

Nurses' challenges: Critically Ill Children Outcomes at Pediatric Intensive Care Units during COVID-19 crisis

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Abstract

Background: Work crisis facing critical care nurses in pediatric intensive care unit are international issues. Therefore, understanding the challenges that faces the nurses and overcome these challenges is crucial in retaining them. **The Study aims:** to identify the challenges faced Pediatric Intensive Care Units (PICUs) nurses & to assess critically ill children outcomes at PICUs during COVID-19 crisis. **Study design:** the descriptive design was used. **Setting:** This study carried out at all PICUs in Port Said hospitals. **Study subject:** Convenient sampling of (115) PICUs nurses & (75) critically ill children in PICUs have participated in this study from the beginning of November 2020 to the beginning of February 2021. **Data collection tools:** a semi-structured electronic form applied to PICUs nurses. Three tools were used in the study, **tool I:** Assessment interview questionnaire sheet composed of two parts, socio-demographic data PICUs nurses & critically ill children in PICUs. **Tool II:** Challenges faced PICUs nurses during COVID 19 crisis **Tool III:** critically ill children out comes. **Results:** The high percentages (97.1%) of studied PICUs nurses faced moral challenges followed by social, psychological challenges, challenges related to the nature of the disease, challenges related to staff and resources deficiency then physical challenges (93.9%, 92.2%, 91.3%, 90.4%, 88.7%) respectively. The results also indicated that two third (60.0%) of studied critically ill children out comes during COVID 19, their hospital' Length of stay was less than one month. While less than one quarter (18.7%) of them, their hospital' Length of stay was more than two months and less than one half (42.7%) of them were died, 40.0% were Discharged & 17.3% of them were Survived cases & still on mechanical ventilation. **Conclusion:** The high percentages of PICUs nurses faced moral challenges followed by social, psychological challenges, challenges related to nature of the disease, challenges related to staff and resources deficiency then physical challenges. Subsequently, two third of studied critically ill children, their hospital' Length of stay was less than one month & and less than one half of them were died, 40.0% were Discharged & the other Survived and still on mechanical ventilation. **Recommendations:** Researches should be conducted to enhance knowledge on COVID-19 prevention and management & thus manipulation the challenges faced PICUs.

Key words: Nurses challenges, COVID19, critically ill out comes and PICUs.

Introduction

COVID-19 pandemic has rapidly enfolded health care systems particularly primary care pediatricians which accompanying multisystem inflammatory disorder in children. The disturbances produced by COVID-19 have exposed the economic susceptibility of self-determining pediatric practice that chiefly depends on service troubles and Social separation and stay-at-home advisories have directed to the termination of predictable well-child and follow-up visits for several children and adolescents (Santoli et al., 2020).

Although the greatest children seem to involvement fewer plain bodily symptoms and have much lesser mortality rates than other age groups resulting from COVID-19 infection, they stay at possibility considerable for negative consequences assumed the well-known financial and social trouble subsequent from the pandemic. (Hatoun et al., 2020 & Huang et al 2020). Children of all ages acted liable to COVID-19 who have been released the significant problem of COVID-19 disease revealed them. Boys are more frequently affected than girls, and ultimate children were either asymptomatic or slightly symptomatic. Children aged less than 3 years and those with congenital

heart disease seem to be disproportionately impacted (*Yagnik et al., 2020*).

Social fundamentals of health are initial as a forecaster of health inconsistency in COVID-19, several of which impression pediatric populations. Vital workers are fewer unlikely to be capable to effort from family and economically tolerate furlough. People with crowded housing, unpredictable contact to care, chronic syndromes, and high-stress levels impacting immune purpose are more vulnerable to contrary consequences as are those who familiarity national or racial predisposition and/or perception (*Golden, 2020*).

Nurses not a single effort extended times in isolation areas outstanding to the deficiency of nurses, but also dress protecting apparatus for 8- to 12-hr shifts, which origins dehydration and discomfort. For instance, wearing N95 masks for an extensive period causes bloody results on nurses' faces. Extensive work periods are accompanying with mistakes and contrary patient results. In addition, working lengthier shifts exposed nurses to a greater threat of psychological or physical exhaustion, enlarged levels of pressure and reduced professional performance, and care quality (*Xie et al., 2020*).

Nurses have constantly assumed themselves an essential character in contamination control, prevention, isolation, and infection, as well as in community health generally, as originally encouraged by Florence Nightingale. Currently, they have developed one of the main suppliers of care for patients infected with the COVID-19 in combat in contrast to the epidemic, which has accessible new challenges for nurses (Smith, Ng, & Ho, 2020). Nurses are operational around the timer and consume enhanced capabilities in isolation areas. Thus, critical difficulties regarding nursing staff distribution are the shortage of nurses and shift schedules in nursing supports (*Huang et al 2020*).

Nurse roles in caring for patients with COVID-19 in ICU include discovering suspected cases with infections; giving vital management in an emergency and production with suspected patients with defenses; serving in decontamination and organization with other healthcare providers; providing universal nursing care in supervision various infections consecutively; playing a serious function in intensifying precaution facilities; and providing with families and relations (*Xie et al., 2020*). In emergencies, they have further responsibilities to fulfill families and their children; consequently, nurses must be well prepared with the

necessary awareness, knowledge, and skills in organizing emergencies involving clinical management, isolation, communication, triaging, emotional support, reassuring, and palliative care if required (*Borasio et al., 2020*).

Efforts should be established to enhance positive challenges and diminish stressors and burdens among clinical staff were also significant, not only to confirm adherence to study practices and protocols and reduce extra strains on teams that were occupied in very challenging conditions amid suspicions of a new disease. Crucial research nurse should review study eligibility with various department teams; establish essential information and thoughts around research chances, with adequate period to simplify decision-making; attaining informed consent; association with clinical concerns to confirm appropriate gathering of samples; and using the accurate sampling bottles, labels, and practices (*Kanthimathinathan et al., 2020*).

Significant of study

Nurses are on the frontline and are responsible for introducing universal precaution for all kinds of patients. Considering the fact that nurses establish the mainstream of healthcare providers, they have a vital role in health care systems occupied full time in the health care services provided to children and their relatives. Thus, even though these workers have valuable facts that be able to support the real condition of pediatric health facilities in the face of the COVID-19 pandemic (*Althobaity et al., 2019*). The coronavirus pandemic has disturbed almost every phase of our lives and the impression will be extensive long-term. Although greatest children do not look like to be at physical risk from the disease itself, the cooperative reaction to the disease. Pediatric ICU nurses should continue fortified—we must screen the direct and indirect effect of this emergency on children, adolescents, and families; communicate our worries to policymakers; and embrace our elected officials responsible for their reactions to the requirements of this susceptible person (*Beal, 2020 & Feeley et al, 2021*).

