

## A study of Chest X-ray findings in positive cases of Covid-19

Khawaja Muhammad Baqir Hassan<sup>1</sup>, Tathir Baqir Hassan<sup>2</sup>, Shakil Sarwa<sup>1</sup>, Syed Aown Raza Shah Bokhari<sup>3</sup>,  
Usman Khan<sup>4</sup>, Hamid Jamal Siddique<sup>5</sup>, Muhammad Omer Aamir<sup>6</sup>

### ABSTRACT

**Objective:** To assess the Various Chest X-ray findings in confirmed cases of COVID -19 patients

**Study Design:** Retrospective Descriptive Cross-sectional Study

**Place and Duration:** Department of Radiology of Combined Military Hospital Malir, Pakistan from 1<sup>st</sup> March 2020 to 31<sup>st</sup> May 2020

**Methodology:** After recording of basic demographic variables, all the standard frontal projections of Chest X-Ray of PCR confirmed COVID-19 patients were studied on computer and radiological findings were noted.

**Results:** Majority of the patients had normal chest X-Ray (75.4%). The most common finding is bilateral pulmonary infiltrates 8.4% followed by mixed opacities 6.1%. The other findings were unilateral peripheral opacities (3.8%) and ground glass opacities (1.0%). All of these findings were independent of gender or ethnicity.

**Conclusion:** The frequency distribution of four main Chest X-Ray findings in confirmed COVID-19 cases can be used to make a provisional diagnosis where PCR result can't be awaited.

**Keywords:** COVID-19, Chest X-ray, Pulmonary infiltrates, Peripheral opacities, Ground glass opacities

### How to Cite This:

Hassan KMB, Hassan TB, Sarwa S, Bokhari SARS, Khan U, Siddique HJ, Aamir MO. A study of Chest X-ray findings in positive cases of Covid-19. *Isra Med J.* 2020; 12(3): 116-120.

This is an Open Access article distributed under the terms of the Creative Commons Attribution-Noncommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

### INTRODUCTION

COVID -19 is a type of viral infection which has caused pandemic in the world<sup>1</sup>. So far the no definitive treatment has been found for the disease. The COVID -19 is currently diagnosed by rt-PCR<sup>2</sup>. The sampling of nasopharyngeal swab or bronchial secretions is used for the testing. Nasopharyngeal swab has a sensitivity and specificity of 50-67% and that of bronchial lavage of 99%

1. Senior Registrar of Radiology, Combined Military Hospital, Malir, Karachi
2. Senior Registrar & Public Health Specialist, Combined Military Hospital, Malir, Karachi
3. Senior Registrar of Radiology, AFIC, Rawalpindi
4. Senior Registrar of Radiology, PNS Shifa, Karachi
5. Health Care Administrator, Combined Military Hospital, Malir, Karachi
6. Consultant of Radiology, AFIRI, Rawalpindi

#### **Correspondence:**

Khawaja Muhammad Baqir Hassan  
Senior Registrar of Radiology,  
Combined Military Hospital, Malir, Karachi  
Email: baqar78@hotmail.com

Received for Publication: June 22, 2020  
1<sup>st</sup> Revision of Manuscript: August 06, 2020  
Accepted for Publication: September 01, 2020

respectively<sup>3,4</sup>. Although in few studies the sensitivity and specificity have improved to 77% and above<sup>5</sup>. Both the methods are cumbersome and require 6-8 hours for the reporting.

Radiological imaging is also playing an important role. High-Resolution Computed Tomography (HRCT) chest in few studies has shown to supersede the PCR in screening and diagnosis of COVID -19. In one of the studies it has shown to be more sensitive and specific than PCR<sup>6</sup>. Few other studies have described limited role of HRCT in this regard.

In Pakistan very limited studies have been conducted on COVID -19 diagnosis and screening. The numbers of confirmed cases are increasing day by day in Pakistan. The PCR though is gold standard is limited and expensive to use as a screening tool. Same goes for the HRCT chest with addition of high radiation and limited use in children and females of reproductive age group<sup>7</sup>. Chest X-ray has not been proved to be reliable modality in screening, diagnosis and management of COVID-19 patients<sup>8</sup>. However in few studies it has been used to rapidly screen the patients with high suspiciousness of COVID-19 patients<sup>8,9</sup>. This scenario is particularly important in surgical, medical and obstetrical emergencies.

