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Integration of Industry 4.0 for a Smart and Sustainable Future of the Healthcare Sector in the Post-COVID Era

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Abstract: The COVID-19 pandemic has result in unprecedented challenges for the manufacturing and service sectors. Further, it has also tremendously affected the global healthcare sector, which is seen in the surge of demand in personal protective equipment, ventilators, masks, medicines, etc. Furthermore, according to Menear (2020), the world population is projected to be at least 8.5 billion people by 2050, including a much higher elderly population. This calls for an urgent, critical evaluation and upgrade of the healthcare sector. In this regard, an implementation of Industry 4.0 (I4.0) technologies is proposed to fulfill the sector's current and future needs. A detailed and systematic review has been conducted using PRISMA, which highlights the various I4.0 technologies for the early detection, control, and management of the healthcare supply chain. Finally, it is imperative that I4.0 be properly implemented for better management of the global healthcare sector. The study also highlights policy implications for stakeholders.

Keywords: COVID-19, healthcare supply chain, industry 4.0, resilient supply chain, sustainability.

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INTRODUCTION

The global healthcare sector is expected to grow at a CAGR from 7.3% to 8.9% from 2014 to 2022 with a market value of nearly $11,908.9 billion (Business Wire, 2019). However, the pandemic has disrupted the whole sector. The industry being the epicenter of unprecedented global pandemic challenge faces a number of issues as reported by the literature and the news articles/reports. One of the biggest challenges is identification of suspected cases which requires faster diagnostic process and continuous revision of testing strategies across the people (Ranney et al., 2020). Apart from this, this sector is facing huge burden like requirement of additional manpower, testing labs, testing kits, ventilators, essential consumables like masks, gloves, Sanitizers, etc. for providing safety in hospital and proper treatment to the infected people which thereby lead to uncertainty in demand and supply dynamics in the supply chain (WHO, 2020; Ranney et al., 2020).

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Amid all the challenges faced, the industry is also witnessing a loss of business and this trend will continue at least for the next 3-6 months. Around 80% of costs are fixed in this sector, but still it is expected that there will be many losses, and they will directly affect the cashflows (ET Markets, 2020; Odoemelam et al., 2020). Most of the medical devices are being exported from different countries like USA, China, Japan, etc. These countries export consumables, disposables, gloves, syringes, computed tomography and imaging devices etc. to India. While currently everyone is focused on controlling the transmission and curtailing morbidity and mortality rate due to COVID 19, how healthcare industry can adopt several mitigation strategies to overcome from current crisis using Industry 4.0 technologies is presented in this paper. To conduct this study, Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology is used which is as follows: i) Identification; ii) Screening of articles; iii) Checking of eligibility; and iv) Review of finally selected articles, suggested by group of 29 authors, methodologists, medical editors, clinicians, and consumers (Moher et al., 2009). The findings of this study suggest that for a sustainable development of a supply chain, integration of the emerging technologies is much needed, particularly in healthcare sector. The various emerging technologies, such as blockchain, IOT, AI, big data, drones, etc. plays a crucial role not only in facilitating the logistics but also helps in building trust, transparency and collaboration among the supply chain partners (Saviano et al., 2014; Mahapatra et al., 2021).

