

COVID-19 PANDEMIC

ESCALATION OF STANDARD PRECAUTIONS DURING COVID-19 PANDEMIC

Review of Electronic Literature and Position Paper

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ABSTRACT • Introduction : It has been proven that COVID-19 asymptomatic carriers and presymptomatic patients do transmit the virus and potentially infect their contacts and caregivers. International medical and scientific societies, as well as governmental and public health bodies, from all over the globe, have issued recommendations about infection prevention and control measures that should be taken, in addition to the general standard precautions measures, while dealing with hospital patients during this pandemic. In this article, we did an electronic review of the published and posted recommendations in different medical scenarios. Accordingly, we put a position set of recommendations about the precautions that are needed to be taken with all patients when the virus is still circulating in the community from an Infectious Disease specialist perspective. **Methods :** This is a narrative electronic review of the available and latest interim guidelines recommendations, position statements, expert commentaries and opinions issued by international scientific societies, international organizations, governmental bodies and public health authorities from different medical specialties in the United States of America, Canada, United Kingdom, Europe, France, Italy, China, Australia, and Asia Pacific region. We searched PubMed and Google Scholar for articles and written material published in English and French between January 1, 2020, and April 25, 2020. **Results :** Recommendations were retrieved from around 50 documents. We endorse the general recommendations that appear in all reviewed specialties. From an infectious disease specialist perspective, the following should be applied to all patients in healthcare settings: • Triage based on a checklist with the timely updated case definition at the entrance and admission to any health facility ward or service. • Aerosol generating procedures to all patients like tracheal intubation for medical reasons or anesthesia, gastrointestinal endoscopy is preferably done under airborne/contact precautions. • Areas of the hospital where patients potentially would undergo aerosol generating procedures should be adequately ventilated and with negative pressure. • All staff should be trained for donning and doffing personal protective equipment, and well trained regarding infection prevention measures in their respective departments. • Face-to-face consultations especially in the vulnerable at risk population, like immunocompromised patients and pregnant women, should be reasonably minimized along with prioritization and deferral of care as much as possible. • Workforce and personal protective equipment management should become a priority in the planning of care. **Conclusion :** The COVID pandemic has become a turning point in the standard of care in healthcare settings. At least, until the availability of universal vaccination or mortality-reducing therapies, healthcare settings will have to apply additional measures to the classical standard precautions, not only to those infected, but to asymptomatic patients, healthcare personnel and visitors.

Keywords : COVID-19; infection prevention and control; standard precautions

INTRODUCTION

The novel coronavirus and its corresponding infection, COVID-19, has become a global threat to human life and well-being, as well as to the global economy. It is suspected that the outbreak originated in the Huanan sea-food market in Wuhan City, China [1].

Since the beginning of the outbreak in December 2019 which transformed into a pandemic, as declared by the WHO in March 2020, more than 3 million people were infected worldwide, with 185 countries affected in five continents by end of April 2020 [2]. A toll death of 227,000 patients was reported by end of April 2020 [2]. Mortality rate has reached 3% with an infectivity index (R0) of 2.3 [2,3]. Two major factors contributed to the snowball effect of the COVID-19 pandemic: the movement of people in the era of globalization, and the human immune system that is completely naïve to the novel coronavirus.

Due to the unavailability of a vaccine and/or definite therapy, the infection prevention strategies in the community and healthcare facilities were the only ways of mitigation against the pandemic. Accordingly, most of the world became under confinement with people staying at home leading to detrimental consequences globally and to individual countries economies [4]. Ultimately, societies will be forced to apply a deconfinement plan, and people will go back to their normal lives, but, until a vaccine is discovered, approved and used universally, COVID-19 will still be smoldering in the communities and finding its way to hospitals [5]. If firm and optimal precautions were not taken properly, there is a big probability of new waves of the pandemic [6].

One of the most important features of COVID-19, in terms of public health and spread of the disease, is the infectivity of asymptomatic and presymptomatic infected individuals [7-9]. The implications of this fact are tremendous. In order to prevent another wave of the pandemic, major changes in our lifestyles and the community are needed and an escalation of the concept of standard precautions in hospitals is crucial.

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In hospitals, an asymptomatic healthcare worker (HCW) or an asymptomatic infected patient would trigger a superspreading event, spreading the infection to other HCWs and to other patients, when the virus is circulating in the communities, theoretically any admitted patient should be considered as a potential carrier of COVID 19 [7]. In order to prevent these superspreading events in hospitals, respiratory precautions from COVID-19 infections in hospitals should become part of standard precautions [10]. The latter encompass the basic principles of infection prevention and control, which aim at preventing infection transmission via healthcare workers, as well as protecting the healthcare workers themselves from contracting any possible infection [11].

The aim of this article is to review the recommendations of the different medical societies in different specialties, about the additional measures that should be applied empirically in hospitals in the context of the 2020 pandemic. These measures are to complement the basic classical set of standard precautions. It is worth noting that infection prevention and control considerations when dealing with suspect and confirmed cases are outside the scope of this article. Thus, this review deals with the empirical precautions to be taken for all patients during the pandemic, in communities where the virus is still circulating.

Based on this review, we will put a position opinion on the additional precautions that have to complement the standard practice in the different specialties in Lebanese hospitals. That being said, we should all take into consideration the epidemiology of the pandemic in Lebanon, as well as the nature of the health system in Lebanon, and the availability of tests and personal protective equipment (PPE).

METHODS

This is a narrative electronic review of the available and latest interim guidelines recommendations, position statements, expert commentaries and opinions issued by international scientific societies, international organizations, governmental bodies and public health authorities from different medical specialties in the United States of America (USA), Canada, United Kingdom (UK), Europe, France, Italy, China, Australia, and Asia Pacific region. We searched PubMed (MEDLINE) and Google Scholar for articles and written material published in English and French between January 1, 2020, and April 25, 2020.

The included papers and documents were either published in peer-reviewed journals or on the official websites of the organizations or scientific societies in question. Medical specialties involved were emergency medicine, critical care medicine, anesthesia, endoscopy, dialysis, ra-

diology, oncology, hematopoietic cell transplantation, obstetrics, blood transfusion, and medical laboratory biosafety practices.

Keywords for the search included: COVID-19, SARS-CoV-2, pandemic, triage, screening, personal protective equipment, social distancing, infection prevention and control, hand hygiene, environmental disinfection, negative pressure systems, airborne/droplet/contact precautions, surgical masks, N95 of FFP2/3 respirators, preparedness, organization, contingency plans, management of workforce, etc. Inclusion criteria for the paper or document were the presence of empiric use of infection prevention measures or facility preparedness irrespective of the COVID-19 status of the patients.

All papers detailing infection prevention interventions among COVID-19 suspect or confirmed cases were excluded. The number of selected papers per specialty is illustrated in Figure 1.

RESULTS

One hundred forty-four documents were retrieved from the electronic search that fulfilled the defined criteria. They dealt with infection control precautions in the Era of COVID-19 Pandemic. They belonged to general international societies and to 10 specialty societies or scientific bodies (Figure 1).

Ninety-three documents were excluded according to the exclusion criteria.

Fifty-one documents were included in the review distributed among the different specialties. Below are the recommendations in general and in different specialties (Tables I and II).

