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# Assessment of COVID-19 precautionary measures in sports facilities: A case study on a health club in Saudi Arabia

Ahmed M. Ibrahim<sup>a,\*</sup>, Mohammad A. Hassanain<sup>b</sup><sup>a</sup> Department of ICT and Natural Sciences, Norwegian University of Science and Technology, Ålesund, Norway<sup>b</sup> Architectural Engineering Department, King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia

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## ABSTRACT

Health club facilities represent a physical space for an industry that is centric to human health and fitness, serving various societal dimensions such as cultural, economic, and social aspects on the individual and the national levels. This research conducts an indicative post occupancy evaluation (POE), for assessing the provision of post-pandemic precautionary measures and management strategies, in health club facilities. The research activities comprised a review of literature, a walkthrough for assessing a case study health club facility, where precautionary measures were investigated to ascertain its preparedness. Observations of trainers and administrative staff were collected, to derive recommendations that ensure sustainable operation in response to the challenges set by COVID-19 on continuity of health club facilities. The research concludes with remarks to propose recommendations and future research directions. The research initiates a topic that is overlooked in the literature of sports management domain. This research serves to raise awareness among designers and managers of health club facilities on the precautionary measures of protecting health club facilities against safety and health risks of COVID-19, from different regional perspectives. This is by tackling an identified contextual gap on health club facilities in the relevant literature.

## 1. Introduction

Health club facilities represent a physical space for an industry that is centric to human health, and fitness, serving various societal dimensions such as cultural, economic, and social aspects on the individual and national levels. Various countries are fostering huge benefits that are driven by investments in youth development; mainly by improving the sports and fitness industries umbrella. Health club facilities are wellbeing purposely built facilities, that aim to occupy different, or unique set of physical activities, usually offered based on a tailored select of users' needs to improve their health, fitness, and stamina. In addition, these facilities are attended by users to relax, socialize, and to function as a place for inhabiting competitions and championships, whenever needed. Moreover, the health club environments operate to be dynamic and motivational, for individuals who are willing to improve and maintain their physical appearances. Thus, health club organizations and owners aim to satisfy varying needs of their subscribers to maintain revenue, while contributing to societal wellbeing and sustainability [1].

Post-occupancy evaluation (POE) is a systematic approach followed to continuously assess and improve the quality and performance of built facilities, by enhancing its management, operation, and maintenance. This means that it applies procedures to identify

\* Corresponding author.

E-mail addresses: [ahmed.m.ibrahim@ntnu.no](mailto:ahmed.m.ibrahim@ntnu.no) (A.M. Ibrahim), [mohhas@kfupm.edu.sa](mailto:mohhas@kfupm.edu.sa) (M.A. Hassanain).

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performance elements and evaluates the physical environment, to derive recommendations and corrective actions to improve the quality of built facilities. It benefits organizations with continuous development programs, on the stack of managing a portfolio of facilities which requires a continuous remodeling and rehabilitation [2]. Preiser [2] defined POE as the act of assessing a built facility performance according to measures and in comparison, to asserted set of performance criteria. The assessment serves to indicate the negative and positive performance aspects. These criteria are documented at the design phase for a set of objectives to be realized over the lifecycle delivery of the facility, and for the sustainable management of its functions.

Health club organizations are challenged to keep a quality facility for its members, trainers, staff, and athletes. The challenges emerge from the need of keeping abreast of the progressed technologies, equipment, enhancing training techniques, improving support services, and maintaining a healthy indoor environment. All accompanied with the need to have an economically balanced service either for the community or for its operational organization. In Saudi Arabia, health club facilities are either managed by large, mid-sized chains, small individual health club businesses and franchised brands. With the spread of COVID-19 in 2020 many of these health clubs reconsidered their operational, and expansive strategies due to the disruptions caused by its impact's anonymity. Thus, in March 2020, the Saudi general sports authority suspended operations of all sports facilities for more than three months, aiming to develop a specific safe and healthy criterion for reopening and managing health club facilities, systematically. The protocol published by ministry of sports, in Saudi Arabia, is a national guiding criterion, published in June 2020, that served the need for a road map, for health club organizations endeavoring on operating their health club facilities in a challenging environmental risk of COVID-19 pandemic [3]. The International Health Regulation [4] is an agreement that legally binds international laws for international collaboration and control toward preserving public health. Saudi Arabia is one of the signatory parties that collaborate in its implementation, through its policies and execution. Further, Saudi Arabia upheld a continuous pandemic preparedness scheme, that is in alignment with World Health Organization (WHO) policies on infection prevention and control [5].

In the literature, there has been few studies, barely limited in number that discussed POE of health club facilities [6]. Thus, this research investigates the literature and presents a systematic approach for the conduct of POE in health club facilities, as a case study in Saudi Arabia. The research discusses various aspects that aim to limit pandemic propagation by evaluating and proposing precautionary measures and strategies for health club facilities; to sustain its operation.

## 2. Research methodology

The research entails the conduct of POE at an indicative level, based on the review of international and contextual literature (on health club facilities) made available by sports authorities and ministries, academic researchers, as well as public and private organizations. The review resulted in the development of a checklist to evaluate the compliance of facility operation activities and physical preparedness at a modular facility, comprising of one of the largest sports chains in Saudi Arabia. This sports chain has modular and standardized type of health club facility, that is considered holistic in offering different sports functionalities. A walkthrough was conducted, to develop a schematic representation of the spaces, and to evaluate the compliance to the pandemic precautionary measures. Following the review of literature, this research aims to address the following questions which are related to the current challenges of operating and limiting the rate of infections in health club facilities:

- RQ1. What are the spaces comprising the modular sports facilities in Saudi Arabia?
- RQ2. What are the required precautionary measures for preventing the risks of COVID-19 propagation?
- RQ3. What checklist can be used to assess the facility pandemic prevention measures?
- RQ4. What are the recommendations to improve the facility management and operation towards ensuring a better pandemic prevention?

To answer these questions, a systematic framework was followed, in an interpretive manner; where observations of available internet open data and investigations of the occupants' behaviors and opinions were collected to ensure, that the investigative walkthrough (comprising of the review of literature, analytics for checklist creation, and inspecting facility compliance to the developed checklist tool) was followed by the users' opinions and observations. The research comprises of sections that present the applied indicative POE methodology and its findings in detail. The following steps summarize the methodology followed in this research:

- The conduct of a literature review to synthesize the previous research on conducting indicative POEs in the context of managing health club facilities. This is to compare COVID-19 precautionary measures from a global perspective. Additionally, the review serves to develop a precautionary measures checklist, to conduct an indicative POE on a case study sports facility in Saudi Arabia.
- The application of indicative POE on a case study health club facility in Saudi Arabia. This is by systematically conducting an indicative walkthrough, to apply the developed checklist as an evaluation tool for the facility operation. Also, the case study involved collection of observation data by two groups of users, namely the members and the training and administrative staff.
- Identifying recommendations for improving operation of the case study facility. This is to provide an exemplary indicative case study POE, to raise the awareness on its effectiveness in a timely manner. This is to address the precautionary post-pandemic measures, that are required to be taken by facility managers, to ensure the sustainable operation of such facilities.
- Concluding the research findings and proposing future areas of relevant research.