Nurses on Pediatric ICU face various challenges during providing health care for children with COVID-19 that impede them from caring for the infected patients, discovering the concerns that nurses encounter while caring for children with COVID-19 willpower, and support nurse and hospital flexibility in reaction to the crisis, in addition, to improve attentiveness and recapture from the disaster (*Al Thobaity et al., 2016*).

Pediatric intensive care is the greatest significant final linkage in well-being precaution provision to critically ill children that it takes conveyed around a incredible development in existence and quality of life and has consistently enhanced the forecast for critically ill patients with life reassuring multisystem disasters Every year at least 200 children per 100,000 need hospitalization in PICUs because of severe disease and almost 90% of pediatric losses in the hospital occur in PICUs because these settings are considered by their intensive technical emphasis on life-saving processes such as the use of mechanical breathing assistance (ventilation), intensive intravenous administration of medications, and artificial hydration and nutrition supplementation (Doorenbos *et al.*, 2012). So that the study conducted to identify the challenges faced PICUs nurses & to assess critically ill children outcomes at Pediatrics Intensive Care Units (PICUs) during COVID-19 crisis.

Aim of the Study:

1. To identify the challenges faced Pediatric Intensive Care Units (PICUs) Nurses during COVID-19 crisis.
2. To assess critically ill children outcomes at Pediatrics Intensive Care Units (PICUs) during COVID-19 crisis.

Research question:

This study was conducted to answer the following research question:

1. What are the Challenges faced PICUs nurses during COVID-19 crisis?
2. What are the critically ill children outcomes at PICUs during COVID-19 crisis?

Material and Methods

Research Design:

A descriptive study design was utilized to conduct this study.

Setting of the Study:

The study was conducted in all Pediatric Intensive Care Units (PICUs) in Port Said hospitals.

Subjects of the Study:

A convenient sample technique was utilized through a semi-structured electronic forms applied via e-mails or What's-App for (115) Pediatric Intensive Care Units (PICUs) nurses & (75) critically ill children in Port Said hospitals .The study was conducted from the beginning of November 2020 to the beginning of February 2021.

Data collection tools:

A semi-structured electronic questionnaire sheet applied for Pediatric Intensive Care Units (PICUs) nurses which consisted of three tools as following:

Tool (1): Semi structured interview questionnaire sheet; it developed by the researcher and composed of two parts:

Part I: Socio-demographic data of critically ill children in PICUs which includes age, gender, number of children on mechanical ventilation, Mechanical ventilation pattern& Clinical diagnosis of studied children.

Part II: Socio-demographic data of PICUs nurses which includes the following items : code number, age, gender, marital status, number of siblings, Academic Qualification, type of housing, years of Experience in ICU, etc....

Tool (2): Challenges faced Pediatrics Intensive Care Units (PICUs) nurses during COVID 19 crisis developed by Góes *et al.*, 2020 & Ulrich *et al.*, 2020 and modified by the researcher after reviewing the literatures. It included six subscales as a following:

1. Physical challenges:

It includes six items as a following: Fatigue, exhaustion, and suffering increased with the outbreak of the Corona epidemic, aches that nurses feel from pain in the back and limbs, bodily reactions (such as fast heartbeat, stomach churning, sweatiness, dizziness) when reminded of the event, not getting enough sleep, not getting enough rest & falling or staying asleep because of the exhaustion.

2. Psychological challenges

It contains six items as a following: Nervous and anxious, under marked psychological stress, upsetting thoughts or memories about the event that have come into the mind when contact with cases, upsetting dreams about the event, acting or feeling as though the event were happening again& feeling upset by reminders of the event.

3. Social challenges:

It includes eight items as a following: Isolation & limitation the communicating with others, because of the difficult work shifts, they lost the concept of the weekend and enjoying the holiday, restrictions on movement among people, unable to go to work by public transport, unable to attend the social festivals, Feel the default of her sons, the nurses cannot to approach their children, as they could not hug them for fear of transmitting the infection for them, nurses had to send their children to their family's home, fearing that they

would be a cause of transmitting the virus to them. And they decided to stay away from them until the end of this crisis & bullying of the neighbors "They disguised them, and started avoiding them, unwilling to communicate directly with them, and turning away from them whenever they met.

4. Moral challenges:

It contains seven items as a following: Experience compromised patient care due to lack of resources/equipment/ bed capacity, be required to care for patients whom the nurses do not feel qualified to care for, be required to work with other health care team members who are not as competent as patient care requires, be required to care for more patients than they can safely care for, Public health emergency, consequently don't follow human rights issues, they are faced with unpalatable and complex ethical issues in practice & a rising number of died nurses in the line of duty often they separated from their loved ones.

5. Challenges related to the nature of disease (covid19) and isolation:

It includes ten items as a following: Vulnerable to becoming infected, exposure to nosocomial infection, transmitted of coronavirus to critically ill children in PICUs, being forced to work excessive hour's consequently inadequate care provided to children in PICUs, being redeployed to different clinical area & other hospitals due to shortage of staff nursing in it & consequently unsafe care provided to critically ill children in PICUs, rapidly spread of coronavirus among PICUs nurses lead to transmission of infection to critically ill children in PICUs,.....

6. Challenges related to the shortage of staff and resources in PICUs.

It contains seven items as a following: Issues of staffing ratios, shortage of healthcare staff, shortage of personal protective equipment, shortage of equipment (ventilators/oxygen etc), lack of masks and gloves, lack of critical care resources & inadequate intensive care capacity.

Scoring system

Scoring system for challenges scale, items were scored 0, 1 and 2 for the responses never, sometimes, and always, respectively. For each one, the scores of items were summed-up and the total divided by the number of the items giving a mean score for the part. These scores were converted into a percent score. The PICUs nurses were considered to be faced high challenges if the percentage score was 60% or more and they faced low challenges if the percentage score was less than 60%.

Tool (3): Studied critically ill children outcomes in PICUs during COVID 19 Crisis (n= 75) which includes: Hospital' length of stay, number of discharged children, number of died children, number of Survive cases & still on mechanical ventilation.

Methods:

Mail or Whats -app), Snowball sample technique was utilized through a semi-structured electronic form applied ensured that their identities and information provided would remain confidential, read an online free and informed consent form, and checked the option. The study was conducted from the beginning of November 2020 to the beginning of February 2021.