The rationale of this study is to establish a set of Chest X-ray findings in local population that are seen in the confirmed cases of COVID -19 patients. This information can be used to classify the patients from low suspiciousness to high suspiciousness of COVID-19 disease. Additionally, the percentage of Chest X-ray findings has been used to classify the disease severity. This information can help to manage the patient and prevent

undesirable exposure of COVID -19 especially to health professionals and care providers. So, this study was conducted with an objective to assess the Various Chest X-ray findings in confirmed cases of COVID -19 patients.

### METHODOLOGY

This Retrospective Descriptive Cross-sectional study was carried out at Radiology Department Combined Military Hospital Malir, Karachi from 1<sup>st</sup> March 2020 to 31<sup>st</sup> May 2020. Retrospective data for study were also collected from Pakistan Naval Hospital Shifa Karachi and Armed Forces Institute of Cardiology, Rawalpindi. The record of all confirmed COVID -19 by PCR of any age and gender, having fever, cough and Shortness of breath were assessed.

The Chest X-ray of the patients were retrieved from hospital record. The standard technique of Chest X-ray (PA-view) in military hospitals was used for the patients in the specified x-ray room for the patients. The bedside portable Chest X-ray through CR systems were also assessed. The Chest X-ray of the same patients was reported by two different radiologists. Inversion technique of Chest X-ray on console was also used to assess the findings. Chest X-ray findings were recorded on pre designed Performa.

**Data Analysis:** Data was analyzed with SPSS version23 Frequency and percentage of findings were computed. The means were individually calculated and means were compared to each other as well.

### RESULTS

A total of 395 patients were included in the study. The mean age of the population studied is 39.11 (SD 15.037) years with age ranges between 8 year to 93 years. The median age for male gender 36.50 (range 8 to 93 year) and female 42.00 (range 20 to 78 year) years. Similarly, the mean age for males was 38.57±15.180 and for females was 42.26±13.867. Also, the minimum age is 8 years indicating that children are also affected by the disease.

**Table-I Frequency Distribution of Chest X-Ray Findings**

Findings	Frequency- n (%)
Normal	298 (75.4%)
Right Peripheral Opacities	11 (2.8%)
Left Peripheral Opacities	4 (1.0%)
Bilateral Peripheral Opacities	14 (3.5%)
Right Pulmonary Infiltrates	2 (.5%)
Left Pulmonary Infiltrates	4 (1.0%)
Bilateral Pulmonary Infiltrates	34 (8.6%)
Ground Glass Opacities	4 (1.0%)
Mixed opacities and pulmonary infiltrates	24 (6.1%)
<b>Total</b>	<b>395 (100.0%)</b>

Majority of the patients had normal chest X-Ray (n=298,75.4%). The most common finding is bilateral pulmonary infiltrates 8.6% (n=34) followed by mixed opacities 6.1% (n=24). This finding was

independent of gender or ethnicity.

**Table-II: Frequency Distribution of Percentage Area Involvement in Positive Chest-X-Ray**

Percentage Involvement	Frequency- n(%)
More than 50%	26 (26.8%)
Less than 50%	33 (34.0%)
Less than 25%	24 (24.7%)
Less than 10%	14 (14.4%)
<b>Total</b>	<b>97 (100.0%)</b>

Table-II shows further stratification of positive chest X-Ray by the percentage of area involved by the COVID-19 pneumonia. This helps to classify the severity of the disease that affects the patient management. The maximum number of the patients, 34.0% (n=33) had less than 50% involvement of the chest X-ray. This falls in the moderate category. 26.8% (n=26) patient fell in severe class of the disease having more than 50% area involvement of the lungs.