### 3. Literature review

#### 3.1. POE conduct in the context of health club facilities

In the 1960s, POE was developed in response to substantial problems that challenged buildings' performance, driven by occupants' perspective. The first studies investigated institutional care facilities, (e.g. hospitals, nursing homes, and correctional facilities). It was remarked that facilities lacked effectiveness in the areas of healing or socializing its occupants. Commonly the identified building performance problems, even for newly built facilities were investigated in relation to the following aspects: health and safety, security, leakage, inadequate design, and adequacy of wayfinding and signages, deficient air circulation and unsatisfactory temperature control, accessibility, storage, privacy, circulation, aesthetics, growth of fungi and accumulation of dust, poor ergonomics and utilization of space, equipment, and maintainability of facades, and fenestrations. POE investigates facilities performance through their operation phase to enhance relatively the lifecycle of the building projects (e.g. design, construction and operational management). It is a diagnostic tool that aims to assess systematically a specific or group of identified criteria. This is on the run to optimize the built environment performance, for enhancing usability, adaptability, and occupation [7]. Li et al. [6] investigated quantitatively and qualitatively the topic of POE in the literature, the research included definitions and benefits, temporal analysis of almost 145 related research projects, from 2010 to 2018, in which 16 protocols were identified, as well as contextual emerging focuses were recognized. The review identified future research areas in the topic of POE from an architectural perspective. The review furtherly investigated different methodologies used and findings concluded over a varying international pool of countries, tackling gaps, trends, and varying levels of effort.

The context of health club facilities was undermined in literature, as it lacked the application of research by the provision of POE case studies. In Saudi Arabia, few studies addressed the topic of health club facilities from a managerial perspective. While Saudi Arabia has a majority of youthful population, where 70% of the population are under 40, thus health clubs make a blue ocean for investors and organizations in the sports sector. Recently new health clubs opened expansively in different cities in Saudi Arabia, their designs are meant to be inclusive for a diversified range of activities such as: swimming, soccer, squash, badminton, mixed martial arts, running, basketball and more [8]. Furtherly, new branches are opened dedicated to female athletes and members [9,10], all targeted toward serving sustainability development goals number 3, 5 and 11; good health and wellbeing, gender equality, and sustainable cities and communities [11].

The following studies were chronologically synthesized from the researchers review of the existing literature on previous research, to discuss the progression of POE as a context of research on health club facilities. Albayrak and Caber [12] discussed customers satisfaction importance in assessing service quality in health club facilities. The study investigated users' satisfaction on staff behavioural characteristics (e.g. patience, communication and responsiveness traits, and consistency of serving), convenience of activities' programs, cleanliness, maintenance, accessibility and safety of lockers, adequacy of the physical facility by parking capacity, and accessibility for the physically challenged individuals. The study also investigated adherence to safety, and workout equipment's adequacy, by assessing its signages, their diversity of types, and availability. The research was implemented on a facility located in Turkey; a limitation discussed by authors that the study cannot be generalized, as more respondents were required, to investigate their levels of satisfaction. Yet, the research did not focus on the precautionary measures required for health club facilities against the pandemic risks as contemporarily challenged in 2020. Kruger et al. [13] investigated accessibility of health club facilities locations to its members residences. The study indicated the need for more research on evidence-based critique for investigating better design decisions of health club facilities.

Pedragosa and Correia [14] discussed members' loyalty and satisfaction in health and fitness club facilities. The research investigated a facility that is located at the suburbs of Greater Lisbon, 463 responses were collected on attributes that are related to expectations of the users, on the facility satisfaction. The study investigated the level of members willingness to recommend the facilities to their peers, repetitive membership purchases and increased frequency of attendance. The study lacked the facility POE perspective to include the execution means towards implementing the precautionary measures, required for limiting the spread and reducing the risks of COVID-19 or pandemics in general; at sports and health club facilities, as introduced in this research study.

Mullen and Whaley [15] studied different individual and contextual factors affecting the involvement and retention of sports club memberships across different age groups and genders, in the USA. The research focused mainly on the levels of physical activities, reasons for participation, commitment, and qualities of the built facility. The results indicated different findings on each of the factors, despite its inclusion of users in its research methodology, it lacked the assessment of precautionary measures needed at sports facilities, specially at times of pandemics, such as COVID-19.

Skille and Säfvenbom [16] discussed the Norwegian policies formulated for sport facilities and their managing organizations, where funds for supporting sports in Norway were discussed, being an enabler for promoting health, education, and culture. The autonomy of sports policy implementation was described as voluntary which stimulates the need for systematic intervention that enhances execution of policies.

Backe et al. [17] investigated safety practices in sports clubs and facilities through governance implementation in Swedish municipalities. The municipality offices conducted inspections that followed the WHO targets toward healthy cities. The Swedish property management office realized the need for safety inspections, being effective in promoting safe practices at sports facilities in local communities. The study aimed to decrease unintentional injuries and improve local regulations on sports premises. The study relates to this research being a potential evidence for its applicability and ability to improve facilities management practices at sport facilities.

Nowailaty et al. [18] proposed the need for the development of social sports club in Jeddah, Saudi Arabia. The research comprised of assessing three case studies of sports facilities architectural design, the aim of this study was to introduce ability of sports club to improve public awareness and engagement toward wellness, healthy community and satisfying a locational gap of need, for a focal

sports club that is positioned in proximity to large potential of members, with a diversified range of activities. Similarly, Al-Sahafi et al. [19] developed a design review of three equestrian facilities to propose a new design of a country horse riding club, both researches aimed to utilize existing international and national facilities design to improve new designs, which indicates the importance of understanding design requirements by review. Yet, both studies did not utilize POE as a tool for the proposed design of the new sports club, which lacked the indicative aspect of assessing facilities, to improve its performance, for post occupancy. Currently with the emergence of COVID-19 a new requirement for developing precautionary measures for sports facilities has taken place. Thus, a lack of systematic procedure from the local design practice was identified, further considerations of precautionary measures were overlooked.

Leon-Quismondo et al. [1] investigated users' satisfaction and prospected importance levels on fitness centers performance and design. The research entailed 414 members of average age of 32 years, from 25 fitness centers located at Madrid, Spain. The research discovered the need for improved services that needs to be considered by public and private fitness organizations for a more engaging physical built environment. The performance considerations were related to accessibility to members' residences, membership and services fees, operational hours, adequacy of staff behavior in service provision, instructors ability to progress members towards achievements, distribution of gifts to attract new and retain existing members, spaces utilization and capacity, adequacy of maintenance, hygiene practices and cleanliness of spaces and restrooms, ventilation, availability and capacity of number of equipment in spaces, temperature of swimming pool, shower baths quality, availability and adequacy of lockers, towels servicing, availability of medical support services, availability and adequacy of cafeteria and Wi-Fi, spaces ability for promotion of social interactions between members and record keeping of clients profiles. Yet, the study did not relate any of the studied aspects to COVID-19 precautionary requirements in specificity. Algaissi et al. [5] studied the governmental response and considerations taken by the government of Saudi Arabia with timeliness of precautions, the study lacked to contextually map or discuss the precautionary measures and their implementation in the context of managing the health club facilities, as discussed in this study.