Validity:

Tools were tested for content-related validity by five experts (jury) in the related field, professors from the pediatric nursing department & health nursing department. The reliability of the developed tool was estimated using the Cronbach's Alpha test, to measure the internal consistency of tools $r = (0.70)$. A pilot study was carried out on 10% of the study subjects to test the applicability and feasibility of the developed tool, necessary modifications were done. Data obtained was excluded from the actual study. Data collection was taken from 1/11/2020 to 1/2/2021.

Ethical Considerations:

Official permissions were obtained after an explanation of the aim of the study; privacy and confidentiality are assured to the study subjects. PICUs nurses were informed that their participation is voluntary and they have the right to be withdrawn from the study with full respect.

Statistical Analysis

All statistical analyses were performed using SPSS for windows version 20.0 (SPSS, Chicago, IL). Variables with continuous data showed normal distribution and were expressed in mean \pm standard deviation (SD). Categorical data were expressed in number and percentage. Chi-square test was used for comparison of variables with categorical data. The reliability (internal consistency) of the individual domains and the total challenge questionnaires was calculated. Statistical significance was set at $p < 0.05$.

Study limitations:

This study's limitations are regarding to connect the participants on an electronic form, resulting in the participants providing more objective answers when compared to a face-to-face

interview, which was unfeasible during the period of data collection due to social isolation measures.

Results

Table 1. Illustrates frequency distribution of the sociodemographic characteristics and clinical characteristics for studied critically ill children in Pediatric Intensive Care Units (PICUs) during COVID 19 Crisis .It indicated that less than one half (45.3%) of them were less than one year with mean 3.1 ± 2.2 . More than one half (57.3%) of them were male. More than two third of them (76.0 %) weren't on mechanical ventilation & more than one half (55.6%) of them on invasive mechanical ventilation. As regards to clinical diagnosis of studied children, less than one third (28.0%) of them suffered from respiratory dysfunction followed by gastrointestinal neurologic, Septic dysfunction, Cardiovascular, multiple systems & renal dysfunction with percentages 17.3%, 14.7%, 14.7%, 10.6%, 8.0%, 6.7% respectively.

Table 2. Shows frequency distribution of the socio-demographic characteristics of PICUs nurses, it noticed that 45.2% of studied pediatric nursing staff in PICU, their ages were between 26 – 30 years with mean 23.7 ± 4.8 , more than two third (73.9%) of them were female, most of them (80.9%) were married and less than one half of them (43.0%) have one sibling. As regards, housing, less than two third of them (64.3 %) were residents in Shared housing. Regarding academic qualifications, about one-half of them (50.4%) have a Bachelor's degree, While 40% of them have a master's degree and 62.6% of the studied nurses have experience in PICUs from 1 – 5 years.

Table 3. Shows frequency distribution of the challenges related to nature of COVID19 faced pediatric Intensive Care Units (PICUs) Nurses during COVID-19 crisis. It indicated that the high percentages (91.3%) of the studied PICUs nurses faced frequently to total challenges related to nature of COVID19.

Table 4. Illustrates frequency distribution of the challenges related to shortages of staff nursing and resources faced Pediatric Intensive Care Units (PICUs) Nurses during COVID-19 crisis. It showed that the high percentages (90.4%) of the studied PICUs nurses faced frequently to total Challenges related to shortage of staff nursing &resources.

Table 5. Clarifies frequency distribution of the moral & psychological challenges faced Pediatric Intensive Care Units (PICUs) nurses during COVID-

19 crisis.it indicated that the most (88.7%) of PICUs nurses faced frequently to total physical challenges. Also the high percentages of them (92.2%) faced frequently to total psychological challenges.

Table 6. Shows frequency distribution of the moral & social challenges faced pediatric Intensive Care Units (PICUs) Nurses during COVID-19 Crisis. It illustrated that the high percentages (96.5%) of them faced frequently to total moral challenges. Also the high percentages (93.9%) of them faced frequently to total social challenges.

Figure 1. Shows frequency distribution of the challenges faced the studied PICUs nurses during the COVID19 crisis, it showed that high percentages (97.1%) of them faced moral challenges followed by social challenges, psychological challenges, challenges related to nature of the disease, challenges related to staff and resources deficiency then physical challenges with percentages 93.9%, 92.2%, 91.3%, 90.4%, 88.7% respectively.

Figure 2. Illustrates frequency distribution of the total challenges faced the studied PICUs nurses during the COVID19 crisis, it clarified that most of them (87%) faced high challenges, while the rest of them (13%) faced low challenges.

Table 7. Shows frequency distribution of the studied critically ill children outcomes in PICUs during COVID 19 Crisis. It indicated that two third (60.0%) of studied critically ill children out comes their hospital' Length of stay was less than one month. While less than one quarter (18.7%) of them, their hospital' Length of stay was more than two months.as regards to number of died children, less than one half (42.7%) of them were died, 40.0% were Discharged& 17.3% of them were Survived cases &still on mechanical ventilation.

Table 8. Shows association between the total challenges score and the socio-demographic characteristics of the studied PICUs nurses during COVID 19 crisis, it indicated that was a statistically significant relationship between the total challenges score and the socio-demographic characteristics of the studied PICUs nurses regarding who have three siblings with p. value <0.001 .

Table 9. Shows the association between the sociodemographic characteristics of critically ill children and their outcomes during COVID 19 crisis. It indicated that there were statistically significant relation between lengths of hospital stay with ages of children ≥ 5 years & Children who weren't on mechanical ventilation with p. value <0.001 .

Table 1. Frequency distribution of Sociodemographic & clinical characteristics of studied critically ill children in Pediatric Intensive Care Units (PICUs) during COVID 19 Crisis (n= 75)

Socio-demographic characteristics of studied children	N	%
Age		
< 1 year	34	45.3
1 –5years	24	36.0
≥ 5 years	17	22.7
Mean	3.1±2.2	
Gender		
Male	43	57.3
Female	32	42.7
Children on mechanical ventilation		
Yes	18	24.0
No	57	76.0
Mechanical ventilation pattern (n=18)		
Invasive	10	55.6
Non- invasive.	8	44.4
Clinical diagnosis of studied children		
Respiratory dysfunction	21	28.0
Cardiovascular dysfunction	8	10.6
Neurologic dysfunction	11	14.7
Septic dysfunction	11	14.7
Gastrointestinal dysfunction	13	17.3
Renal dysfunction	5	6.7
Multiple systems dysfunction	6	8.0

Table 2. Frequency distribution of socio-demographic characteristics of pediatric Intensive Care Units (PICUs) Nurses during COVID-19 crisis. (n= 115)