METHODS

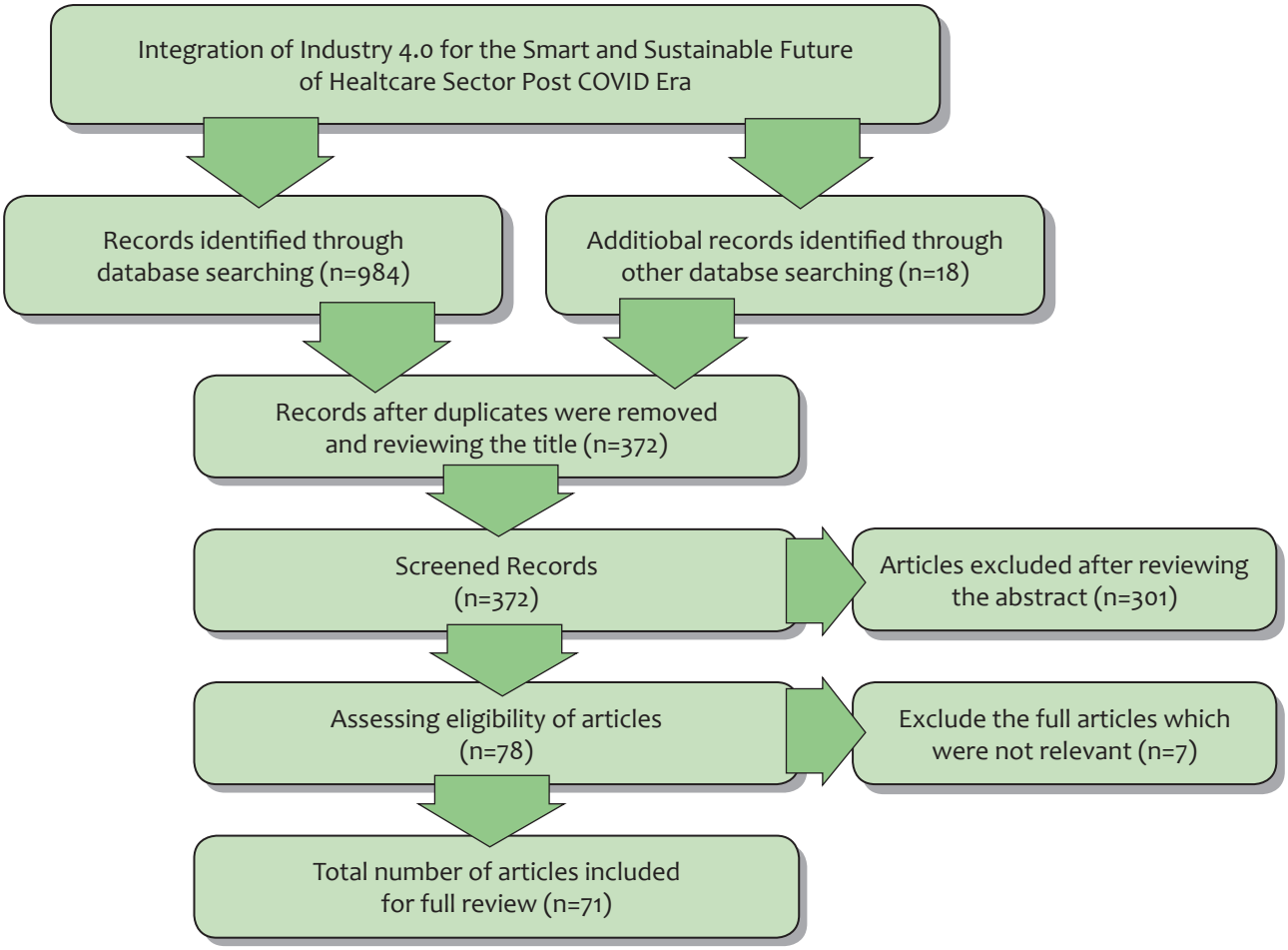

Figure 1 PRISMA Methodology

With reference to the PRSIMA methodology, we have chosen two central databases, "Scopus" and "Google Scholar" which were considered for conducting the literature review. After defining the databases, we have used search strings ("Industry 4.0" OR "Internet of Things" OR "Cloud Computing" OR "Blockchain" OR "Augmented Reality" OR "Virtual Reality" OR "Artificial Intelligence" OR "AI" OR "Machine Learning" OR "ML" OR "Cyber Security" OR "Big Data" OR "Automation") AND ("Healthcare") for covering all relevant articles. In the first phase, 1002 articles were retrieved. For our evaluation, we have only considered peer-reviewed articles. We have excluded the book chapters, thesis, book chapters, papers other than the English Language and articles in the press. In the same line, in the next step, we have gone through abstract and titles of the papers, removed duplicated articles, non-relevant articles and finally selected 71 papers for final review purpose meeting the quality standards of application of Industry 4.0 in the Healthcare Sector.

RESULTS AND DISCUSSION

Possible solutions to curb the effects of Pandemic in Healthcare Sector

The Ministry of Health, Family and Welfare (MoHFW), Government of India are monitoring the COVID- 19 situation and they are intensifying their preparedness and response efforts (MoHFW, 2019). National and state health authorities are constantly reviewing public health preparedness including surveillance, diagnosis, hospital preparedness, prevention and control of infection, logistics and risk communication. The National Centre for Disease Control (NCDC) has launched Strategic Health Operations Centre for Disease control (NCDC) to provide command and control functions and an open platform to answer all the queries by public.