Guo et al. [20] reviewed and compared the operational guidelines of heating and ventilation air conditioning systems from different geographical contexts, in link with the spread of COVID-19 pandemic. The research identified that the main aspect that negatively assesses respiratory diseases transmission in built facilities is the *poor use of ventilation systems and confinement of indoor spaces*. As droplets of COVID-19 spread efficiently in buildings, through air streams and flows of air supply and drainage systems. Thus, dilution of airflows in the built facilities assist limiting the spread of the anticipated particles, especially in commercial systems. The researchers reviewed guidelines from *the Architectural Society of China, Chinese Association of Refrigeration, American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE), Society of Heating Air-conditioning and Sanitary Engineering in Japan (SHASE), Chartered Institute of Building Services Engineers (CIBSE), German Association of Indoor Ventilation Technologies (RLT) and the Federation of European Heating, Ventilation and Air-Conditioning Associations (REHVA)*. Also, the researchers reviewed the countermeasures to airborne transmission of COVID-19 in Heating Ventilating and Air-conditioning systems (HVAC) in buildings. These countermeasures are increasing the amount of outdoor ventilation and openness of dampers to full capacity, as much as possible, improving the central air filters with specifications of a minimum efficiency reporting value (MERV-13), maintain the HVAC system operational along 24 h and 7 days a week, increase the use of portable air cleaners which are accommodated with HEPA filters, and adoption of ultraviolet germicidal irradiation for higher risk spaces.

In addition, Li et al. [6] review on POE case studies indicated that the reviewed studies covered 1575 buildings, in which residential buildings accumulated 62% of studies followed by educational facilities by 19%, office buildings by 12%, higher education facilities by 3%, medical facilities by 2%, commercial facilities by 1%, where transport and governmental facilities ranked least by ensuing lower than 1%. All the 146 projects reviewed where mainly focused on case studies in the contexts of residential, office, university, educational (e.g. schools, and vocational training institutions), and medical buildings. This indicated the lack of focus of POE studies on the context of management of health club facilities, from an international research frame.

### 3.2. Procedures for post-pandemic precautionary measures

The government of UK issued a manual for operation of sports facilities in times of COVID-19, the guide aims to help facility managers and operators to ensure indoor and outdoor preparedness of precautionary actions required for sports facilities [21]. The manual indicates that control measures may limit the sports activities in place, services offered to facility members such as food and drinks; all based on tiers of COVID-19 risk of spread and number of cases. The manual advised the need to carry out COVID-19 risk assessment to appropriately identify the actions required to improve the precautionary acts against health and safety hazards at sports facilities. Records of operation, protection measures, signages and briefings are stated to be important aspects for managing the pandemic risks.

The Saudi ministry of sport published a guiding protocol that is concerned with six main dimensions, namely: 1) environment, protection, and social distancing regulations, 2) Sports facilities regulations, 3) Play courts regulations, 4) sports that require additional precautionary and protective regulations, 5) reporting and monitoring of symptoms, and 6) awareness and communication regulations [22].

The sports council of Abu Dhabi announced precautionary measures necessary for reopening sports facilities. The measures were centered around three different dimensions, namely: 1) physical arrangement precautionary measures, 2) regulations for technical sector and its training teams, and 3) measures concerned with players and athletes' practices [23].

The International Association for Sports and Leisure Facilities (IAKS), in Germany, kept a track of measures that need to be taken for different types of facilities, based on focus group discussions made online. An initiative that has been developed in the times of COVID-19 and must be continued to develop on the measures discussed [24]. The German Federal Environment Agency [25] has set a statement on the use of swimming pools at the times of COVID-19, the statement directed the continuity of use the swimming pools as long as a disinfectant (chlorine) is added to the water, based on the accepted standards. Noting that transmission requires contact

between swimmers, thus, it was recommended that personnel must be responsible of keeping the required distances between swimmers while ensuring water disinfection procedures. Yet, IAKS [26] did not present a comprehensive unified guide on its website, as other references discussed, which represents a different approach of formulating the facility guidelines for being assessed contextually, on the basis of experts' opinions.

The National Center for Chronic Diseases in USA (CDC) [27] has set considerations for youth sports organizations, which aim to protect people, and groups and slow spread of COVID-19. The approach is based on risks evaluation, the more the equipment or space is shared or occupied the higher its potential risk to contribute to the spread of COVID-19. The activity typology as well is considered to be a determining factor for increasing the risk. The risks are categorized on five degrees, namely: low risk, increasing risk, more risk, even more risk, and high risk. The risks range from individual practice of the activity, a group activity, a group competition, participation in local competition, and participation of different teams in a diverse set of regions' competitions; respectively. The level