Socio-demographic characteristics	N	%
Age (years)		
<25	51	44.3
25 – 30	52	45.2
≥30	12	10.4
Mean	23.7 ±4.8	
Gender		
Female	85	73.9
Male	30	26.1
Marital status		
Single	22	19.1
Married	93	80.9
Number of siblings		
One	40	43.0
Two	28	30.1
Three	25	26.9
Housing		
Separated housing	41	35.7
Shared housing	74	64.3
Academic Qualifications		
Master degree	46	40.0
Bachelor degree	58	50.4
Technician nursing	11	9.6
Experiences in PICU		
<1 year	22	19.1
1 – 5 years	72	62.6
6 – 10 years	14	12.2
>10 years	7	6.1
Received adequate training in personal protective precaution to deal with COVID-19.		
Yes	56	48.7
No	59	51.3

Table 3. Frequency distribution of the challenges faced pediatric Intensive Care Units (PICUs) Nurses during COVID-19 crisis. (n= 115)

Nurse 'Challenges	Never		Some times		Frequently	
	N	%	N	%	n	%
Challenges related to nature of COVID19						
• Vulnerable to becoming infected.	3	2.6	5	4.3	107	93.0
• Exposure to nosocomial infection.	4	3.5	6	5.2	105	91.3
• Transmitted of coronavirus to critically ill children in PICUs.	6	5.2	7	6.1	102	88.7
• Being forced to work excessive hour's consequently inadequate care provided to children in PICUs.	4	3.5	6	5.2	105	91.3
• Being redeployed to different clinical area & other hospitals due to shortage of staff nursing in it & consequently unsafe care provided to critically ill children in PICUs.	4	3.5	5	4.3	106	92.2
• Rapidly spread of coronavirus among PICUs nurses lead to transmission of infection to critically ill children in PICUs.	4	3.5	6	5.2	105	91.3
• Rapidly spread of coronavirus among PICUs nurses lead to decrease the progress of clinical outcomes among critically ill children in PICUs.	3	2.6	5	4.3	107	93.0
• Rapidly spread of coronavirus among PICUs nurses lead to increase mortality rate among critically ill children in PICUs.	4	3.5	6	5.2	105	91.3
• Transferring competent pediatric nursing staff to isolated adult department due to shortage of adult nursing staff led to decrease quality of care for critically ill children in PICUs.	4	3.5	5	4.3	106	92.2
• Transmission of infection to children indirectly method through nurses who had contact with one of their family members infected with the Corona virus which lead to deterioration the health status of critically ill children in PICUs.	4	3.5	6	5.2	105	91.3
Total Challenges related to nature of COVID19	3	2.6	7	6.1	105	91.3

Table 4. Frequency distribution of the challenges faced pediatric Intensive Care Units (PICUs) Nurses during COVID-19 crisis. (n= 115) *cont.*

Nurse 'Challenges	Never		Some times		Frequently	
	n	%	N	%	n	%
Challenges related to shortage of staff nursing &resources						
• Issues of staffing ratios	4	3.5	5	4.3	106	92.2
• Shortage of healthcare staff	3	2.6	3	2.6	109	94.8
• Shortage of personal protective equipment	5	4.3	7	6.1	103	89.6
• Shortage of equipment (ventilators/oxygen etc)	4	3.5	7	6.1	104	90.4
• Lack of masks and gloves.	4	3.5	6	5.2	105	91.3
• Lack of critical care resources.	7	6.1	9	7.8	99	86.1
• Inadequate intensive care capacity	5	4.3	10	8.7	100	87.0
Total challenges related to shortage of staff nursing &resources	4	3.5	7	6.1	104	90.4

Table 5. Percentage distributions of the challenges faced Pediatric Intensive Care Units (PICUs) nurses during COVID-19 crisis (n= 115).*Cont*

Nurse 'Challenges	Never		Some times		Frequently	
Physical challenges						
• Fatigue, exhaustion, and suffering increased with the outbreak of the Corona epidemic.	4	3.5	6	5.2	105	91.3
• Aches that nurses feel from pain in the back and limbs	7	6.1	12	10.4	96	83.5
• Bodily reactions (such as fast heartbeat, stomach churning, sweatiness, dizziness) when reminded of the event.	4	3.5	8	7.0	103	89.6
• Not getting enough sleep	5	4.3	8	7.0	102	88.7
• Not getting enough rest	6	5.2	7	6.1	102	88.7
• Falling or staying asleep because of the exhaustion.	4	3.5	4	3.5	107	93.0
Total Physical challenges	4	3.5	9	7.8	102	88.7
Psychological challenges						
• Nervous and anxious	3	2.6	5	4.3	107	93.0
• Under marked psychological stress.	4	3.5	5	4.3	106	92.2
• Upsetting thoughts or memories about the event that have come into the mind when contact with cases.	5	4.3	6	5.2	104	90.4
• Upsetting dreams about the event.	4	3.5	6	5.2	105	91.3
• Acting or feeling as though the event were happening again.	3	2.6	4	3.5	108	93.9
• Feeling upset by reminders of the event.	4	3.5	6	5.2	105	91.3
Total Psychological challenges	3	2.6	6	5.2	106	92.2

Table 6. Frequency distributions of the challenges faced pediatric Intensive Care Units (PICUs) Nurses during COVID-19 Crisis (n= 115) .*Cont*

Nurse 'Challenges	Never		Some times		Frequently	
Moral challenges						
• Experience compromised patient care due to lack of resources/equipment/ bed capacity.	2	1.7	3	2.6	110	95.6
• Be required to care for patients whom the nurses do not feel qualified to care for.	2	1.7	2	1.7	111	96.5
• Be required to work with other health care team members who are not as competent as patient care requires.	2	1.7	3	2.6	110	95.6
• Be required to care for more patients than they can safely care for.	2	1.7	1	0.9	112	97.4
• Public health emergency, consequently don't follow human rights issues.	2	1.7	2	1.7	111	96.5
• They are faced with unpalatable and complex ethical issues in practice.	3	2.6	3	2.6	109	94.8
• A rising number of died nurses in the line of duty often they separated from their loved ones.	2	1.7	0	0.0	113	98.3
Total moral challenges	2	1.7	2	1.7	111	96.5
Social challenges						
• Isolation & limitation the communicating with others.	3	2.6	4	3.5	108	93.9
• Because of the difficult work shifts, they lost the concept of the weekend and enjoying the holidays	4	3.5	5	4.3	106	92.2
• Restrictions on movement among people.	3	2.6	3	2.6	109	94.8
• Unable to go to work by public transport.	2	1.7	3	2.6	110	95.6
• Unable to attend the social festivals.	3	2.6	3	2.6	109	94.8
• Feel the default of her sons, the nurses cannot to approach their children, as they could not hug them for fear of transmitting the infection for them. "	2	1.7	4	3.5	109	94.8
• Nurses had to send their children to their family's home, fearing that they would be a cause of transmitting the virus to them. And they decided to stay away from them until the end of this crisis	3	2.6	5	4.3	107	93.0
• Bulling of the neighbors "They disguised them, and started avoiding them, unwilling to communicate directly with them, and turning away from them whenever they met.	3	2.6	4	3.5	108	93.9
Total social challenges	2	1.7	5	4.3	108	93.9

