OR Mandatory Testing OR screening) .sh.
13.	(Disease Outbreaks OR Epidemics OR Pandemics OR pandemic OR epidemic OR outbreak) .sh.
14.	(Coronavirus Infections OR COVID-19 OR SARS-CoV-2 OR Tuberculosis OR Influenza A Virus, H1N1 Subtype OR HIV OR Hemorrhagic Fever, Ebola OR Ebolavirus OR HIV infections* OR AIDS Serodiagnosis OR HIV infections*) .sh.

Web of Science Core Collection:

January 1, 2010 to June 3, 2021; n = 1592	
1.	TS = (screening or “mass testing” or “disease testing program” or “infectious disease testing”)
2.	TS = (design or evaluation or planning or implementation)
3.	TS = (pandemic* or epidemic* or outbreak*)
4.	TS = (tuberculosis or HIV or “human immunodeficiency virus” or h1n1 or “SARS-COV-2” or “SARS-COV2” or “SARSCOV-2” or SARSCOV or “SARS-COV*” or SARSCOV* or “severe acute respiratory syndrome 2” or “sever acute respiratory syndrome cov” or “covid-19” or covid or ncov* or 2019ncov* or “Hcov-19” or coronavirus or “corona virus” or ebola* or EVD)

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