**Table 1**  
Comparative analysis of COVID19 precautionary measures.

Code	COVID-19 precautionary means of Action	Impact/Risk	Reference
<b>Occupants based control measures</b>			
A1	Reconfiguration of workspaces to back-to-back or side to side type	Assurance of control over occupants' interactions. Aims to reduce physical interactions and exposure.	[21]
A2	Collection of members attendance and contacts information		[3,21]
A3	Maintaining a limited occupancy		[3,21,27]
A4	Limit shared transportation and commute practices if any		[27]
A5	Conduct Virtual training where suitable		[27]
A6	Designating staff and working trainers to specific spaces and assignment of implementation tasks for control over the precautionary measures		[3,21,27]
A7	Allowance of activities time break		[3,21]
A8	Reducing congestion at entries, and enhancing ques management		[21]
A9	Avoidance of offering shared items (e.g., towels, robes, and rackets)		[3,21]
A10	Prevention of face to tap usage of water fountains		[3,21]
A11	Compliance to social distancing of 2 m minimum		[3,21,27]
A12	Evaluation of activities continuity in case of inability for social distancing		[21,27]
A13	Reducing activities sessions and durations		[3,21,27]
A14	Limiting change in formations of group activities		[3,21,27]
A15	Allow administrative staff, and evaluate their possibility to work from home	Assurance of control over unnecessary occupancy. Aims to reduce physical interactions.	[3,21,23,27]
A16	Provision of protective equipment (such as medical gloves and masks) staff assessing and handling tools and clothing	Assurance of users' preparedness. Aims to reducing the risks of physical interaction.	[23,27]
<b>Facility based control measures</b>			
A17	Ensuring visibility, adequacy, effectiveness, and transparency of precautionary control measures and signages for precautionary procedures	Assurance of facility preparedness. Aims to reduce risks of physical interactions, and uninformed practices of the occupants.	[3,21,27,34]
A18	Promote considerations of disabilities and accessibility	Assurance of facility preparedness. Aims to reduce risks of physical interactions, through reducing the need of assistance and support.	[21]
A19	Closure of spaces with functions of close contact activities (e.g., message therapies, and Karate)	Assurance of facility preparedness. Aims to reduce risks of physical interactions.	[3,21,27]
A20	Use of contactless means of payment	Assurance of facility preparedness. Aims to reduce risks of physical interactions.	[3,21]
A21	Ensuring continued ventilation through fenestrations		[3,21,27]
A22	Reducing contact within or closure of lockers and storage components		[3,21,27]
A23	Avoidance of paperwork through digitalization		[3,21]
A24	Controlling vertical and horizontal circulation through directing flows by the use of informing signages		[3,21]
A25	Encouraging use of outdoor spaces		[21]
A26	Testing and tracing procedures (temperature control, measurements etc.)		[3,21,23]
A27	Closure of prayer rooms		[3]
A28	Continuous cleaning of surfaces and implementation of sterilization processes	Assurance of facility preparedness. Aims to reduce risks of residuals transmissibility through surfaces.	[3,21,23,27]
A29	Use of protective curtains, screens, and barriers for ensuring individuals' separation	Assurance of facility preparedness. Aims to reduce risks of residuals transmissibility through used equipment.	[21,27]
A30	Frequent sterilization of confined spaces (e.g., changing rooms, toilets, and showers)	Assurance of facility preparedness. Aims to reduce risks of residuals transmissibility through used spaces.	[3,21,27]
A31	Provision of waste collection places, bins at the facility spaces, and locker rooms	Assurance of facility preparedness. Aims to reduce risks of residuals transmissibility through used supplies.	[23,27]
A32	Provision of first aid and medical services space in the sports facility, for quarantine and procedures for response to the identified cases	Assurance of facility preparedness. Aims to reduce risks of the pandemic transmissibility.	[23,27]
A33	Development of a tracking dashboard for logging precautionary measures implementation at the facility on website or using a mean of communication with members, staff, and trainers	Assurance of facility preparedness. Aims to reduce risks of uninformed practices of the occupants.	[3,21]
A34	Assigning a mean for communicating complaints and self-reporting of members infection, as well as directed notification announcements		[3,21,27]
A35	Promotion of hygiene handwashing procedures and provision of sanitizing resources	Assurance of users' conduct of hygiene practices. Aims to reducing the risks of physical interaction.	[3,21,23,27]



of risk can be reduced based on the interaction level required for the activity, and its adherence to the social distancing measure. Players' age is another consideration of risk assessment, as well as the involvement of non-essential guests during competitions or training sessions (e.g., parents, friends, or supporters). Additionally, the number of cases of varying regional teams involved in competitions, such as: when higher cases area representative team plays with a lower cases region team.

Ho and Chan [28] discussed the societal response to COVID-19 in Hong Kong, where infection rates were relatively low, due to citizens and professionals' awareness, on the control measures introduced by the government. Additionally, the effective implementation of the coercive measures, have positively prevented the spread of the pandemic in Asian countries, such as: Macau, Taiwan, Singapore, and Hong Kong. In Hong Kong, all public sports and leisure facilities were instructed to be closed in January 25, 2020, this was followed by a prevention and control of disease ordinance numbered as CAP599 [29] in March 2020, that came out to all private fitness centers, to prohibit the co-location of more than four people in its spaces, while implementing temperature checks upon entry to all public spaces. This then was followed by a complete shutdown of public sports facilities in mid-July of the same year. The return of normal public services was then attained in September 2020, after the government have applied a large-scale community testing project. In late September, the reopening followed an issuance of a revised and an amended regulation, namely (CAP599G); targeting both indoor (e.g. gym centers, message salons, badminton courts, ice-skating courts, bowl and table tennis courts) and outdoor sports facilities (e.g. bike parks, horse riding schools, golf courts and exterior runways).

The Council of the European Union meeting in June 2020, developed a set of guidelines due to the impacts of COVID-19, in the member countries for the recovery of its sports sector. The proceeding entailed 41 guidelines categorized under the following themes, namely: 1) assessing the existing situation by recalling previous actions taken in the EU states (e.g. the economic impacts on the sectors, the integrity of organizations and abidance to social distancing, cancellation of major events and competitions, impact of partial and full lockdowns on physical and mental health, the context of post-pandemic resumption strategies), 2) highlighting the wellbeing of the member states citizens, solidarity and endurance of private sector organizations, free circulation of athletes and professionals (referring to it as a health crisis, demanding the need for better exchange of information on the mitigation of risks and national reporting of infection situation), and 3) Inviting member states to take actions towards sustainable development of the sector, applying investment initiatives to improve the temporary frameworks and promoting the value of physical activities to overcome the consequences on its citizens well being in times of COVID-19 [30].

Table 1 illustrates the precautionary measures developed by different entities internationally, few variations were identified but there is a general consensus on the majority of the measures offered.

### 3.3. Post-pandemic precautionary management strategies

Health club facilities are considered as corporates that are linked to association of members, membership conditions and organizational decision-making formation. Health club facilities involve informal and formal interactions among its occupants, possess a historical value, and an external distinctive identity as well as internal social stability. The individuals do not shape the management of the facility but influence it, thus, adaptation to varying contextual conditions take place continuously [31]. User-centric is the term which aims to orient design and operational activities based on occupants' behavior (as users in the facilities management domain), especially for the modularly built facilities [32]. Management of health club facilities must have a considerable dimension of the occupants' participation in implementation, which can be realized by transparent guidelines and procedures, which aims to prevent the propagation of the pandemic. Also, the user inputs on the physical built environment should be evaluated and corrected accordingly, this ensures that larger pool of details are justified. Managing health club facilities in times of post-pandemic requires regaining members confidence and reducing fear of shared spaces that have increased potential risks of pandemic propagation.

Staff active supervision is a critical management strategy to ensure that activities are being implemented according to the precautionary measures. Training the staff and assuring their continuous monitoring reduces the risk of pandemic propagation. The staff have to conduct precautionary measures awareness sessions and inform individual members on the best practices aimed to reduce contact between members, especially where sport equipment is highly used. Cleaning staff need to have the protective equipment for sterilization of spaces on a daily basis while replacing consumed sanitizers and covers [33].

Physical arrangements of the facilities' assets are essential to limit the risk of propagation. The golden rule of social distancing can be driven from spacing the equipment, at condensed arrangements; a seize of half of the equipment is a probable solution to limit physical proximity and to create distanced activity spaces. Further, increased fresh ventilation, use of ultra-violet (UV) light sterilizers during break times and off time are essential to prevent the risks of residuals. The use of ICT and digitalization in the times of Pandemic is pivotal, where it enables the realization of multiple aspects such as: monitoring athletes or members log, monitoring indoor environmental quality, monitoring sanitization rounds, evaluating space arrangements, categorizing equipment types, notifying and engaging members with the precautionary measures, monitoring thermal temperature at spaces and entrances, managing membership updates and offers, logging the inventory of sanitizing and protective resources, reporting facility performance using automated dashboards, monitoring heart rates and pressure of players, and providing virtual online or offline workout sessions and training activities.