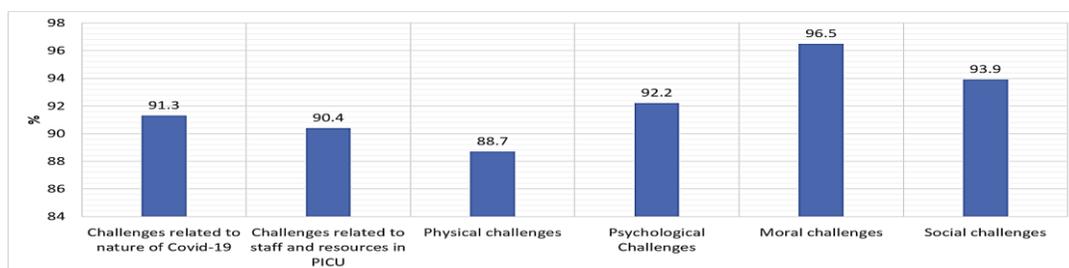


Figure 1. Frequency distribution of challenges faced PICUs Nurses during COVID19 crisis.(N: 115)

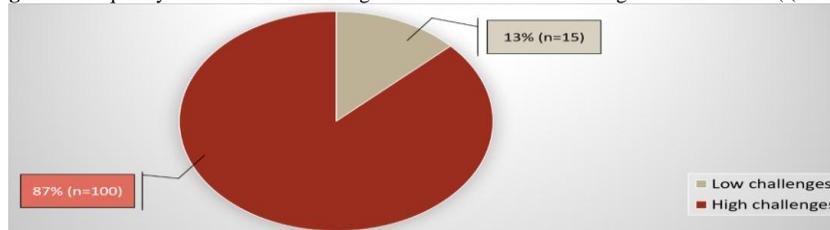


Figure 2. Percentage distribution of total challenges faced PICUs Nurses during COVID19 crisis.(N: 115)

Table 7. Frequency distribution of studied critically ill children outcomes in PICUs during COVID 19 Crisis (n= 75)

Critically ill children out come	N	%
Hospital' Length of stay		
• < 1month	45	60.0
• 1- 2 months	16	21.3
• ≥ 2 months	14	18.7
No. Discharged children	30	40.0
No. Died children.	32	42.7
No. Survive cases &still on mechanical ventilation	13	17.3

Table 8. Association between the total challenges score and the socio-demographic characteristics of PICUs nurses during COVID19 crisis. (N: 115)

Socio-demographic characteristics	Total challenge score				Chi square test	
	Low challenges		High challenges		X2	P
	N	%	N	%		
Age (years)						
20 – 25	11	73.3	40	40.0		
26 – 30	4	26.7	48	48.0		
31 – 35	0	0.0	12	12.0	6.381	0.041
Gender						
Female	7	46.7	78	78.0		
Male	8	53.3	22	22.0	6.641	0.010
Marital status						
Single	2	13.3	20	20.0		
Married	13	86.7	80	80.0	0.375	0.540
Number of siblings						
One	0	0.0	40	50.0		
Two	0	0.0	28	35.0		
Three	13	100.0	12	15.0	41.106	<0.001*
Housing						
Separated housing	9	60.0	32	32.0		
Shared housing	6	40.0	68	68.0	4.457	0.035
Academic Qualification						
Master degree	3	20.0	43	43.0		
Bachelor degree	12	80.0	46	46.0		
Nursing technician	0	0.0	11	6.365	0.041	0.048
Experience in ICU						
<1 year	0	0.0	22	22.0		
1 – 5 years	10	66.7	62	62.0		
6 – 10 years	2	13.3	12	12.0		
>10 years	3	20.0	4	4.0	8.850	0.031

Table 9. Association between the sociodemographic characteristics of critically ill children and their outcomes (n=75)

Sociodemographic characteristics of critically ill children	Length of hospital stay (months)						Chi square test	
	< 1 (n=45)		1 – 2 (n=16)		≥ 2 (n=14)		X ²	P
	N	%	n	%	n	%		
Age								
< 1 year	12	26.7	8	50.0	14	100.0		
1 –5years	16	35.6	8	50.0	0	0.0		
≥ 5 years	17	37.8	0	0.0	0	0.0	30.376	<0.001*
Gender								
Male	23	51.1	9	56.3	11	78.6		
Female	22	48.9	7	43.8	3	21.4	3.301	0.192
Children on mechanical ventilation								
Yes	0	0.0	4	25.0	14	100.0		
No	45	100.0	12	75.0	0	0.0	58.553	<0.001*
Mechanical ventilation pattern (n=18)								
Invasive	0	0.0	2	50.0	8	57.1		
Non-invasive.	0	0.0	2	50.0	6	42.9	0.064	0.800
Clinical diagnosis of studied children								
Respiratory dysfunction	11	24.4	7	43.8	3	21.4		
Cardiovascular dysfunction	6	13.3	0	0.0	2	14.3		
Neurologic dysfunction	7	15.6	2	12.5	2	14.3		
Septic dysfunction	6	13.3	2	12.5	3	21.4		
Gastrointestinal dysfunction	10	22.2	2	12.5	1	7.1		
Renal dysfunction	2	4.4	2	12.5	1	7.1		
Multiple systems dysfunction	3	6.7	1	6.2	2	14.3	8.317	0.760

Discussion

The covid-19 pandemic is expected to place healthcare professionals through the world in an unparalleled condition, taking to sort incredible choices and effort below serious burdens and stressors. These choices might comprise in what manner to assign inadequate resources to similarly deprived patients, in what way to equilibrium their specific physical and psychological healthcare essentials of patients, how to support their need and responsibility to patients and their family to deliver attention for all critically ill patients with embarrassed or insufficient resources. This might origin certain understanding different challenges concerning the COVID-19 crisis from the perception of pediatric nursing staffs, with emphasizing on the improvement of essential and quality care for children and subsequently impact on critically ill children out comes for hospitalized children in PICUs (*Greenberg & Docherty, 2020*).so that The present study was conducted to identify the challenges faced PICUs nurses &

to assess critically ill children outcomes at PICUs during COVID-19 crisis.