### DISCUSSION

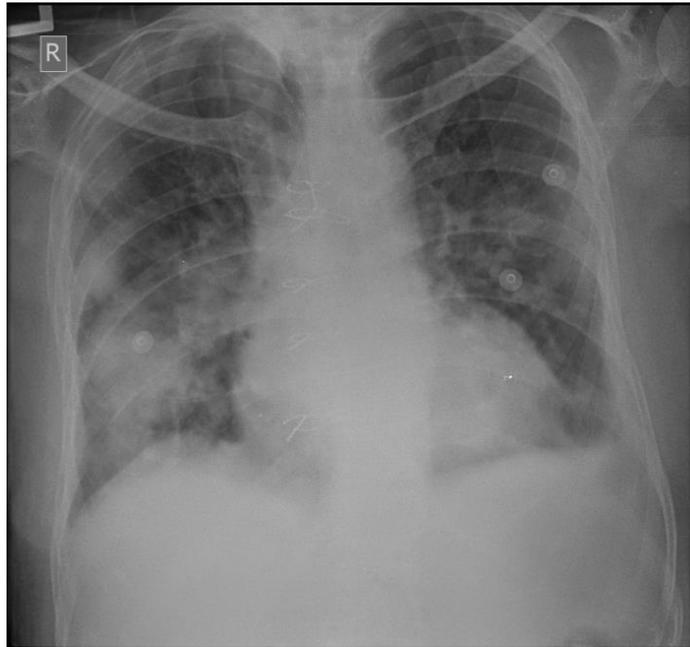
Coronavirus disease 2019 (COVID-19) pandemic that was first reported in Wuhan, China, has rapidly spread around the world just within a month, causing global public health emergency<sup>9</sup>. Although HRCT chest is superior to Chest-Xray<sup>10</sup> but its limited availability and cost limits its wide spread role<sup>11</sup>. No study so far has been published in Pakistan where frequency of chest x-ray findings was studied. Although similar studies have been published internationally<sup>12</sup>. Various studies have been published on chest x-ray where pictorial reviews of the findings have been discussed as well<sup>8</sup>. In Italy they have used Chest-X-ray as radiological tool for predicting the clinical outcome of the patients. They have used a scoring system for this purpose. This study has specially helped in hospital patient management<sup>13</sup>. In another study radiographic severity index was correlated with age and gender<sup>14</sup>. Chest X-Ray scoring systems have been used for other diseases as well<sup>15</sup>.

As it is known that COVID -19 is a pandemic which has claimed hundreds of thousands of lives and infected millions of people round the globe<sup>16</sup>. Majority of the patients have normal chest X-ray on the day of diagnosis<sup>17,10</sup>. This doesn't mean that the lungs may not be involved by the infectious process. HRCT chest has been found to be more sensitive than Chest X-Ray. But they are expensive, less available and cause more radiation exposure<sup>7</sup>. In addition to this HRCT can't be used on daily basis for disease monitoring and in serious patients in ICU's. This is the reason that Chest-Xray is still the most common and primary radiological investigation in COVID-19, especially in countries like Pakistan. Portable Chest X-Ray are also being employed for ICU / critical patients.

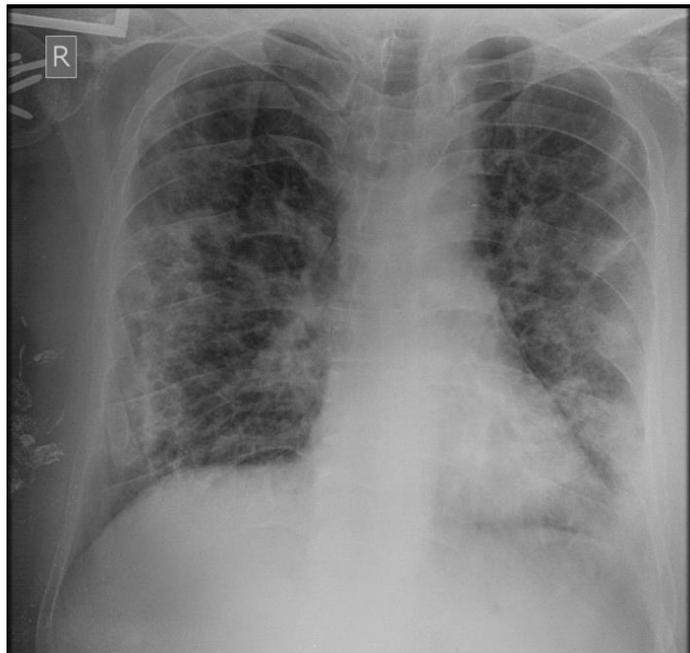
Two types of Chest X-Ray projections are commonly used. Postero-anterior in the patients who can stand and come to the department and antero-posterior commonly in lying patients or who cannot come to the departments. These projections don't cause significant differences in estimating the Chest X-Ray findings in COVID-19 patients. The major findings already

described in various international studies are ground glass opacities, pulmonary infiltrates both alveolar or interstitial type, consolidations, peripheral opacities and indistinct hemi diaphragms. Few uncommon findings like pleural effusions or fibrotic bands have also been described.<sup>(12)</sup>

The major findings of Chest X-ray in our study are bilateral pulmonary infiltrates and mixed ground glass opacities with infiltrates. The findings are shown in fig 1 and 2. The pulmonary infiltrates are alveolar and interstitial type.