Non-speciality organizations or bodies recommendations

Infection prevention and control precautions for suspected or confirmed COVID-19 cases are well known so far [12-14]. However, in view of the possibility of viral transmission from presymptomatic/asymptomatic patients [7-9] and the potential virus persistence in the community, clinicians, healthcare personnel and policymakers, are concerned with the empiric or additional precautions to be applied to all patients regardless their COVID-19 infection status in multiple inpatient care settings. Several international organizations and governmental services including the World Health Organization (WHO) [12, 13], the US Center for Disease Control and Prevention (CDC) [14], the European Center for Disease Control and Prevention (ECDC) [15], and the United Kingdom National and Public Health Services (Public Health England) (PHE) [16] have published general recommendations regarding these additional precautions. All these

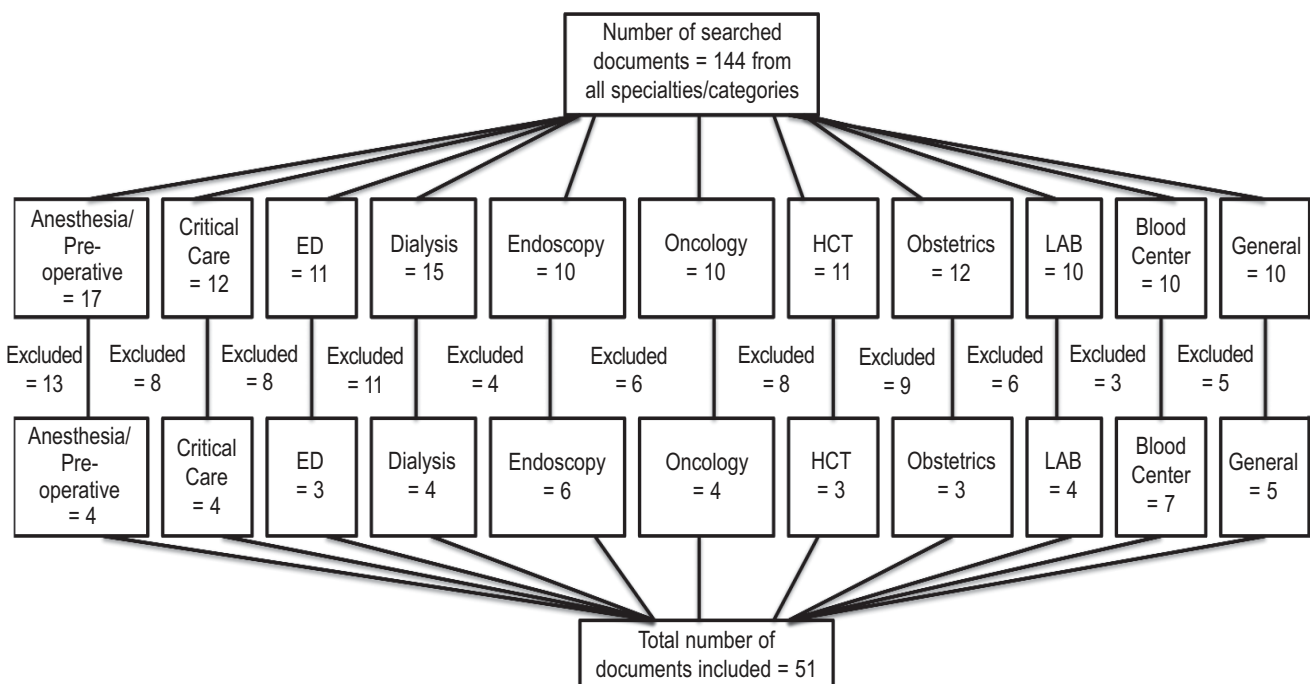


Figure 1. Search results

international organizations have generally agreed on the necessity of applying the following measures to all patients [12-16] (Table I):

1. Triage and assessment of patients presenting to acute care facilities at multiple times and checkpoints (prior to admission, upon admission, during admission, etc.) for fever, upper respiratory tract infection signs and symptoms, as well as contact with COVID-19 suspect/confirmed cases according to predefined checklists.
2. Implementing standard precautions, the minimum infection prevention practices that are designed to both protect the healthcare personnel and prevent them from spreading the infection [11]. These include hand hygiene, use of personal protective equipment according to risk assessment, respiratory hygiene, sharps safety and safe injection practices, proper use of sterile equipment, environmental surfaces cleaning and disinfection, safe handling and cleaning of soiled linen and waste management [11].
3. Social distancing considerations and design modifications inside the facility including distancing 1 to 2 meters between patients in waiting rooms and common treatment areas, separate units for care and separate equipment for COVID-19 patients, organization and proper labeling of entrances, check-in points/patient desks, waiting areas, hallways, patient transport routes, as well as posting infection prevention alerts where necessary.
4. Education and systemic training on in-hospital in-

fection control measures for all healthcare personnel (donning and doffing PPE, hand hygiene, safe use and decontamination of medical equipment, environment cleaning and disinfection).

5. Implementing daily staff screening for COVID-19 for symptoms and/or temperature checks and establishing clear stay-at-home/sick leave policies and return-to-work guidelines.
6. Rigorous patients' visitors and companions policy restricting unnecessary access to the facility to the minimum necessary levels.
7. Crisis planning and management of the workforce (including privileging virtual meetings/continuous education/e-learning/telecommunication between personnel, organization of work schedules, etc.)
8. Judicious management of the resources (mainly for PPE) (prioritization of use, stock management, prolonged use and recycling).

Other special measures were recommended individually by the formerly mentioned organizations to include the following (Table II):

1. Prioritization of care and deferral in case of non-urgent procedures as per the WHO [12] and CDC [14] guidelines.
2. Following contact and droplet precautions for all non-aerosols generating (non-AGP) procedures in patient care using proper PPE (disposable head covers, gloves, fluid-resistant long-sleeved gowns, shoe covers, goggles, full-face shields and surgical masks) as per the ECDC [15] and PHE [16] guidance.

TABLE I GENERAL INFECTION PREVENTION AND CONTROL PRECAUTIONS IN ACUTE CARE FACILITIES DURING THE COVID-19 PANDEMIC AS RECOMMENDED BY INTERNATIONAL ORGANIZATIONS AND SOCIETIES FROM DIFFERENT MEDICAL SPECIALTIES