The present study indicated the clinical characteristics of critically ill children in PICUs during COVID 19 crisis. It illustrated that More than two third of the studied critically ill children weren't on mechanical ventilation & more than one half of them on invasive mechanical ventilation. As regards to clinical diagnosis of studied children, less than one third of them suffered from respiratory dysfunction followed by gastrointestinal neurologic, Septic dysfunction, Cardiovascular, multiple systems & renal dysfunction. This results agreed with *Derespina et al., 2020* who stated that about one third of the studied children suffered from Fever and cough were the common presenting symptoms. Less than one quarter of them were met severe sepsis criteria; (20%) required vasopressor support; 30% developed acute respiratory distress syndrome (ARDS); 12.9% met acute kidney injury criteria & Forty-nine(70%) patients required respiratory support: 14 (20.0%) noninvasive mechanical ventilation, 20 (28.6%) invasive mechanical

ventilation (IMV), 7 (10%) prone position, 2 (2.8%) inhaled nitric oxide, and 1 (1.4%) extracorporeal membrane oxygenation. **also these results were consistent with Chao et al., 2020** who stated that all patients admitted to the PICUs had signs of systemic inflammatory syndrome, and developed septic shock requiring vasopressor support and fluid resuscitation.

In relation to challenges faced the studied PICUs nurses during the COVID19 crisis, the findings showed that high percentages (97.1%) of them faced moral challenges followed by social challenges, psychological challenges, challenges related to the nature of the disease, challenges related to staff and resources deficiency then physical challenges (93.9%, 92.2%, 91.3%, 90.4%, 88.7%) respectively (**Figure.1**). These findings were agreed with **Joshi, 2020** who stated that the common challenges faced by nurses in the existing condition were: Deficiency of qualified nurses in the clinics and hospitals; Deficiency of private protecting equipment necessary to avoid infection transmission, such as masks. Some organizations have been provided that insufficient PPE; Unobtainability of transport and accommodation supplies for the health care provider; Insufficient isolation abilities for them; Physical tiredness and psychological experiences because of employed in an irregular state; Absence of health insurance abilities; challenges regarding individual security, safety regarding the safety of family members; Absence of training; Communication gap between the nursing leaders and hospital establishments initiating confusion and interruption in judgments; subsequent in frustration and psychological tiredness; insufficient supportive facilities such as nutrition and other services.

Considering, moral challenges faced studied pediatrics ICU nursing staff during COVID 19 pandemic, the results indicated that high percentages (97.1%) of them faced moral challenges. It may be due to the pandemic has brought into a sharp emphasis on obligatory to care for more patients than they can safely care for; Experience conceded patient care due to deficiency of equipment, resources, and bed capacity; Be essential to care for patients whom they do not feel experienced& qualified to care for; be required to work with other health care team members who are not as competent as patient care requires. These findings were consistent with

Epstein et al., 2019 & Feeley et al,2021 who reported that moral distress scores were highest in response to the statement 'working with team members who were not as competent as patient care requires'. Also, **Ulrich et al, 2020** added that the epidemic of COVID19 has taken into sharp focus our interconnectedness and how intertwined our specific reliability is with the integrity of others and the moral ecosystem we exist in. They established the resolution to be safe even when in front of hazards or threats on themselves, and even death. We necessity recognized that although there were moral failures, there were many moral achievements that reflect the integrity of teams individuals, and organizations.

Social challenges were the second challenge faced the studied pediatrics ICU nursing staff during the COVID19 crisis. The results revealed that high percentages of pediatrics ICU nursing staff faced social challenges. It rationalized by more half of studied pediatrics ICU nurses spend more than 12 hours in work, take extra shifts per week& transferring to other departments and other hospitals during the COVID 19 crisis that they have feelings of isolation because of the hard work shifts; their limitations on movement between people; communicated Coronavirus to family and friends; Unable to attend the social festivals; Feel the default of her sons; The disease forced them not to approach their children, as they could not hug them for fear of transmitting the infection for them. These results were consistent with **Huang et al 2020** who clarified that during COVID 19 pandemic, nurses' have been reported to experience strain related to family separation, sleep deficit, and heavy capabilities produced by health system request and staff deficiencies. Additionally, the moral and supplies concerns that emerge during a pandemic can have negative social & psychological influences.

Psychological challenges were the third challenge faced the studied pediatrics nursing staff during COVID 19 pandemic. The finding showed that 92.2% of them faced psychological challenges. It may be due to fear& anxiety from exposure to infection and transmitted infection to the family members. In addition to stress & anger as a result of individual bullying and stigmatization. These results were degree with **Dewey et al, 2020 & Ulrich et al., 2020**. Who stated that Healthcare workers were psychologically affected regardless of specific

exposure to infected patients or high-risk work areas & emotional suffering involved: family anxiety & concerns; fear of infection; the stress of job; solitary separation; stigmatization; and mobilization to areas of work outside usual responsibilities.

Challenges related to the nature of the disease were the fourth challenge faced studied pediatrics ICU nursing staff during COVID19. The findings reported that 91.3% of the studied pediatrics nursing staff faced challenges related to the nature of the disease. It is rationalized that COVID 19 is a great infectious and pathogenic disease that rapid transmission& threat life. These results were consistent with *Huang et al 2020&Tang et al., 2020* who indicated that COVID-19 is the third extremely pathogenic human coronavirus disease to date. It is a rapid spreading of this highly infectious disease that has modeled the severest threat to worldwide health in this century. It has spread very fast all over the world. *Deng & Peng, 2020* added that the outbreak of COVID-19 in China reached an endemic greatest in February. *Ulrich et al, 2020* also stated that the total number of cases sustained increase severely in early February at an average rate of more than 3,000 newly confirmed cases per day & at least 156,000 U.S. health care workers had become infected with COVID-19 by early September, recognizing that this is an underestimate& in other countries, the infection rate has been remarkable with more than 37,000 health care workers infected in Spain, accounting for 20% of confirmed cases in that country.