All the functions of the government would be possible when there will be seamless and uninterrupted connectivity of data that would help in sharing the health data across the practitioners and policy makers for analyzing it for services. This has led to the acceptance of Artificial Intelligence (AI) across the supply chain (Kao et al., 2014, Anparasan & Lejeune, 2018; Wirz et al., 2018; Cai et al., 2019; Chen et al. 2019; Wen et al. 2019; Wang et al. 2020; Ganasegeran & Abdulrahman, 2020).

With the rise of AI, Telemedicine could be proved as risk mitigation strategy for Healthcare industry after this crisis situation (Ginsberg et al., 2009; ET Heath World, 2020). Telemedicine is use of technology to solve the problems of patients by connecting them to doctors through online platform specially during the pandemic. The current paradigm of care can be changed by use of telemedicine and it will help in providing improved access and improved health outcomes in cost effective manner (Portno et al., 2020). During this Pandemic, Ministry of Health and Welfare with the collaboration of NITI Aayog, released Telemedicine Practice Guidelines to enable Registered Medical Practitioner to provide healthcare services in remote and inaccessible area. On a regular interval basis online training session needs to conducted for healthcare workers like doctor, nurses, and paramedic staff so that they can follow protocol designed for detection, isolation and communication regarding any suspect of COVID 19 (The Economic Times, 2020). Healthcare industry can adopt this and can overcome after this crisis of COVID 19.

From last few decades, India emerged as Pharmaceutical hub of the world (FICCI, 2018). The reason behind is that India is the largest supplier of generic medicines all across the globe with 50 percent of globally created demand for vaccines. The crisis of COVID 19 highlighted the contribution of Indian Pharmaceutical industry by exporting a large amount of Hydroxychloroquine. This medicine showed some positive results to treat the patients affected by COVID 19. Despite being so strong in Pharmaceutical Industry, India has a dependence on China for some raw materials and intermediate products. According to data released by India's Pharmaceutical

Exports Promotion Council, exports of bulk drugs and intermediated have increased over the previous year. Bulk drugs are raw materials used in formulations or medicines. They used to make different essentials drugs like Paracetomol, Ciprofloxcin, Amoxicillin etc. Whereas intermediates are those chemical compounds which we used to produce Bulk drugs. The reason behind importing these drugs from China is economic considerations i.e. cost effective for Indian Pharmaceutical manufacturer (Health Analytics Asia, 2020). During this COVID 19 crisis, when China stopped giving information that could prevent current pandemic, countries started to move their manufacturing plants out of China. In addition to India, Japan, United Stated of America paying their companies to move out from China. This can be proven as one of biggest opportunity for the internalize the whole supply chain for our good. There is one more area where we have completely dependent on China and other foreign countries. and that Medical equipment manufacturing (The Economic Times, 2020). This includes Ventilators, masks, PPE, Diagnostic kits. Medical equipment manufacturing requires technology integration, assembly, quality control and testing and validation, we depend on other countries. During this crisis supply chain disruption occurred and India was not able to import this leads to Make in India concept. During crisis, China offered detection kit that can produce faster results Because of continuous increase in number of cases, rapid testing was needed that's why India ordered kits from China. But soon, India withdrawal offer from China because of failing quality control check of kits. Indian Council of Medical research also claims that kits were faulty and overpriced (Grainmart News, 2020). Due to increase in demand of essential items during pandemic, several Indian companies took benefit of the opportunity and convert their manufacturing to make ventilators, diagnostic kits, masks, gloves etc. (Times of India, 2020; Hindustan Times, 2020) Day by day we are reading in newspapers that people are giving cost effective and innovative ideas to overcome from this current crisis. If we will depend on our self, then this will provide benefit to our Healthcare Industry. Ultimately, we should push ourselves to use Make in India products. Indian government has also launched Arogya Setu app for the users to the identify that whether people are in safe zone or danger zone. It stores the user data, their travel history, health etc.