Measures	General/ Specialty nonspecific	Anesthesia, Preoperative unit	Intensive Care Unit	Emergency Department	Dialysis	Endoscopy	Oncology	Hematopoietic cell transplantation	Obstetrics/ Delivery	Radiology/ Imaging	Clinical Diagnostics/ Laboratory Biosafety (specimen handling/ processing)	Blood Centers/ Banks
Patient triage/screening at different checkpoints/times based on checklists for fever, respiratory signs and symptoms, other physical examination, and contact with COVID-19 suspect/confirmed cases	- PHE [16] - WHO [12,13] - CDC [14] - ECDC [15]	- Greenland J. et al. [21] - CSA/CAA [22]	- ANZICS [20] - WHO [12] - CDC [14]	- ACEP [17] - EUSEM [19]	- CDC [33] - ASN [34] - ERAVEDTA [35] - NICE (NG160) [36] - ISN [37]	- AFSDE [25] - CAGEF [26] - ESGE/ ESGENA [27] - BSG [28] - AGA, ASGE [29,30] - WEO [31] - Repici A. et al. [32]	- ASCO [40] - ESMO [41] - NCCN [43] - NICE (NG161) [42]	- BSBMTCT [44] - NICE (NG164) [45] - EBMT [46]	- CDC [14] - ACOG/ SMFM [38] - RCOG [39]	- Radiology SEP [47] - BSTI [48] - SFR/SF2H [49]	Not applicable	- CDC [50] - FDA [51] - CSBT [52] - WHO [53] - APBN [54] - NHS [55]
Standard precautions including the use of standard appropriate personal protective equipment (PPE), hand hygiene, respiratory hygiene, equipment use/ decontamination & surface cleaning/disinfection between cases	- PHE [16] - WHO [12,13] - CDC [14] - ECDC [15]	- Greenland J. et al. [21] - CSA/CAA [22] - ASA/APSF [23] - AAGBI [24]	- ANZICS [20] - WHO [12] - CDC [14]	- ACEP [17] - IFEM [18] - EUSEM [19]	- CDC [33] - ASN [34] - ERAVEDTA [35] - NICE (NG160) [36] - ISN [37]	- AFSDE [25] - CAGEF [26] - ESGE/ ESGENA [27] - BSG [28] - AGA, ASGE [29,30] - WEO [31] - Repici A. et al. [32]	- ASCO [40] - ESMO [41] - NCCN [43] - NICE (NG161) [42]	- BSBMTCT [44] - NICE (NG164) [45] - EBMT [46]	- CDC [14] - ACOG/ SMFM [38] - RCOG [39]	- Radiology SEP [47] - BSTI [48] - SFR/SF2H [49]	- WHO [56] - CDC [14] - PHE [16] - ABSA [57]	- CDC [50] - FDA [51] - CSBT [52] - WHO [53] - APBN [54] - NHS [55]
Social distancing considerations and design modification inside the facility (including separate units for care & equipment, entrances, check-in points, waiting areas organization, hallways, patient transport routes, posted infection prevention visual alerts)	- PHE [16] - WHO [12,13] - CDC [14] - ECDC [15]	- Greenland J. et al. [21] - CSA/CAA [22] - ASA/APSF [23] - AAGBI [24]	- ANZICS [20] - WHO [12] - CDC [14]	- ACEP [17] - IFEM [18] - EUSEM [19]	- CDC [33] - ASN [34] - ERAVEDTA [35] - NICE (NG160) [36] - ISN [37]	- AFSDE [25] - CAGEF [26] - ESGE/ ESGENA [27] - BSG [28] - AGA, ASGE [29,30] - WEO [31] - Repici A. et al. [32]	- ASCO [40] - NICE (NG161) [42]	- BSBMTCT [44] - NICE (NG164) [45] - EBMT [46]	- CDC [14] - ACOG/ SMFM [38] - RCOG [39]	- Radiology SEP [47] - BSTI [48] - SFR/SF2H [49]	- WHO [56] - CDC [14] - PHE [16] - ABSA [57]	- CDC [50] - FDA [51] - CSBT [52] - WHO [53] - APBN [54] - NHS [55]
Patient visitors/companions policy	- PHE [16] - WHO [12,13] - CDC [14]	Not mentioned in reviewed documents	- WHO [12] - CDC [14]	- ACEP [17]	Not mentioned in reviewed documents	- ESGE/ ESGENA [27] - Repici A. et al. [32]	- ASCO [40]	- EBMT [46]	- CDC [14] - RCOG [39]	- SFR/SF2H [49]	Not applicable	- CSBT [52]
Staff education/training regarding infection prevention measures during COVID-19 pandemic (hand hygiene, use of PPE, equipment use/ decontamination, surface cleaning/disinfection)	- PHE [16] - WHO [12,13] - CDC [14] - ECDC [15]	- Greenland J. et al. [21] - CSA/CAA [22] - ASA/APSF [23] - AAGBI [24]	- ANZICS [20] - WHO [12] - CDC [14]	- ACEP [17] - IFEM [18] - EUSEM [19]	- CDC [33] - ASN [34] - ERAVEDTA [35] - NICE (NG160) [36] - ISN [37]	- AFSDE [25] - CAGEF [26] - ESGE/ ESGENA [27] - BSG [28] - AGA, ASGE [29,30] - WEO [31] - Repici A. et al. [32]	- ASCO [40] - ESMO [41]	- BSBMTCT [44] - NICE (NG164) [45] - EBMT [46]	- CDC [14] - ACOG/ SMFM [38] - RCOG [39]	- Radiology SEP [47] - BSTI [48] - SFR/SF2H [49]	- WHO [56] - CDC [14] - PHE [16] - ABSA [57]	- CDC [50] - FDA [51] - CSBT [52] - WHO [53] - APBN [54] - NHS [55]

Daily staff screening for COVID-19 for signs/symptoms including fever and contact with COVID-19 suspect/confirmed cases according to checklist	- PHE [16] - CDC [14]	Not mentioned in reviewed documents	CDC [14]	- ACEP [17]	Not mentioned in reviewed documents	- ESGE/ ESGENA [27]	- ASCO [40] - ESMO [41] - NCCN [43] - NICE (NG161) [42]	- BSBMTCT [44] - NICE (NG164) [45] - EBMT [46]	CDC [14]	Not mentioned in reviewed documents	Not mentioned in reviewed documents	- CDC [50] - FDA [51] - CSBT [52] - WHO [53] - APBN [54] - NHS [55]
Crisis Planning & Management of the workforce (including virtual meetings/continuous education/e-learning/telecommunication between personnel, organization of work schedules, etc.)	- PHE [16] - WHO [12,13] - CDC [14] - ECDC [15]	- Greenland J. et al. [21] - CSA/CAA [22] - ASA/APSF [23] - AAGBI [24]	- ANZICS [20] - WHO [12] - CDC [14]	- ACEP [17] - IFEM [18] - EUSEM [19]	- CDC [33] - ASN [34]	- APSDE [25] - CAGEF [26] - ESGE/ ESGENA [27] - BSG [28] - AGA, ASGE [29,30] - WEO [31] - Repici A. et al. [32]	- ASCO [40] - ESMO [41] - NCCN [43]	- BSBMTCT [44] - NICE (NG164) [45] - EBMT [46]	CDC [14]	- Radiology SEP [47] - SFR/SFZH [49]	Not mentioned in reviewed documents	- CDC [50] - CSBT [52] - WHO [53] - APBN [54] - NHS [55]
Management of the resources (mainly PPE) (prioritization of use, stock management, prolonged use and recycling of PPE)	- PHE [16] - WHO [12,13] - CDC [14]	- ASA/APSF [23]	- ANZICS [20] - WHO [12] - CDC [14]	- ACEP [17] - IFEM [18] - EUSEM [19]	- CDC [33] - ASN [34]	- ESGE/ ESGENA [27] - AGA, ASGE [29,30] - WEO [31] - Repici A. et al. [32]	- ASCO [40] - ESMO [41] - NCCN [43]	Not mentioned in reviewed documents	CDC [14]	- Radiology SEP [47] - SFR/SFZH [49]	Not mentioned in reviewed documents	Not mentioned in reviewed documents

Abbreviations per each category/specialty:

- General/Specialty, non-specific
 - **CDC**: Center for Disease Control and Prevention
 - **ECDC**: European Center for Disease Prevention and Control
 - **PHE**: Public Health England
 - **WHO**: World Health Organization
- Anesthesia and Preoperative Unit
 - **AAGBI**: Association of Anaesthetists of Great Britain & Ireland
 - **ASA**: American Society of Anesthesiologists
 - **APSF**: Anesthesia Patient Safety Foundation
 - **CAA**: Chinese Association of Anesthesiologists
 - **CSA**: Chinese Society of Anesthesiology
- Intensive Care Unit
 - **ANZICS**: Australian and New Zealand Intensive Care Society
 - **CDC**: Center for Disease Control and Prevention
 - **WHO**: World Health Organization
- Emergency Department
 - **ACEP**: American College of Emergency Physicians
 - **EUSEM**: European Society for Emergency Medicine
 - **IFEM**: International Federation for Emergency Medicine.
- Dialysis
 - **ASN**: American Society of Nephrology
 - **CDC**: Center for Disease Control and Prevention
 - **EDTA**: European Dialysis and Transplant Association
 - **ERA**: European Renal Association
 - **ISN**: Italian Society of Nephrology
 - **NICE (NG160)**: National Institute for Health and Care Excellence guideline
- Endoscopy
 - **AGA**: American Gastroenterological Association
 - **APSD**: Asian Pacific Society for Digestive Endoscopy
 - **ASGE**: American Society of Gastrointestinal Endoscopy
 - **BSG**: British Society of Gastroenterology
 - **CAGEF**: Canadian Association of Gastroenterology for Endoscopy Facilities
 - **ESGE**: European Society of Gastrointestinal Endoscopy
 - **ESGENA**: European Society of Gastroenterology and Endoscopy Nurses and Associates
 - **WEO**: World Endoscopy Organization.
- Oncology
 - **ASCO**: American Society of Clinical Oncology
 - **ESMO**: European Society for Medical Oncology
 - **NCCN**: National Comprehensive Cancer Network
 - **NICE (NG 161)**: National Institute for Health and Care Excellence guideline.
- Hematopoietic cell transplantation
 - **BSBMTCT**: British Society of Blood & Marrow Transplantation
 - **EBMT**: European Society for Blood and Marrow Transplantation
 - **NICE (NG164)**: National Institute for Health and Care Excellence guideline.
- Obstetrics/Delivery
 - **ACOG**: American College of Obstetricians and Gynecologists
 - **CDC**: Center for Disease Control and Prevention
 - **RCOG**: Royal College of Obstetricians and Gynaecologists
 - **SMFM**: Society for Maternal Fetal Medicine.
- Radiology/Imaging
 - **BSTI**: British Society of Thoracic Imaging
 - **SEP**: Scientific Expert Panel
 - **SF2H**: Société Française de Radiologie
 - **Clinical Diagnostics/Laboratory Biosafety (specimen handling/processing)**
 - **ABSA**: American Biological Safety Association
 - **CDC**: Center for Disease Control and Prevention
 - **PHE**: Public Health England
 - **WHO**: World Health Organization
- Blood Centers/Banks
 - **APBN**: Asia Pacific Blood Network
 - **CDC**: Center for Disease Control and Prevention
 - **CSBT**: Chinese Society of Blood Transfusion
 - **FDA**: US Food and Drug Administration
 - **NHS**: United Kingdom National Health Service
 - **WHO**: World Health Organization

3. For aerosol generating procedures (AGP), the application of airborne, droplet, and contact precautions becomes necessary with suitable PPE [disposable head covers, beard covers, gloves, fluid-resistant long-sleeved gowns, waterproof aprons, shoe covers, goggles, full-face shields, and N95 or filtering face piece (FFP2/FFP3) respirators or powered air-purifying respirator (PAPR)], in addition to the use of special areas of care with negative pressure systems and specific ventilation requirements (anesthesia and operating rooms) as per PHE recommendations [16].

Recommendations that are specific to individual departments or services (Table II)

Emergency department

Healthcare teams in emergency departments (ED) are in the front-line in this pandemic, in terms of identification and early management of potential COVID-19 cases. Early identification and immediate isolation of cases are cornerstones for preventing spread of the infection in the hospital, and this is based on active triage according to a checklist based on the latest local case definition of COVID-19 infection [17-19].

Several international societies of emergency physicians from all over the world including the US and Europe recommended applying the general measures outlined in the previous section of this paper, in order to minimize the impact of this virus, in line with the CDC, ECDC, and WHO (Table I) [12,14,15]. These societies also recognize that emergency care systems in different regions and countries around the world will vary in their capacity to respond to a surge of cases.

There is also a specific set of measures to be considered precisely in ED. It is worth relisting triage because it is the most important measure in ED. PPE procurement management and avoiding PPE supply shortage, organization of workflow through managing staff shortage and absenteeism should both be among the pillars of the ED management plan [17-19]. Adequate PPE include N95 respirators, surgical masks, eye and face protection, gowns, and gloves.

ED clinicians and healthcare personnel should be empirically wearing surgical masks and applying droplet and contact precautions at all times irrespective of the patient's COVID-19 status [17]. Airborne precautions are empirically applied only when performing aerosol-generating procedures irrespectively, whether the patient is known or suspected for COVID-19 infection [17].

All patients should be wearing facemasks or facecloths when presenting to emergency departments; if not, they should be provided with facemasks at triage to put on during their stay in ED [17].

Other measures to protect the staff and preserve hospital capacity are through implementing telemedicine where possible and prioritization of care such as transferring patients not requiring hospitalization to outpatient care [18].

A functional redesign of the emergency department to provide adequate ventilation in all the areas to receive any patient irrespective of COVID-19 screening status is recommended by EUSEM [19].

Critical care medicine

During the pandemic, critical care teams should have a low threshold for COVID-19 suspicion. Position statements and interim guidance of international societies of critical care medicine have emphasized the importance of applying the aforementioned general precautions related to facility preparedness, logistics/surge capacity, triage, communication and protection of the workforce (Table I) [14,16,20].

Irrespective of the COVID-19 screening status in critically ill patients, supplementary measures include the necessity of adequate ventilation where separate room ventilation is recommended as well as negative pressure systems in the dedicated areas of care, where potential airborne generating procedures are performed. Droplet/contact precautions are used for all patients if their COVID status is not known [14,16,20]. In case of AGP, airborne precautions are employed (Table II) [14,16,20].

Preoperative and anesthesia units

International societies of anesthesiologists from the United States, United Kingdom and China have unanimously recommended applying the same measures mentioned in the general section for all patients entering the preoperative units or requiring urgent surgeries [21-24]. They included patient triage and risk assessment with deferral of surgeries if possible in case the patient has COVID-19 symptoms, the use of standard precautions, staff education and training, crisis management simulation and emergency planning, the organization of workflow, facility unit redesign to cope with the current situation and minimize traffic in and out areas of dedicated care, in addition to proper use of resources, especially in case of shortage of PPE supply (Table I) [21-24].

There are additional recommendations specific to patients undergoing general anesthesia with endotracheal intubation (Table II). Each patient should be considered a potential carrier of SARS-CoV-2 and dealt with accordingly. Subsequently, an escalation of standards of practice during airway management is necessitated in all patients to reduce exposure to secretions [21-24].

Healthcare workers should empirically use PPE that is appropriate for aerosol-generating procedures when

working near the airway with all patients, including disposable head covers, beard covers, gloves, fluid-resistant long-sleeved gowns, waterproof aprons, shoe covers, goggles, full-face shields and N95 or FFP2/FFP3 respirators or PAPR) [21-24].

Videolaryngoscopy is to be used for intubation to distance oneself from the airway [24]. Oral or tracheal suction should be performed with a closed suction system after intubation [21-24].