## 4. Case study of indicative POE on a health club facility

Health clubs are developed to accommodate several sports activities to enhance health, wellbeing of the societal members as well as to improve social interactions and positive competitions with good well, in some cases they are developed to generate revenues on membership basis or to increase society participation by public offering of spaces to conduct various sports activities. The case study facility is a branch of one of the largest brand of health clubs in Saudi Arabia that have more than 100 branches over different

geographical national regions. The branch selected for the study is of premium quality and is near to the operation and management headquarters, this is to ensure that it resembles best performance of the precautionary measures to pandemic are being considered. Fig. 1 illustrates the ground and first floors of the evaluated case study facility.

#### 4.1. Scope and facility description

The facility built up area is 2400 m<sup>2</sup>, that has one main entrance, and three emergency exits located at each side, that is different from the main entrance. The facility operates for 18.5 h daily, from 5:30 a.m.–12 a.m., except on Friday operates from 1 to 11 p.m.

##### 4.1.1. Entrance, reception, and membership area

Entrance area comprises of a wide reception desk, with a camera mounted in the ceiling for security purposes, and two adjacent tripod type turnstiles; to limit access. The access control utilizes Radio-frequency Identification Chips that were given to members, at

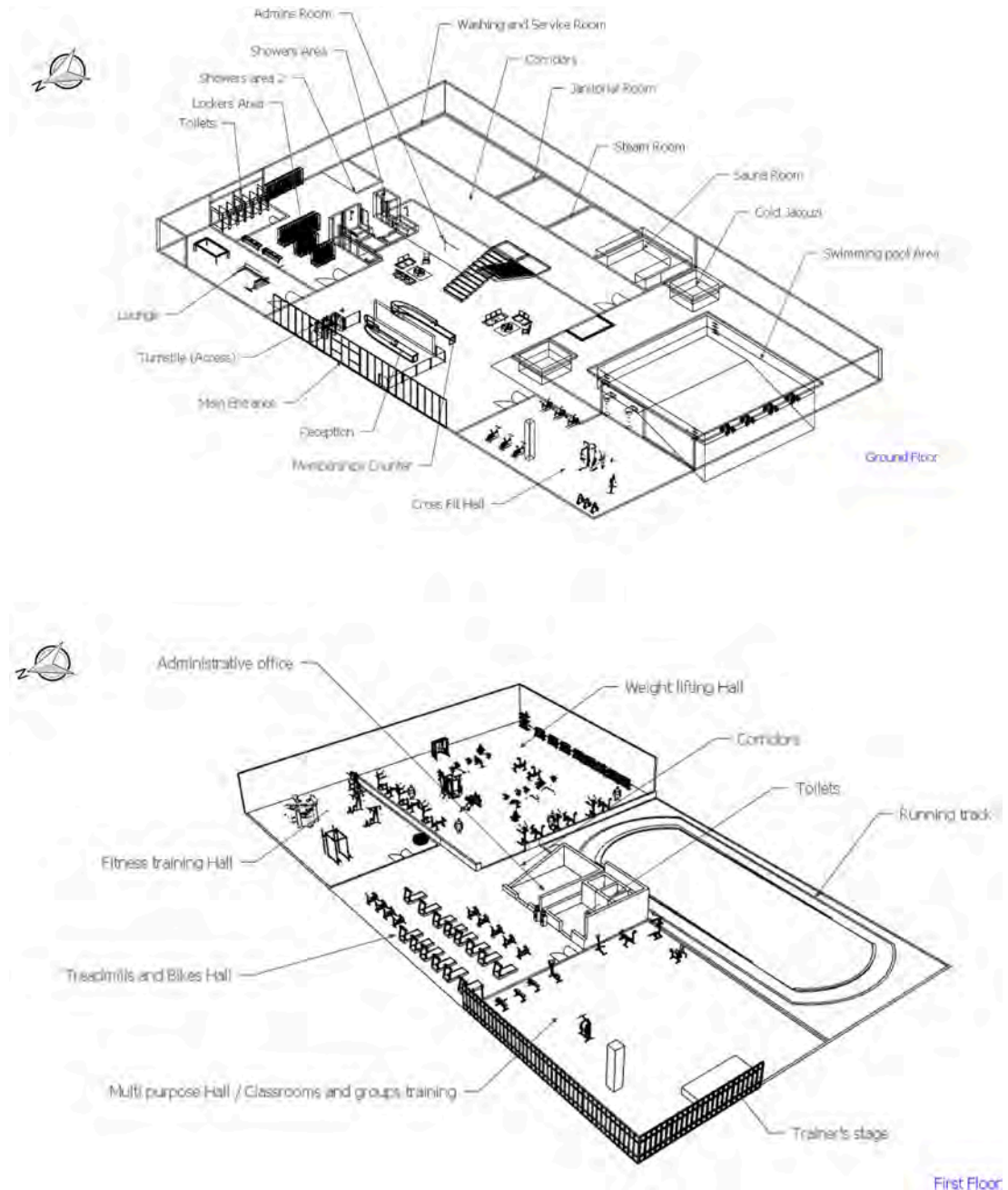


Fig. 1. Ground and First floor schematic of the facility spaces.

time of registration. Behind the reception desk, a decorative partition separates a membership registration counter, that serves two persons distanced by 4 m. The floor finishes are made of regular ceramic tiles. The wall finishes vary between decorative modern wallpapers and white paint finish. The entrance area is ventilated through rectangular ceiling diffusers and has an automatic double glass door, remained open for improving fresh ventilation. The entrance is equipped with gym etiquette announcement sign board, and a clear list of precautionary measures for members. Hand sanitizers are located on the turnstiles, as a replaceable bottle with manual cap of plastic dispenser pump. The receptionists use an infrared thermometer to measure members temperature. The Gym developed a mobile app that limits occupancy to a specific number, where members have to register their preferred exercise time based on an hourly reservation calendar system. The members need to show the reservation to the receptionists to be permitted to enter.

#### 4.1.2. Break lounge and waiting open areas

The waiting open areas are located at the entrance hall. Each set has a sofa, two chairs, a coffee table, and a TV for watching soccer games and news. The sofa has been wrapped with a warning tape at two slots; limiting the use to one person, the TVs were turned off permanently to prevent social gathering. The waiting areas do not have a visible hand sanitizer bottle served on it. The break lounge consists of a billiard table and a sofa fronting a large TV and a bookshelf for readers. The lounge was considered as high-risk interaction area; thus, it was closed.

#### 4.1.3. Lockers, toilets, and change booths

The lockers, toilets, and change booths are located with direct proximity to each other at the ground floor. It consists of three rows, of double faced, adjacent lockers, separated by aisles, that has change room benches between them. The lockers are locked by a manual combination lock, that requires touching and spinning. The lockers capacity is set to half by wrapping a warning tape on every mid-locker in series, increasing the distance gap between the useable ones. The lockers are made of High-density fiber boards, known for its resistance to moist and termite, and for its washability, and have an inner breathable opening in each. The change booths are located in the lockers area, as shown in Fig. 1, in a consecutive row. Each room has a mirror, fixed seat, and a clothes hook, with a stained-glass door. Each unit is opened from the top making it ventilated with lockers hall air.