Ayurveda has proven potential treatment for prevention and treatment of COVID 19 that boost up the immunity (Rastogi et al., 2020). This has the reference with the AYUSH framework that calls for human services that offices are additionally being prepared to be changed over into isolated offices during hardship. From this point of view, actualizing the recommended mediation plan inside AYUSH medicinal services offices by Ayurveda workforce may profit the country incredibly (Rastogi et al., 2020).

It is also recommended to follow Sendai Framework for Disaster Risk Reduction adopted by UN in 2015 (Jacobsen, 2020). This may help in mitigating the healthcare supply chain risk in a holistic manner taking social, environmental, political, and institutional factors into consideration.

It has been observed that community awareness towards maintaining hygiene may have a positive impact. Nowadays, several campaigns have been started by the government and by several big celebrities for the promotion of maintaining hygiene and prevention of transmission of virus infection. All signs point to an extended time of disease and maybe occasional returning tops too, which implies sensibly long pattern of unique accentuation available cleanliness, face cover, sterile social propensities, and purification. These long patterns of spotlight on cleanliness joined with Swachh Bharat Abhiyan may have positive effect on improved wellbeing of the public, in spite of the fact that degree of advantage will be hard to gauge substantially.

Government infrastructure and Public Private partnership needs to be strengthened to overcome the current crisis. As we all know that current infrastructure of India is not up to the mark, and it is absolutely inadequate to meet the basic requirements of people of such a large nation. 70% of the Indian population resides in rural area and healthcare services are extremely poor in rural area. In terms of quality services India rank as 145th number

among 195 countries. Imagine United States of America and Italy ranked 1 and 2 in terms of their services and infrastructure. But pandemics like COVID19 destroyed them in an awful manner. If same kind of situation arises in India, then we are not ready to fight a battle against such pandemic. Nations that spend as much as 8-10 percent of GDP on social insurance are likewise disintegrating under the colossal weight of this pandemic, offering shudders to the administrations over the creating scene, including India., India spends a pitiful 1.28 percent of GDP as open consumption on human services (The New Indian Express, 2019). Perceiving the insufficiency of this for serving such a colossal populace, the administration had spread out aspiration to expand the spending to 2.5 percent of GDP in the following a few years. Till now, progress has been made in enlargement of foundation and labor through opening new tertiary establishments, increasing in number of seats in medical colleges and executing extension of essential services arrangement the nation over under Ayushman Bharat Yojana, a ton despite everything needs to be finished. This need is intensely being felt now while we plan for a situation if the circumstance leaves hand further, and this acknowledgment will ideally quicken usage of human services framework reinforcing. Simultaneously, in the present moment since a tremendous spend is being used for dealing with the pandemic, budgetary portions on current plans will get realigned.

A big crisis aroused when the migrants started travelling to their home place during the lockdown in search of economic, social and health security in India. Therefore, health security for the people, particularly in developing countries, should be given top priority whereby community-based health insurance schemes and other government subsidies should be encouraged (Jütting, 2004). All these proposals will ultimately lead and be direct towards achieving sustainability across the various entities in a value chain. Sustainable and resilient healthcare supply chains are therefore an important area of research and a critical need of research. To achieve global supply chain sustainability, it is required to ensure that supply chain information and transparency is maintained effectively across the various stakeholders that may improve the sustainability outcomes (Gardner et al., 2019; Eklund, 2020; Jaipuria et al., 2020).

CONCLUSION

The study highlights the role of Industry 4.0 technologies in shaping the healthcare sector which has led a new revolution in the area of healthcare. This paper shows a way-forward to the healthcare practitioners and academicians in terms of trying to respond to the disruptions in the healthcare supply chain. The recent outbreak of COVID 19 has become a threat to global healthcare. This further dictates the criticality of the pandemic preparedness in response to the outbreak for mitigating the disruption risks. Evidently, it is required to do perform rigorous research for the risk mitigation strategies to overcome the current crisis situation of COVID 19 pandemic in India using Industry 4.0 technologies. Further, researchers may explore to understand the criticality in the supply and demand of the vaccines across the supply chain. The new emerging technologies may help in tracking and reaching out to various places for resource allocation and capacity building. The critical success factors and the barriers in the implementation of the industry 4.0 in healthcare supply chain may be explored by using multi-criteria decision making techniques, such as Fuzzy AHP, ISM, etc.

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