Endoscopy services

Several scientific societies of gastroenterology and gastrointestinal endoscopy from the US, Canada, UK, Europe, Asia-Pacific region and others have issued their own interim guidelines, joint statements, and expert commentaries regarding the management of endoscopic procedures during the COVID-19 pandemic [25-32]. In addition to the general recommendations (Table I), which are in line with those of the other specialties, further mandatory precautions should be empirically implemented, irrespective of the COVID-19 screening status (Table II) [25-32].

During rapid and high viral transmission in the community, most societies recommend postponing elective and non-urgent endoscopies, whereas urgent endoscopies are performed by a cohort trained team of staff to minimize concomitant exposure [25-32].

Whenever possible, all patients entering the gastrointestinal (GI) endoscopy unit should wear respiratory protective equipment (surgical mask) [27,32].

The European Society of Gastrointestinal Endoscopy recommends using telemedicine for follow-up after care, and contacting patients at 7 and 14 days after endoscopy to inquire about any new COVID-19 diagnosis, or development of COVID-19 symptoms [27].

Regarding the use of appropriate type of PPE during endoscopy procedures, it depends on the risk of generating aerosols.

All societies recommend using airborne/droplet/contact precautions empirically in upper GI endoscopy and bronchoscopy [25-32].

As for lower GI endoscopy, all societies recommend droplet/contact precautions in lower GIE, regardless of the COVID-19 status [25-28,31,32] except the American Gastroenterological Association (AGA) and American Society of Gastrointestinal Endoscopy (ASGE) that consider it as high risk, thus strictly necessitating airborne precautions [29,30].

All societies warrant using negative pressure systems for high risk and aerosol generating procedures in patients with respiratory symptoms and those who are suspect or confirmed cases [25-32]. For any patient undergoing a GIE regardless of the COVID-19, the empiric

use of negative pressure systems has not yet been recommended by any scientific society.

Dialysis

Nephrology societies and scientific experts from the US, UK, Italy and Europe similarly shared the aforementioned general recommendations of societies from other medical specialties for mitigating the risk of COVID-19 [33-37].

Among these recommendations, it is worth emphasizing the importance of screening patients upon presenting to the dialysis unit for respiratory symptoms and fever, not to mention similar daily screening of health-care workers in the unit [33-37].

In addition, nursing and medical staff working in dialysis rooms should follow droplet and contact precautions through wearing surgical masks, protective glasses, and disposable gloves with all patients [33-37]. Surgical masks should be changed every 4 to 6 hours, according to type and producer's instructions [37].

In areas of high COVID-19 prevalence, further testing with COVID-19 polymerase chain reaction is advised in dialysis patients [35]. In these settings as well, dialysis patients should be instructed to self-quarantine on non-dialysis days, to minimize any possible contact with potential carriers.

Generally speaking, waiting areas in dialysis treatment areas should be well aerated or have adequate ventilation, in order to clear droplets containing viruses from the air [35].

Obstetrics

Regarding obstetric and delivery services, scientific societies from the US and UK share the general recommendations we previously discussed (Table I) [14,38,39].

In particular, pregnant women and their birth partners are instructed about hand and respiratory hygiene [14,39]. They are advised to wear face masks when coming to the delivery suite [14,39].

In high prevalence areas only, the American College of Obstetricians and Gynecologists recommends additional testing strategies because of the potential for asymptomatic patients presenting to labor and delivery units [38].

As per the *Royal College of Obstetricians and Gynaecologists*, maternity services should offer a combination of telemedicine and face-to-face consultations for antenatal and postnatal care (Table II) [39].

Visitors/birth partners are screened for symptoms and are instructed to only visit the patient room and should not go to other locations within the facility, including any newborn nursery [14,39].

TABLE II SPECIFIC INFECTION PREVENTION AND CONTROL PRECAUTIONS IN ACUTE CARE FACILITIES DURING THE COVID-19 PANDEMIC AS RECOMMENDED BY INTERNATIONAL ORGANIZATIONS AND SOCIETIES FROM DIFFERENT MEDICAL SPECIALTIES

Measures	Anesthesia Preoperative unit	Intensive Care Unit	Emergency Department	Dialysis	Endoscopy	Oncology	Hematopoietic cell transplantation	Obstetrics/ Delivery	Radiology/ Imaging	Clinical Diagnostics/ Laboratory Biosafety (specimen handling/ processing)	Blood Centers/ Banks
Empiric COVID-19 polymerase chain reaction testing/repeat screening considerations irrespective of triage results	-	-	-	-	-	-	-BSBMTCT [44] - NICE (NG164) [45] - EBMT [46]	-	-	-	-
Pre-care quarantine and/or contacting patients after care to inquire about their health status especially any new COVID-19 diagnosis or development of symptoms	-	-	-	- CDC [33] - ASN [34] - ERA/EDTA [35] - ISN [37]	- ESGE/ ESGENA [27] - Repici A. et al. [32]	-	-BSBMTCT [44] - NICE (NG164) [45] - EBMT [46]	-	-	-	- FDA [51] - CSBT [52] - WHO [53] - APBN [54] - NHS [55]
Specific ventilation and/or negative pressure systems for patient care areas irrespective of COVID-19 screening status	- CSA/CAA [22] - PHE [16]	- ANZICS [20] - PHE [16]	- EUSEM [19] (Adequate ventilation system)	-	-	-	-BSBMTCT [44] - NICE (NG164) [45] - EBMT [46] (Specific ventilation systems/positive pressure system)	-	-	- WHO [56] - CDC [14] - PHE [16] - ABSA [57]	- CSBT [52] (Adequate ventilation not negative pressure system)
Empiric use of Airborne/ Droplet/Contact precautions in aerosol generating procedures irrespective of COVID-19 screening status [Personal protective equipment (PPE): Disposable head cover, hair caps, beard covers, gloves, fluid-resistant long-sleeved gowns, waterproof aprons, shoe covers, goggles, full-face shields and N95 or filtering face piece (FFP2/FFP3) respirators or powered air-purifying respirator (PAPR)]	- Greenland J. et al. [21] - CSA/CAA [22] - ASA/AFSP [23] - AAGBI [24]	- ANZICS [20] - WHO [12] - CDC [14]	- ACEP [17] - IFEM [18]	- ERA/EDTA [35] For nasopharynx swabs for COVID-19 PCR	<u>Upper GI/E</u> - BSG [28] - CAGEF [26] - AGA/ASGE [29,30] - Repici A. et al. [32] - WEO [31] - APSDE [25] <u>Lower GI/E</u> - AGA/ASGE [29,30] <u>Bronchoscopy</u> - BSG [28] - CAGEF [26] - AGA/ASGE [29,30] - Repici A. et al. [32] - WEO [31] - APSDE [25]	-	-	-	- WHO [56] - CDC [14] - ABSA [57] (In viral isolation procedures)	-	
Empiric use of Droplet/Contact precautions in non-aerosol generating procedures irrespective of COVID-19 screening status (PPE: Disposable headcover, hair caps, beard covers, gloves, fluid-resistant long-sleeved gowns, waterproof aprons, shoe covers, goggles, full-face shields and surgical masks)	-	-	- ACEP [17] - IFEM [18] - EUSEM [19]	- CDC [33] - ASN [34] - ERA/EDTA [35] - ISN [37] (Italian recommendation: Surgical masks to be changed every 4-6 h, according to type and producer's instructions)	<u>Lower GI/E</u> - CAGEF [26] - Repici A. et al. [32] - WEO [31] - APSDE [25]	Type of PPE depends on disease status	-BSBMTCT [44] - NICE (NG164) [45] - EBMT [46]	-	- Radiology SEP [47] - BSTI [48] - SFR/SF2H [49]	- WHO [56] - CDC [14] - PHE [16] - ABSA [57] (In non-viral isolation procedures, use standard laboratory measures)	- WHO [63] - APBN [54] - FDA [51]
Education to patients/ relatives/caregivers	Not applicable	Not applicable	ACEP [17]	- CDC [33] - ASN [34] - ERA/EDTA [35] - NICE (NG160) [36] - ISN [37]	-	- ASCO [40] - ESMO [41] - NCCN [43] - NICE (NG161) [42]	-BSBMTCT [44] - NICE (NG164) [45] - EBMT [46]	- CDC [14] - RCOG [39]	-	Not applicable	- FDA [51] - CSBT [52] - WHO [63] - APBN [54] - NHS [55]