#### 4.1.4. Indoor swimming pool and Jacuzzis

The swimming pool consists of four swimming lanes and 50 m in length. The swimming pool has three aluminum stairs and four jumping stands. The pool is lit by a grid of high bay metal halide luminaires. The swimming area has a cold and hot Jacuzzi sinks, that can accommodate 6 persons distanced a meter, each. The pool area has chaise lounge chairs to rest on, and a table so that members can keep their private belongings on. The pool area has a three standing open showers stall. A guard staff is made available to ensure the safety of members. The floor is finished with anti-slippery ceramic tiles and walls are painted regularly with different motivative colors. The air supply in the hall is run through two main ducts, with a large linear diffuser at each outlet. The pool is located at the ground floor.

#### 4.1.5. Indoor running track

A 200 m running track with two lanes, made for running and paced walk exercises. The track has a centric overlooking on the swimming pool, bounded by a glass paneled, aluminum baluster, and has three window openings, for improved ventilation and daylight. The ceiling is made of sandwich panels, due to the compartment steel structure, of the zone design. The ceiling has a lower boundary level of false ceiling that is decorative and holds spotlights for the running track lighting. The track flooring is made of athletic elastic material, to comfort athletes, ease and absorb shocks caused by jumps through running. The walls are not flat and has varying voids along the track, which increases risk of injuries in case of accidental falls while running.

#### 4.1.6. Weightlifting Hall

The hall entrance is a shutter door type to give aesthetic look of a garage door. The weightlifting hall consists of multiple equipment, purposely accustomed to serve different body building exercises (e.g., upper-, lower- and mid-; abdominal, chest, tri, bi, shoulders, back and leg exercises), the equipment are placed adjacent to each other in a condensed manner. A southern side of the hall consists of mirrors and a longitudinal dumbbell shelves that are fronted with different exercise benches. The hall has four main columns, covered by metal sheets to give a sense of an underground training garage. The ceiling is exposed to upper slab soffit, with epoxy painted finish. The air ducts are exposed and painted black. Rectangular diffusers are supplying air at every side of the hall. LED strip lights are mounted in a zig-zag multileveled style, to give a sense of industrial design. The columns are equipped with sanitizing dispensers, a packet of wet wipe rolls is left at every corner to allow members to wipe surfaces before and after equipment use. Two Janitors are revolving around the used equipment to make sure that it is sanitized after use. The aisles are marked with directional arrows to ensure circulation in one direction in and out of the hall and to reduce unnecessary interaction. Half of the replicated equipment is covered with warning tapes, to distance members and limit their use. Multiple sanitizer bottles with dispensing pumps are left on the equipment for cleaning and sterilizing.

#### 4.1.7. Gymnasium and step training Hall

The gymnasium hall, located at the first floor, aims to hold different activities such as: step training, group, yoga, stretching exercises, rope jumping, cardio, high intensity training, aim fit, fitness sessions and classes. The hall is finished with parquet floorings, and has a northern side with curtain wall, that has three panels which can be opened to enhance ventilation. The southern side has a glass partition which separates the hall from the running track, that provides a visual connection. The hall consists of a stage that is backed with full mirrored wall, that provides spacious feel to the hall and ensures a better follow up, of members to trainer, at group exercises. The hall ceiling is finished with gypsum board that has linear diffusers, for air supply and return. The flooring is marked with



**Table 2**

Precautionary measures checklist, as a tool for guiding the walkthrough.

Space type	Precautionary Measure	Complied	Not Complied	Remarks
<b>Entrance, reception, and membership area</b>				
1.1	Reduced and controlled capacity of occupants	✓		The health club developed a mobile application, that serves managing occupancy by allowing members to login through unique user accounts, to register their preferences of visit time and duration, there is no strict abidance to exact time of entry and duration. The health club does not want to be strict to sustain members.
1.2	Non-physical access, provision of electronic scheme for access	✓		Entry turnstiles have integrated RFID for uniquely made membership tokens that were given at the start of the users' membership subscription, yet there is potential to touch the turnstile in order to enter.
1.3	Distanced floor signages and wayfinding	✓		Despite the availability of circular marks distanced for members to follow at the entrance, it is difficult in applicability with multiple entrees and different circulation at entrance. An image recognition scheme should be used for members movements monitoring.
1.4	Temperature test and ensuring mask wear and protection preparedness	✓		Thermal measurements are taken for ensuring the unavailability of COVID-19 symptoms, the receptionists ask all members entering to keep wearing the mask during interaction with others and circulation within the facility foyers and corridors.
1.5	Availability and visibility of space use policies and announcements	✓		The facility has awareness signages that describe what members must do at the space.
1.6	Cashless payments and electronic membership transactions	✓		Different modes of cashless payments and electronic handing over of the membership documents through email and SMS are available.
1.7	Ventilated and enhanced fresh air circulation at receptions and entrance	✓		The reception area directly faces the main entrance which allows entry of fresh air
1.8	Availability of full body sterilizers and hand sanitizers		✓	Only hand sanitizers were provided above the turnstile for potential disinfection of indirect touch.
<b>Break lounge and waiting open areas</b>				
2.1	Distanced occupancy interactions and usage		✓	The space was closed in order to limit the high risks of social interaction.
2.2	Continuous sterilization of furniture, library, billiards and reading material shelves		✓	
2.3	Availability of Cashless beverage machines		✓	
2.4	Availability of billboards and banners on awareness of space precautionary measures		✓	
<b>Lockers, toilets, change booths and showers</b>				
3.1	Availability of soaps, hand driers and wipes	✓		There are facilitated sanitizing resources at the location, an automatic infrared dispenser can be utilized to reduce the risks of physical interaction.
3.2	Availability of touchless and self-sanitizing lockers		✓	Not made available.
3.3	Distancing and spacing between units	✓		Units are reduced to half, by wrapping every mid locker in three lockers, in series.
3.4	Continuous cleaning, sterilization of units and hygienic practice of janitors	✓		The janitors are continuously sanitizing the surfaces, based on hourly schedule, and continuous use of the members.
3.5	Removal of shared and reusable resources (e.g. hair driers, towels, and slippers)	✓		The service of clean towels was stopped, hair driers were shut down and shared swimming and bath slippers were removed.
3.6	Removal of benches and obstacles between the locker aisles	✓		To allow more space for distanced movements and reduce possible indirect physical interactions.
<b>Indoor swimming pool and Jacuzzis</b>				
4.1	Limited occupancy to the number of lanes in the pool and Jacuzzis		✓	No specific policies were taken at the swimming pool. A policy must be incorporated to limit swimmers in the pool.
4.2	Continuous monitoring and treatment of the water quality	✓		Yet, there is no scientific evidence on the propagation of COVID-19 through treated water in the literature. The chlorine level is monitored continuously by traditional methods.
4.3	Availability of circulation and ventilation means for fresh air		✓	Despite that there are open small windows to allow fresh air and natural light. The water chlorine evaporates to the upper overlooking running track without exhausts and adequate entry of fresh air. A recommendation of exhausts placement has been made.
<b>Indoor running track</b>				
5.1	Cleaning, sterilization, and hygiene of the possible interaction surfaces (e.g. guard rails, flooring, and walls)	✓		Janitorial staff clean and sterilize the surfaces on daily basis.
5.2	Limited occupancy to the number of running and walk lanes		✓	