Challenges related to staff & resources deficiency were the fifth challenge faced the studied pediatrics ICU nursing staff during COVID 19 crisis. The results revealed that 90.4% of the studied pediatrics ICU nursing staff faced challenges related to staff & resources deficiency. It may be due to health care provider during a pandemic crisis must be followed the standards and precautions in order to prevention of transmission of infection through contact with all suspected and confirmed patients by wearing their personal protective equipment (PPE) including a face mask, eye protection, and gloves; in addition to increasing numbers of cases, these lead to an insufficient number of human resources. The results agreed with *Emanuel et al., 2020& Desroches et al, 2021* who clarified that the provision of quality of the material that is essential

to prevent and combat the disease such as diagnostic tests and PPE, directly impacting patient safety and health practice. This is a crisis various countries face and which demands leadership at the various managerial levels, as well as a just and ethical allocation of health resources in the face of imbalances between supply and demand during the COVID-19 pandemic. *World Health Organization, 2020* stated also that the emergence and highly contagious nature of this coronavirus, however, has shattered traditional standards of practice. The absence of sufficient individual protecting tools and overall deficiency of organized preparation for the capacity of COVID-19 patients within clinic structures has faced frontline nurse's predisposed-challenges - to an insistent feel of fault, anxiety and guilt.

Finally physical challenges were the sixth challenge faced the studied pediatrics ICU nursing staff during COVID 19 crisis. The results reported most of the studied pediatrics ICU nursing staff faced physical challenges. This is rationalized by more than one- half of them taking extra shifts, working more than 12hours per day, and transferring to other departments & other hospitals that producing fatigue, exhaustion, aches, pain in the back and limbs, bodily reactions, not getting enough sleep rest. These findings were consistent with *Ungard et al., 2019* who showed that nurses not only work long hours in isolation departments due to the lack of nurses but also dress defensive equipment for 8- to 12-hr shifts, which origins discomfort and dehydration. For instance, wearing N95 masks for an extensive period origins blood-stained characters on nurses' faces. Longer work hours are accompanying with mistakes and opposing patient outcomes. Furthermore, *Jarrar et al., 2020* added that working longer shifts exposed nurses to a higher danger of psychological or bodily fatigue, increased ranks of pressure, and reduced performance of job and quality of care.

According to the critically ill children outcomes in PICUs during COVID 19 Crisis. The present result indicated that two third of studied critically ill children out comes their hospital' Length of stay was less than one month. While less than one quarter of them, their hospital' Length of stay was more than two months. As regards to number of died children, less than one half of them were died, 40.0% were discharged & 17.3% of them were Survived cases &still on mechanical ventilation. These results were

consistent with *Derespina et al., 2020*. Who stated that the majority of patients initially admitted to the PICU (were discharged home with a median length of stay of 7 days. Four patients remain hospitalized in the PICU at day 14. In one patient with metastatic disease from underlying malignancy, the family chose to withdraw care & associated with duration of PICU and hospital stay, and lower probability of PICU and hospital discharge at hospital day 14. and these results also agreed with *Chao et al., 2020* who stated that mortality at 60 days was 8.4%, and 107 of 500 (22%) patients acquired at least one infection during their pediatric intensive care unit stay. Over 30% of patients had severe malnutrition on admission, with body mass index z-score >2 (13.2%) or <-2 (17.1%) on admission.

In relation to the association between the total challenges score and the socio-demographic characteristics of the studied PICUs nurses during COVID 19 crisis, it indicated that was a statistically significant relationship between the total challenges score and the socio-demographic characteristics of the studied PICUs nurses regarding who have three siblings with p. value <0.001 . It rationalized by the challenges among studied PICUs nurses increased as result frightened of attainment infected for their siblings through transfer the infection to their families followed by their belief that the disease is highly transmissible. These results were consistent with *Abdelhafiz et al., 2020* who reported that the first and the most frequently mentioned items that make HCWs afraid of getting infected is their fear to transmit the infection to their families followed by their belief that the disease is highly transmissible. The stigma associated with infection was mentioned by about two-thirds of the respondents. The stigma associated with COVID-19 infection could also be explained by banning of the funeral prayer in mosques and churches and preventing funeral ceremonies. Although it may sound not important, it has significance, since it may lead to the reluctance of the public to seek medical care and underreporting of cases, which may cause the rapid spread of the disease. Stigma can be combated through proper education, clear announcing of healthcare policies, and launching stigma reduction programs in Egyptian hospitals

Conclusion

Based on the light the findings of the present study, it was concluded that most of the studied

PICUs nurses faced high challenges during COVID 19 crisis that The high percentages of PICUs nurses faced moral challenges followed by social, psychological challenges, challenges related to nature of the disease, challenges related to staff and resources deficiency then physical challenges. Subsequently, two third of studied critically ill children, their hospital' Length of stay was less than one month & less than one half of them were died, 40.0% were Discharged & the other Survived on mechanical ventilation

Recommendations:

- Researches should be conducted for PICUs nurses in order to enhance knowledge and practices related to prevention, precautions and management of COVID-19 either at hospital or home.
- Training programs essential to empower nurses with appropriate preparations & manipulation the challenges and experiences faced them in order to improve the skills of self-confidently and subsequently enable them to deal with challenges and control of disasters.

References:

- Abdelhafiz, A. S., Mohammed, Z., Ibrahim, M. E., Ziady, H. H., Alorabi, M., Ayyad, M., & Sultan, E. A. (2020).** Knowledge, perceptions, and attitude of Egyptians towards the novel coronavirus disease (COVID-19). *Journal of Community Health*, 45(5), 881-890. 0. 1007/ s10900-020-00827-7.
- Al Thobaity, A., Alamri, S., Plummer, V., & Williams, B. (2019).** Exploring the necessary disaster plan components in Saudi Arabian hospitals. *International Journal of Disaster Risk Reduction*, 41, 101316. <https://doi.org/10.1016/j.ijdr.2019.101316>.
- Al Thobaity, A., Williams, B., & Plummer, V. (2016).** A new scale for disaster nursing core competencies: development and psychometric testing. *Australasian Emergency Nursing Journal*, 19(1), 11-19. <https://doi.org/10.1016/j.aenj.2015.12.001>.
- Beal, J. A. (2020).** Lessons Learned from the COVID-19 Pandemic for Paediatric