Empiric use of PPE by patients (face masks) or facecloths irrespective of the COVID-19 status	-	-	ACEP [17]	- CDC [33] - ASN [34]	- ESGE/ ESGENA [27] - Replaci A. et al. [32]	- ASCO [40] - ESMO [41] - NCCN [43] - NICE (NG161) [42]	- BSBMTCT [44] - NICE (NG164) [45] - EBMT [46]	- RCOG [39]	- Radiology SEP [47] - SFR/SF2H [49]	Not applicable	- CSBT []
Prioritization of care/delerral of procedures in case of non-urgency thus preserving hospital capacity	-	-	- IFEM [18] (e.g. transferring patients not requiring hospitalization to outpatient care)	-	- APSDE [25] - CAGEF [26] - ESGE/ ESGENA [27] - BSG [28] - AGA, ASGE [29,30] - WEO [31] - Replaci A. et al. [32]	- ASCO [40] - ESMO [41] - NCCN [43] - NICE (NG161) [42]	- BSBMTCT [44] - NICE (NG164) [45] - EBMT [46]	-	-	-	-
Telemedicine for consultations/ follow-up on patient health status (Minimizing face-to-face consultations)	-	-	- IFEM [18]	-	ESGE/ESGENA [27]	- ASCO [40] - ESMO [41] - NCCN [43] - NICE (NG161) [42]	- BSBMTCT [44] - NICE (NG164) [45] - EBMT [46]	- RCOG [39]	-	-	-

Abbreviations per each category/specialty:

- **Anesthesia and Pre-operative unit**
 - **AAGBI**: Association of Anaesthetists of Great Britain & Ireland
 - **ASA**: American Society of Anesthesiologists
 - **APSF**: Anesthesia Patient Safety Foundation
 - **CAA**: Chinese Association of Anesthesiologists
 - **CSA**: Chinese Society of Anesthesiology.
- **Intensive Care Unit**
 - **ANZICS**: Australian and New Zealand Intensive Care Society
 - **CDC**: Center for Disease Control and Prevention
 - **WHO**: World Health Organization.
- **Emergency Department**
 - **ACEP**: American College of Emergency Physicians
 - **EUSEM**: European Society for Emergency Medicine
 - **IFEM**: International Federation for Emergency Medicine.
- **Dialysis**
 - **ASN**: American Society of Nephrology
 - **CDC**: Center for Disease Control and Prevention
 - **EDTA**: European Dialysis and Transplant Association
 - **ERA**: European Renal Association
 - **ISN**: Italian Society of Nephrology
 - **NICE (NG160)**: National Institute for Health and Care Excellence guideline.
- **Endoscopy**
 - **AGA**: American Gastroenterological Association
 - **APSD**: Asian Pacific Society for Digestive Endoscopy
 - **ASGE**: American Society of Gastrointestinal Endoscopy
 - **BSG**: British Society of Gastroenterology
 - **CAGEF**: Canadian Association of Gastroenterology for Endoscopy Facilities
 - **ESGE**: European Society of Gastrointestinal Endoscopy
 - **ESGENA**: European Society of Gastrointestinal Endoscopy and Endoscopy Nurses and Associates
 - **WEO**: World Endoscopy Organization.
- **Oncology**
 - **ASCO**: American Society of Clinical Oncology
 - **ESMO**: European Society for Medical Oncology
 - **NCCN**: National Comprehensive Cancer Network
 - **NICE (NG 161)**: National Institute for Health and Care Excellence guideline.
- **Hematopoietic cell transplantation**
 - **BSBMTCT**: British Society of Blood & Marrow Transplantation
 - **EBMT**: European Society for Blood and Marrow Transplantation
 - **NICE (NG164)**: National Institute for Health and Care Excellence guideline.
- **Obstetrics/Delivery**
 - **CDC**: Center for Disease Control and Prevention
 - **RCOG**: Royal College of Obstetricians and Gynaecologists.
- **Radiology/Imaging**
 - **BTSI**: British society of Thoracic Imaging
 - **SEP**: Scientific Expert Panel
 - **SF2H**: Société Française d'Hygiène Hospitalière
 - **SFR**: Société Française de Radiologie
 - **ABSA**: American Biological Safety Association
 - **CDC**: Center for Disease Control and Prevention
 - **PHE**: Public Health England
 - **WHO**: World Health Organization
- **Blood Centers/Banks**
 - **APBN**: Asia Pacific Blood Network
 - **CDC**: Center for Disease Control and Prevention
 - **CSBT**: Chinese Society of Blood Transfusion
 - **FDA**: US Food and Drug Administration,
 - **NHS**: United Kingdom National Health Service
 - **WHO**: World Health Organizations

Clinical oncology

The COVID-19 pandemic has complicated management of oncology patients, the patients themselves, their caregivers, family members and their unit health. All workers involved in patient care should take extra measures to prevent getting infected and spreading the infection to their vulnerable patient. Several international clinical oncology societies from the US, UK, and Europe have issued the same general interim recommendations mentioned earlier aiming at reducing the impact of the pandemic, where protection of this patient population is the ultimate aim of these approaches [40-43] (Table I).

Besides these common measures, other issues merit mention (Table II). All societies consider the importance of the “risk to benefit ratio” in the choice of management approach with a careful evaluation of the ultimate goal of anticancer therapy and its urgency, based on severity of illness and expected response to therapy [40-43].

Experts recommended privileging the use of virtual consultation and the use of web-based technology for transmitting important information to patients and their caregivers as in instructing them to self-quarantine before and after care, in addition to basics in hand and respiratory hygiene, and the strict use of facemasks when entering the facility regardless their COVID-19 status [40-43].

Another strategy is adapting the therapeutic approaches to reduce face-to-face contact with the immunosuppressed patient whenever appropriate and safe, i.e. when this approach does not compromise patient outcome and prognosis. This can be realized by postponing chemo/radiotherapy if safe, using shorter or fractionated treatment regimens if possible, shift intravenous to temporary oral or subcutaneous anticancer therapy if possible to improve disease control [40-43].

The type of PPE to be used by staff caring for cancer patients should follow standard operating procedures, based on the patients’ severity of disease and immunosuppression [40-43].

Hematopoietic cell transplantation (HCT)

As in medical oncology, the essence of management in hematopoietic cell transplantation during this pandemic is protection, focused on patients, their caregivers and families and clinical staff.