(continued on next page)

Table 2 (continued)

Space type	Precautionary Measure	Complied	Not Complied	Remarks
<b>Entrance, reception, and membership area</b>				
5.3	Availability of circulation and ventilation means for fresh air		✓	No specific control measures over occupants entering the running track. An electronic counter should be used to limit the capacity.
5.4	Distanced towel and accessories hangers		✓	A placement of exhaust fans is highly recommended. The towels hangers are placed close to each other, a change in distance must be implemented. Further, lockers shall be placed to improve the keep of members accessories, at the same floor.
5.5	Markings and separation of warm up areas and running lanes		✓	Members tend to warm up at corners where others are running which increases potential risk of interaction. Instructions should be made to limit this practice.
<b>Weightlifting hall</b>				
6.1	Cleaning, sterilization, and hygiene of the furniture, equipment, and machines (e.g. dumbbells, lift benches, racks, and mirrors)	✓		Janitors have schedules of rotary activities to sterilize the equipment. An hourly complete sterilizing session should be put in place.
6.2	Distanced control of occupancy and furnishing of equipment and machines	✓		Close and repetitive equipment is wrapped with warning tape, to limit use.
6.3	Availability of visible policies and signages for awareness	✓		Signs are placed visibly on each equipment, with instructions on precautionary use.
6.4	Supervised monitoring of members interaction and wellbeing by coaches or health supervisors	✓		The staff are continuously rotating to ensure safe interaction and wellbeing of members.
<b>Gymnasium and step training hall</b>				
7.1	Availability of marking for controlled occupancy and distanced interactions	✓		Rectangular tape markings are placed on floor to ensure the members placement during group sessions.
7.2	Removal of shared and reusable resources (e.g. matts, jumping robes and stretching resistance bands)		✓	Mats are kept un-sanitized; members should be instructed to bring their own equipment.
7.3	Availability of visible policies and signages for awareness	✓		The signs are visible, with clear precautionary instructions
7.4	Cleaning, sterilization, and hygiene of the furniture, and light machines (e.g. abdominal benches, stretch rails and mirrors)	✓		Janitors are scheduled to ensure sanitization and sterilization of equipment after use. An hourly complete sterilization scheme must be introduced.
7.5	Availability of circulation and ventilation means for fresh air	✓		Fresh ventilation is supplied through air ducts.
<b>Treadmills and fitness bikes hall</b>				
8.1	Availability of separation curtains and protective screens		✓	There is a need to place plastic curtains, that are washable on a daily basis to separate equipment micro surroundings.
8.2	Availability of distance markers and means	✓		The equipment is reduced to half by wrapping the high risk of interaction placed equipment.
8.3	Availability of visible policies and awareness advertising signages	✓		Signs are made visible with clear precautionary instructions, IPTVs are utilized to circulate awareness materials about COVID-19 and its precautionary considerations in the hall.
<b>Sauna and steam bath</b>				
9.1	Individual use of the units		✓	The spaces were closed in order to limit the social interaction.
9.2	Cleansing and sterilization of the units		✓	
9.3	Enforcing time gaps between each use cycle		✓	
<b>Security and executive coach offices</b>				
10.1	Limited interaction with the coaches	✓		Only one member is allowed to enter the admins space.
10.2	Continuous documentation of occupancy and logging through CCTV	✓		Reports and monitory tasks were considered in place, during times of operation.
10.3	Managing and scheduling for members-controlled consultancy visits and tests	✓		A staff member was allocated to serve this purpose.
10.4	Availability of hand sanitizers	✓		The use of infrared dispensers is recommended.

taped rectangles to ensure individuals positioning and a distance is kept at group exercises, while limiting the maximum number of participants. Yoga mats are made available with sanitizer sprays to allow members to clean them before and after exercises. The hall has a double glass door entrance, that is kept open to improve ventilation.

#### 4.1.8. Treadmills and fitness bikes Hall

The treadmills and fitness bikes hall is located at the first floor. With multiple grid arrangements of equipment, the bikes and treadmills are located next to each other, the granular arrangement is directed toward north side. The ceiling is made of white painted gypsum boards. The flooring is fitted with regular 60x60 ceramic tiles, and the north side is open to sunlight but with an inoperable curtain wall. The hall has two drinking coolers that are closed with warning tapes, and a direct access to toilets area, coach offices, gymnasium, and step training hall. The hall is fitted with Internet Protocol Television (IPTVs) at front row of the equipment, positioned at high level for visibility, with different channels viewed. IPTVs serve to distribute some precautionary measures announcements. There are two janitors that aim to sanitize and wipe equipment before and after use. The ceiling height is 3.5 m and the hall has access to the facility core stairs transitioning occupants between ground and first floors.

#### 4.1.9. Sauna and steam-bath rooms

They are located at ground floor with access to a linear corridor that links the emergency exit door at one end and the swimming pool entrance at the other end, perpendicular to a linked corridor leading to showers area, and the lockers room. The corridor has two drinking water coolers located after the sauna room by 5 m, that are wrapped with warning tapes. The steam room has a fixed seating parameter, finished by bright ceramic tiles, where three outlets infiltrate the room with steam based on the occupant's level of preference. The Sauna room is made of wooden finishes and has a capacity of four persons. Both rooms have glass doors, that are kept closed for avoiding high risk of propagation.

#### 4.1.10. Security and executive coach offices

There are security offices located at the ground floor next to the locker's hall, referred to in Fig. 1, as admin room. The room is equipped with several screens that aim to serve monitoring and control of security and safety of the players, auditing the coaches, and staff performance through the sessions. The room also, serves to hold meetings between administrative staff and members to manage complaints and recommendations.

#### 4.1.11. Stairs

The stairs are centered as a core for the facility, the width is 2.2 m, finished with ceramic tiles and a chromium handrail. A mid-line was taped on floor with directional arrows to control circulation flows, one side for going up and the other down. The stairs are lit by spotlights.

#### 4.1.12. Walkthrough investigation

The walkthrough was guided by a checklist that was developed out of the literature review and interpretations of the authors. Table 2 illustrates the checklist of the precautionary measures. The checklist was applied on the previously described spaces; as the POE scope of work.