- Workplaces. *MCN: The American Journal of Maternal/Child Nursing*, 45(5), 309. <https://doi.org/10.1097/NMC.0000000000000647>.
- Borasio, G. D., Gamondi, C., Obrist, M., & Jox, R. (2020).** COVID-19: decision making and palliative care. *Swiss medical weekly*, 150(1314). DOI: <https://doi.org/10.4414/smww.2020.20233>.
- Chao, J. Y., Derespina, K. R., Herold, B. C., Goldman, D. L., Aldrich, M., Weingarten, J., ... & Medar, S. S. (2020).** Clinical characteristics and outcomes of hospitalized and critically ill children and adolescents with coronavirus disease 2019 at a tertiary care medical center in New York City. *The Journal of pediatrics*, 223, 14-19. <https://doi.org/10.1016/j.jpeds.2020.05.006>
- Deng, S. Q., & Peng, H. J. (2020).** Characteristics of and public health responses to the coronavirus disease 2019 outbreak in China. *Journal of clinical medicine*, 9(2), 575. <https://doi.org/10.3390/jcm9020575>.
- Derespina, K. R., Kaushik, S., Plichta, A., Conway Jr, E. E., Bercow, A., Choi, J., ... & Medar, S. S. (2020).** Clinical manifestations and outcomes of critically ill children and adolescents with coronavirus disease 2019 in New York city. *The Journal of pediatrics*, 226, 55-63. <https://doi.org/10.1016/j.jpeds.2020.07.039>
- Desroches, M. L., Ailey, S., Fisher, K., & Stych, J. (2021).** Impact of COVID-19: Nursing challenges to meeting the care needs of people with developmental disabilities. *Disability and health journal*, 14(1), 101015. <https://doi.org/10.1016/j.dhjo.2020.101015>.
- Dewey, C., Hingle, S., Goelz, E., & Linzer, M. (2020).** Supporting clinicians during the COVID-19 pandemic. <https://doi.org/10.7326/M20-1033>.
- Doorenbos, A., Lindhorst, T., Starks, H., Aisenberg, E., Curtis, J. R., & Hays, R. (2012).** Palliative care in the pediatric ICU: challenges and opportunities for family-centered practice. *Journal of social work in end-of-life & palliative care*, 8(4), 297-315. <https://doi.org/10.1080/15524256.2012.732461>.
- Emanuel, E. J., Persad, G., Upshur, R., Thome, B., Parker, M., Glickman, A., ... & Phillips, J. P. (2020).** Fair allocation of scarce medical resources in the time of Covid-19. DOI: 10.1056/NEJMsB2005114.
- Epstein, E. G., Haizlip, J., Liaschenko, J., Zhao, D., Bennett, R., & Marshall, M. F. (2020).** Moral Distress, Mattering, and Secondary Traumatic Stress in Provider Burnout: A Call for Moral Community. *AACN advanced critical care*, 31(2), 146-157. <https://doi.org/10.4037/aacnacc2020285>.
- Feeley, T., Tan, M. H., Magner, C., L'Estrange, K., Efrimescu, C. I., O'Connor, E., ... & Delaney, S. (2021).** Psychological impact of COVID-19 on staff working in paediatric and adult critical care. *British journal of anaesthesia*, 126(1), e39-e41. DOI: <https://doi.org/10.1016/j.bja.2020.09.040>.
- Góes, F. G. B., Silva, A. C. S. S. D., Santos, A. S. T. D., Pereira-Ávila, F. M. V., Silva, L. J. D., & Silva, L. F. D. (2020).** Challenges faced by pediatric nursing workers in the face of the COVID-19 pandemic. *Revista latino-americana de enfermagem*, 28. <http://dx.doi.org/10.1590/1518-8345.4550.3367>.
- Golden, S. H. (2020).** Coronavirus in African Americans and other people of color. Johns Hopkins Medicine. Retrieved from <https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/covid19-racial-disparities>.
- Greenberg, N., Docherty, M., Gnanapragasam, S., & Wessely, S. (2020).** Managing mental health challenges faced by healthcare workers during covid-19 pandemic. *Bmj*, 368. <https://doi.org/10.1136/bmj.m1211>
- Hatoun, J., Correa, E. T., Donahue, S. M. A., & Vernacchio, L. (2020).** Social distancing for COVID-19 and diagnoses of other infectious diseases in

- children. *Pediatrics*, 146(4). DOI: <https://doi.org/10.1542/peds.2020-006460>.
- Huang, L., Lei, W., Xu, F., Liu, H., & Yu, L. (2020).** Emotional responses and coping strategies in nurses and nursing students during Covid-19 outbreak: A comparative study. *PLoS One*, 15(8), e0237303. <https://doi.org/10.1371/journal.pone.0237303>.
- Jarrar, M. T., Minai, M. S., Al-Bsheish, M., Meri, A., & Jaber, M. (2019).** Hospital nurse shift length, patient-centered care, and the perceived quality and patient safety. *The International journal of health planning and management*, 34(1), e387-e396. <https://doi.org/10.1002/hpm.2656>
- Joshi, S. (2020).** Coronavirus disease 2019 pandemic: Nursing challenges faced. *Cancer Research, Statistics, and Treatment*, 3(5), 136. DOI: 10. 4103/CRST.CRST_148_20.
- Kanthimathinathan, H. K., Dhesi, A., Hartshorn, S., Ali, S. H., Kirk, J., Nagakumar, P., & Jyothish, D. (2020).** COVID-19: a UK children's hospital experience. *Hospital pediatrics*, 10(9), 802-805. DOI: <https://doi.org/10.1542/hpeds.2020-000208>.
- Santoli, J. M. (2020).** Effects of the COVID-19 pandemic on routine paediatric vaccine ordering and administration—United States, 2020. *MMWR. Morbidity and mortality weekly report*, 69. (19):591–593.
- Tang, D., Comish, P., & Kang, R. (2020).** The hallmarks of COVID-19 disease. *PLoS pathogens*, 16(5), e1008536. <https://doi.org/10.1371/journal.ppat.1008536>.
- Ulrich, C. M., Rushton, C. H., & Grady, C. (2020).** Nurses confronting the coronavirus: Challenges met and lessons learned to date. *Nursing outlook*, 68(6), 838-844. <https://doi.org/10.1016/j.outlook.2020.08.018>.
- Ungard, W., Kroger-Jarvis, M., & Davis, L. S. (2019).** The impact of shift length on mood and fatigue in pediatric registered nurses. *Journal of pediatric nursing*, 47, 167-170. doi: 10.1016/j.pedn.2019.05.014.
- World Health Organization.** WHO interim guidance on clinical management of severe acute respiratory infection when novel coronavirus infection is suspected (2020). Available at: <https://apps.who.int/iris/handle/10665/331830>
- Xie, J., Tong, Z., Guan, X., Du, B., Qiu, H., & Slutsky, A. S. (2020).** Critical care crisis and some recommendations during the COVID-19 epidemic in China. *Intensive care medicine*, 46(5), 837-840.
- Yagnik, P. J., Umscheid, J., Khan, A. W., Ali, M., Bhatt, P., & Desai, P. H. (2020).** Pediatric characteristics of 2019 novel coronavirus: review of available published literature. *Clinical pediatrics*, 000992 2820 920017 <https://doi.org/10.1177/0009922820920017>.