Scientific societies from the Europe and UK have issued special recommendations for HCT practice, besides the general precaution measures, outlined at the beginning by all other medical specialties (Tables I and II) [44-46]. Cell transplantation societies recognize that transplant units are aware of the measures needed to pre-

vent acquisition and transmission of respiratory viruses in their units [44-46]. It is crucial that they continue applying them during the COVID-19 outbreak, along with local hospitals along with institutional and national public health recommendations [44-46].

Any planned transplantation, whether autologous or allogeneic, should be reviewed and deferred if possible and non-urgent according to the patient’s type of malignancy and status before transplantation [44-46].

Empiric testing for COVID-19 polymerase chain reaction by nasal and throat swabs is required at least 72 hours before starting conditioning irrespective of triage, taking into consideration the carriage of the virus and its potential transmission during the asymptomatic and pre-symptomatic phases. Testing may vary between different institutions [44-46].

Pre-transplant self-quarantine is necessary for patients and ensuring good hygiene practices for at least two weeks prior to conditioning [44-46]. Instructions regarding preventive measures are given to patients and caregivers and should be supported with written information [44-46].

Allogeneic donors are advised as well to self-quarantine and to practice good hygiene at least 4 weeks prior to donation [44-46]. Donors are screened twice prior to starting conditioning and on the day of donation [44-46]. Donors are contacted 2 weeks post-harvest to determine if they were diagnosed with COVID-19 or experienced any symptoms suggestive of it [44-46].

After transplantation, patients and their caregivers, if possible, should be managed in strict reverse isolation, in addition to providing them with the proper instructions on how to avoid any contact risk after discharge [44-46]. Healthcare providers should take measures to reduce face-to-face visits through privileging telemedicine for consultation and follow-up [44-46].

Radiology, imaging and diagnostic services

Similar to other specialties, radiology and imaging scientific societies from France, UK and the US recommend the general precautions in their interim guidelines (Table I) [47-49]. Standard operating procedures for this department should be followed. To reduce patient movement between the floors, portable-imaging units should be used wherever possible [47-49].

Where CT is performed, departments may consider dedicated time slots [47-49]. This ensures delivering optimal imaging and treatment while reducing unnecessary movement and congregation of patients within the hospital environment. For this service specifically, the recommended respiratory precautions are the droplet and contact precautions [47-49]. Patients are advised to wear facemasks or facecloths [47-49] (Table II).

Blood donation

Several international societies and organizations including the WHO, CDC, US Food and Drug Administration (FDA) and UK National Health Service (NHS), in addition to specialty blood societies like Asia Pacific Blood Network (APBN) and the Chinese Society of Blood Transfusion (CSBT) issued recommendations to mitigate the potential risk of transmission through the transfusion of blood and blood components [50-55].

Any actions taken to mitigate this risk are considered precautionary, since transmission of respiratory viruses through blood or blood components has never been reported [50-55]. Besides recommendations considered as “general” which are in line with other specialties (Table I), other specific measures are warranted in blood donation (Table II).

Donors should be educated to postpone or refrain from blood donation if they were experiencing COVID-19 symptoms, or were diagnosed as carriers or being infected or had any contact with a confirmed case [50-55]. They must be wearing masks and have hand sanitizers during their visit to the blood donation unit or facility [52].

After donation, facilities should contact the donors to report a subsequent diagnosis of COVID-19 [50-55]. Accordingly, they may wish to consider to quarantine the blood products in such cases [50-55].

The CSBT recommends good air ventilation in donation rooms, through minimizing the use of central air conditioning and disinfecting air outlets at densely populated places after each shift [52].

Regarding infection prevention and control (IPC) precautions among staff, empiric droplet and contact precautions and the usual bloodborne pathogens precautions are requested [51,53,54]. Enhanced infection control measures through using additional PPE such as N95 respirators and double gloving for collection of blood are not currently considered necessary [54].

Medical laboratory biosafety practices for handling and processing specimens

Irrespective of the COVID-19 pandemic, good microbiological practices and standard operating procedures for handling and processing clinical specimens should be followed in all medical laboratories [12,14,56,57]. Individual site- and activity-specific risk assessments should be conducted in each facility to ensure its competence in safely performing the intended tests with suitable risk control measures in place [12,14,56,57].

The WHO, CDC, PHE, and the American Biological Safety Association (ABSA) international recommended some of the general measures mentioned before to minimize the risk of the pandemic (Table I) [12,14,56,57].

These include application of standard precautions as hand hygiene, PPE including laboratory coats or gowns, gloves, and eye protection, as well as universal precautions to be applied by all personnel. The type of PPE should be planned according to detailed risk assessment of each laboratory activity [12,14,56,57].

Safe use, cleaning and decontaminating laboratory equipment, as well as surface cleaning and disinfection should be followed according to standard guidelines [12,14,56,57].

Redesigning the area of laboratory work should be done if necessary, not to mention posting infection prevention visual alerts and reminders to laboratory personnel [12,14,56,57].

Staff education and training on different IPC measures during COVID-19 pandemic is a must to all medical laboratory workers [12,14,56,57].

Laboratory activities involving handling patient samples (respiratory, blood, and urine), in addition to work involving full-length genomic ribonucleic acid (RNA) should be carried using standard precautions at Biosafety level (BSL) two (BSL-2) [12,14,56,57]. Primary and secondary barriers in BSL2 environment include the following. First, biosafety cabinets should be certified and maintained according to manufacturers' recommendations [57]. The laboratory should also have an adequate ventilation system that provides an inward flow of air and prevents recirculation of air in the same area. Policies and procedures for managing and disposal of infectious waste should be present [57]. The PPE used in BSL2 laboratories include surgical mask, single gloves, gown/lab coat, and eye protection [57].

Procedures involving viral propagation and isolation (high concentrations of live virus) or manipulating large volumes of infectious specimens should be basically performed at BSL-3 [12,14,56,57]. In a BSL3 environment, all infectious material should be manipulated within a specific biosafety cabinet, or other containment devices. Airborne protection PPE is recommended (N95 or PAPR respirators). Waste should be autoclaved before disposal, and the exhaust system must have high efficiency particulate air (HEPA) filtration [57].

Aerosol and/or droplet generating laboratory work should be carried out in Class II biosafety cabinets with additional precautions including droplet precaution PPE like a surgical mask or a splash field, a sealed centrifuge or other physical barriers [12,14,56,57]. N95 of FFP2/3 respirators are not a proper substitute for processing samples in these cabinets when a risk of aerosols/droplet production is present [12,14,56,57]. For decentralized and point of care testing, standard precautions are to be used in the presence of a shield between the patient and the healthcare worker [12,57].

DISCUSSION AND POSITION STATEMENT ABOUT APPLICATION OF EMPIRIC ADDITIONAL IPC MEASURES

Historically, universal precautions were introduced by the CDC in the wake of the Human Immunodeficiency Virus epidemic (HIV) between 1985 and 1988 [58-59]. The aim of these precautions was to prevent transmission of bloodborne pathogens in the hospital setting, since infected patients can carry and transmit HIV, while being asymptomatic. Clinicians are then expected to treat body fluids with precautions. In the turn of the 20th century, the concept of universal precautions was replaced by standard precautions whereby the latter are meant to prevent transmission of bloodborne pathogens and other infectious agents from all sources [11].