### 4.2. Observations of the members (as users)

The members were observed during different training days, along with the use of the checklist, to check the applicability of the precautionary policies, the policies were deemed being followed by the members. Some of the members were coming to the facility without pre-booking on the digital calendar, thus, staff were advised to register and record their access prior for entry. The masks were taken off during the sessions for enhanced breathability; during the group sessions, yet the members were instructed to keep a distance based on the floor markings made available. Due to the limited number of interactions between members allowed, and the scope of the case study POE, following an indicative level of effort, five members were interviewed to question their perspective, about implementation of the precautionary measures and its impacts. The following comments were collected:

- A need for 24/7 operation of the facility was identified, the occupancy peak was skewed toward night operation times all days of the week, and evenly distributed on Fridays. The members suggested their need for extending operational times during early hours of the day, to reduce their need to attend the limiting operational hours.
- A need for better management of facility occupancy was identified, the interviewed members complained about the number of members, permitted to the facility at the nighttime. A stricter control is needed, to reduce the concentration of members activity, within the gym hall and the use of its equipment. The reduction of replicated equipment, set for operation, have adversely increased the queues of members at each, waiting for turn of workout. Thus, spatial arrangement of equipment needs to be considered to increase the number of operating equipment, while maintaining the precautionary measures in place.
- A need for introducing virtual training classes was identified, through proposal of introducing a recorded systematic training session, on the facility mobile app. Such proposal would enable the members to train on their own rather, than being in need to have more interaction with the coaches, at the limiting group schedules.
- The members complained about the closure of sauna and steam rooms. Despite the increased risks of the pandemic, they requested to have a sterilization scheme, that would allow the usage of such spaces while limiting their occupancies.
- The members requested improvements to the training equipment to be more interoperable, with their wearables and mobile phones, in order to record, monitor and report their health; through the sessions (e.g., temperature monitoring, heart rate

monitoring and registration of equipment use utilizing digital membership identifiers, to register the members who used the equipment and trace infections).

- The members requested to have the water coolers back, to refill their bottles, during the activities. A proposal of having disposable water bottles should be considered to ensure better dehydration, during their training sessions.
- The members requested to improve the ventilation at the fitness training and weightlifting halls.

#### 4.3. Observations of the trainers and administrative staff

The staff and trainers were observed throughout the training day, they were interviewed to identify their perspective on the implementation of the precautionary measures. A need for more protective equipment and cleaning tools was identified. Specially for the janitors, to reduce the potential risks of interaction with the sterilized surfaces and waste during collection. The administrative staff discussed the need for having a monitoring system to control the use of sanitizers by the members. The following observations were noticed during the conduct of the indicative walkthrough:

- The janitors requested to have a more inclusive planning of the wards, specially for sanitization. As the sanitization tasks are dispersed and consume their workhours. Participation of each member before and after the sessions, in cleaning their used equipment, would reduce the demanding workloads.
- The staff conducted talks, every shift to coordinate their work schemes and discussed the cleaning and operation processes. Staff health was screened, at the start of each shift, to ensure a reduced risk of the pandemic transmissibility.

### 5. Recommendations for post-pandemic measures

Recommendations have been classified under five main consideration categories, namely: HVAC, lighting systems; safety and security, maintenance and cleaning management, and spatial configurations for the facility under study. These recommendations were validated and verified by the collection of photographs and notes through the walkthroughs, as a supporting evidence, while the researchers have conducted a brainstorming session, to foster solutions that shall improve the facility prevention and preparedness against risks of propagation, by following the investigated literature on the recommendations by different international organizations such as WHO, these recommendations were:

- HVAC systems recommendations: replacement of the air duct types is highly recommended from aluminum type to fabric type, this would allow the better control over possible inner contaminations through disposal or washability. The diffusers are not equipped with filters, a consideration has been placed to improve the purity of supplied air into the halls and spaces.
- Lighting systems recommendations: the lighting systems needs to be incorporated with UV lights. A design of UV lights should be incorporated in spaces to conduct disinfection of residuals, specially during the facility closure times. The lighting systems should have red, green, and blue (RGB) color controls, to provide visual notification to the occupants during complete sterilization sessions, which are recommended to be introduced.
- Safety and security recommendations: a sterilizing chamber should be placed at the main entry of the facility. Also, chlorine shoe sinks/dispensers can be placed at the entry to disinfect members shoes from external residuals and reduce the risks of external environment. The equipment should be fitted with disposable seat covers to reduce the effort of cleaning and sterilization by members and janitors, consumed before and after the sessions.
- Maintenance and cleaning management recommendations: the maintenance team should clean air diffusers more frequently; dusty diffusers were observed at the indoor running track ceiling. Complete sterilization sessions should be incorporated in the preventive maintenance schedules, cleaning of air ducts, refreshing air in confined spaces and sterilization methods for sauna and steam baths. Anti-bacterial sprays can be used to disinfect air in spaces after use, specially at peak training hours. Increasing air ventilation at peak times is recommended to limit the arousal impacts of the sterilizing agents used in place.
- Spatial configuration recommendations: the treadmills and bikes need to supplement with protective screens in front of the users, to reduce the risks of transmissibility during sneezes and to limit spread of members liquid wastes during intensive exercise sessions. The equipment should be arranged in spaces to reduce the closure of equipment, this reduces members wait time, enhances their satisfaction by better service provision and strengthens the facility revenue.

### 6. Conclusions

The paper presented a systematic approach, that is novel, to fill a gap in literature and to enhance the understanding of health club facilities precautionary measures, after the pandemic times has taken place. The study investigated a modular sport facility in one of the largest health club chain in Saudi Arabia, a context that was not introduced before in the literature. The research investigated the literature to develop a list of the precautionary measures required in health club facilities, in response to the risks of the pandemic propagation. This is to ensure a continued safe operation of an active facility, that has varying range of occupants throughout its operation. A checklist was developed to assess the implementation of the precautionary measures, an investigative walkthrough was conducted as an exemplary practice that can be replicated at different modular type of health club facilities, in Saudi Arabia.

This study links the management of sports facilities to the applications of assessment of the precautionary measures applied in times of COVID-19. The study proposed recommendations to improve the facility management, operation, and its precautionary measures using different management strategies. These recommendations covered HVAC, lighting systems, safety, security, maintenance and cleaning management and aspects related to spatial configuration. The application of the checklist as in this research have provided an

exemplary method of conducting an indicative POE, in response to the pandemic risks, where the monitored observations, and the discovered recommendations can be corrected while not sacrificing the continuous operation of the facility. This is to ensure the sustainability of health club facilities in times of the COVID-19, as an act towards the bigger goal of improving the societal wellbeing through continuity of operation of health club facilities; serving the UN sustainable development goal No.3 “Ensure healthy lives and promote well-being for all at all ages”. Future studies shall investigate users’ satisfaction upon the applied precautionary measures in health club facilities and the economic impacts on public and private sports organizations due to the application of the post-pandemic precautionary measures, on their facilities.

This research is an exemplary conduct of an indicative POE, which focuses more on qualitative aspects for the evaluation of built facilities. A limitation for this study is the lack of quantifiable measures, due to its focus on the precautionary measures, from an assessment point of view, while comparing different precautionary measures at different countries.

The case study provides a POE on a contextual facility that has never been reported upon in the literature, which adds novelty by being focused on health club facilities. The drawings are schematics and aim to be explanatory rather than accurate; to provide visualization of the facility layout, in line with the nature of an indicative conduct of POE (which utilizes hand sketches for assessment). Further diagnostic POE studies should be made to continue research and entail further descriptive material of built facilities based on quantitative methods.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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