In 2020, with the COVID-19 pandemic, an escalation of the concept of standard precautions might be needed. Asymptomatic and presymptomatic individuals can harbor the novel coronavirus in their upper respiratory tract and can potentially transmit it to others without showing signs of infection [7-9]. Although standard precautions include PPE, specification of which ones to use in which conditions has become a necessity for healthcare personnel during patient care, as long as the novel coronavirus is circulating in the community. Besides these precautions, other preventive measures have to be also considered during the pandemic.

These additional precautions converge all to the basic general principles that were recommended by the CDC, WHO, ECDC, in addition to specific recommendations for certain medical specialties that consider factors like the potential of aerosol production during patient care or the patient immune status.

Based on this review, we recommend additional measures to be taken in hospitals at least until the COVID-19 vaccine is available for widespread use in the country [60]. Before putting any recommendations, we need to consider the local epidemiology of the novel coronavirus, the availability of PPE and viral PCR testing, as well as hospital medical engineering aspects.

RECOMMENDATIONS

Checking for fever

- Every person entering the hospital premises including employees, patients or visitors should be checked for fever, at a distance. Visitors with body temperature above 37.5°C should not be allowed to enter the hospital and are advised to go to ER triage or consult their physicians [14,16].

Patient triage

- All patients admitted to the hospital, as regular cold admission or through ED, should undergo triage based on a predefined checklist to screen for symptoms or signs of COVID-19, or contact with confirmed case or sick respiratory or febrile patients [17-19].
- All patients coming for one-day surgical or medical treatment should be seen in triage to be checked for symptoms, signs or contact history of COVID-19 [14,16,33,29,30,47].
- Suspect cases as per the triage checklist when admitted to the hospital follow the known procedure of admitting such cases [17-19].

Physical distancing [12,14,16,17,29,46,47,54]

- Physical distancing among patients, medical staff, and visitors of at least 1 m should be respected in all waiting areas, whether in clinics, radiology, endoscopy, laboratory waiting areas, as well as and in the “one day” treatment pavilions.
- In waiting areas, suspect or confirmed COVID-19 cases should be isolated in specific, designated, and properly labeled spaces, while wearing surgical masks.

PPE [12-14,16-17,20,29,46-47,54]

- All medical personnel involved in patient care should be trained for proper donning and doffing techniques of PPE.
- All hospitals should have PPE procurement and management plans to avoid shortage of PPE supply.

Facemasks

- *Surgical/medical masks*
 - Healthcare workers should be wearing surgical/medical masks while caring for all patients and specifically those are under droplet/contact precautions with the proper donning and doffing techniques [11-14].
 - All healthcare workers in the ED, and in face-to-face triage rooms should be wearing a surgical/medical mask and a face shield [17-19].
 - Suspect or confirmed COVID-19 cases should wear surgical/medical masks as much as they can tolerate during their hospital stay [17-19].
- *N95 or FFP2/3 respirators*
 - The empiric application of aerosol/contact precautions should be considered while caring for patients in the following situations:
 - Anesthesia requiring intubation [21-24].
 - Upper and lower GI endoscopy [25-30].
 - Bronchoscopy [25-30].
 - Caring for patients on mechanical ventilation.

- Nasopharyngeal or nasal specimen taking for nucleic acid amplification testing (NAAT) for COVID-19 [35, 57].
- o N95 or FFP2/3 respirator use can be extended to a shift of 6 hours [61]. They should be properly donned and doffed [12-16].
- *Cloth face masks*
 - o Cloth facemasks are not PPE [33,34]. Yet their use potentially prevents the spread of the novel coronavirus from asymptomatic carriers to others. They should be worn by [33-34,39,40-42]:
 - Visitors.
 - Hospital employees in case of shortage of surgical masks, when they are in the hospital premises, but not while performing patient care.
 - o Cloth facemasks should be donned and doffed according to the standard donning and doffing techniques of medical or surgical masks [12-16].

Hospital staff screening and management of absenteeism [14,16,27,29,30,33,43,53]

- Facilities should implement daily screening tools and/or temperature checks for their staff.
- They should establish clear stay-at-home/sick leave policies and return-to-work guidelines.

Management of the workforce and healthcare workers safety [14,16,27,29,30,33,43,53]

- This should be adequately planned and documented in the hospital policies for an efficient use of workforce.
- It is equally important for preventing exposure through minimizing the number of personnel entering the dedicated areas of patient care.

Environmental cleaning and disinfection [12,14,16,33]

- Thorough environmental cleaning and disinfection should occur between cases using hospital-approved disinfectants.
- It should be applied as per hospital schedules and protocols.

Specific engineering considerations

- Empiric negative pressure and specific air circulation frequency are recommended in the following conditions (other than in designated areas COVID-19 patient care):
 - o Areas for endotracheal intubation in ED.
 - o Areas for nasopharyngeal specimen collection for COVID-19 testing.
 - o Laboratory area for nucleic acid amplification or virus culture.

- o Rooms of patients with COVID-19 that have a high potential of aerosol production.

NAATs

- Besides COVID-19 suspect cases, NAAT (PCR) is empirically recommended for asymptomatic patients in the following situations [44-46]:
 - o Blood donors in case they report symptoms within 14 days after donation.
 - o Patients planned to undergo HCT at least 72 h prior to conditioning.
 - o Allogeneic donors at the medical and repeat at harvest.
 - o Cryopreservation donation at the assessment and again at harvest of stem cells or donor lymphocytes.

Patient self-quarantine

- It is recommended in the following situations [44-46]:
 - o HCT patients: 2 weeks prior to transplant.
 - o Allogeneic donors: 4 weeks prior to transplant.

Telemedicine and prioritization of care [18, 25-32, 39-46]

- It is recommended to minimize face-to-face consultations of immunocompromised patients like cancer patients or pregnant women.
- Organizing the rules of telemedicine, recognizing its limitations and responsibilities, as well as physicians' rights.
- Prioritizing care according to a scale taking into consideration the risk of complications with COVID-19, severity and prognosis of underlying illness especially in patients with neoplastic disorders on chemotherapy or those with rheumatologic diseases on immunosuppressive treatment regimens.

Management of suspect cases

- All suspect patients for COVID-19 should be managed according to specific guidelines, yet this is outside the scope of this paper.

STRENGTHS AND LIMITATIONS

Despite that most of the reviewed documents were issued by international scientific societies and official governmental bodies, they were not all retrieved from peer-reviewed journals. These recommendations were not based on solid evidence-based medicine, rather than on expert opinions. This is inevitable in this early stage of the COVID-19 pandemic, even when the most prestigious journals had expedited publications to spread information about the pandemic. Nevertheless, this is the time where recommendations are most needed in order

to flatten the curve and to prevent the emergence of subsequent epidemic waves.

On the other hand, these infection prevention recommendations are provisional and might be subject to change with time according to the dynamics of the epidemic.

This review would help hospitals in Lebanon update their infection control policies in the pandemic era based on current international recommendations. It would also guide them to prioritize PCR testing, to decide which PPE to use in which situation, to effectively manage workforce, and to apply engineering changes where needed.

CONCLUSION

The novel coronavirus pandemic has stretched our understanding of standard precautions to include additional practices that should be simultaneously applied to all patients, as long as the virus is circulating in the community. Droplet/contact precautions have become part of daily care, and what once was a routine healthcare visit has become a daily exercise of triage and prioritization.

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