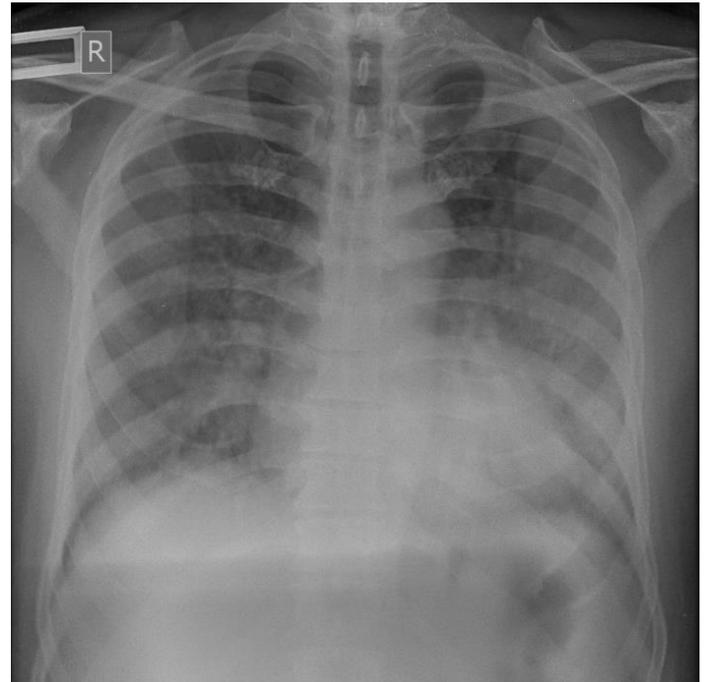
**Figure-1: CXR PA view showing bilateral pulmonary infiltrates having alveolar predominance**



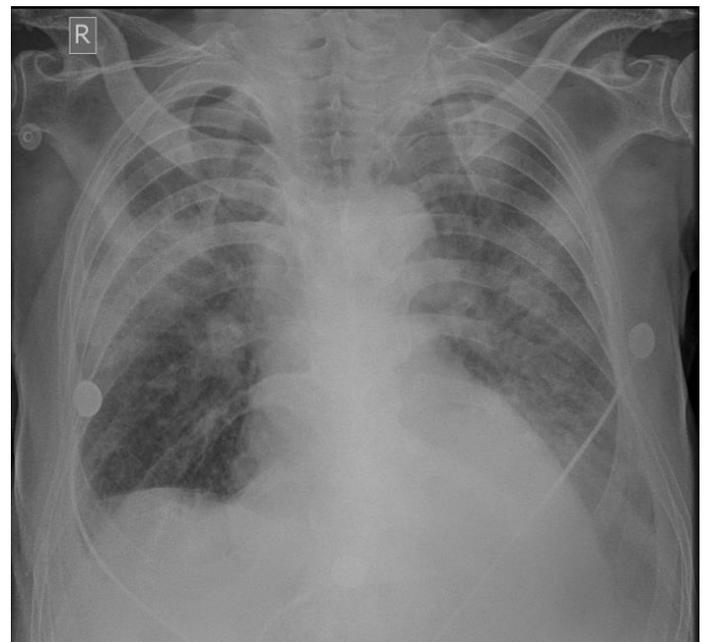
**Figure-2: CXR PA View showing bilateral pulmonary infiltrates having interstitial predominance**

They have been described as major findings in other studies as well<sup>18</sup>. Other findings are indistinct hemi-diaphragms and ground

glass opacities. The findings are also shown in fig 3 and 4. Recognizing these findings<sup>12</sup> can help the doctors to make a diagnosis even in the absence of PCR. This will help in better assessment of the patients in early course of disease.



**Figure-3: CXR PA View showing ground glass haze on left side**



**Figure-4: CXR PA view showing right sided pleural effusion and indistinct left hemi diaphragm**

Developing countries like Pakistan have limited resources. Rural areas and smaller cities don't have the resources available for HRCT chest. Mostly the patients or suspects of COVID -19 report to the nearby larger setups for diagnosis and management. Chest X-ray is a radiological common investigation which is present almost everywhere<sup>19</sup>. The findings of Chest X-ray in our study can help the doctors in peripheral health care setups to

raise level of suspiciousness in suspected cases of COVID-19. Additionally the area percentage involvement can also be used for classification of the disease severity. These findings can also be used in decision in making and management of the patients in acute emergencies where PCR result can't be awaited.

### CONCLUSION

The frequency distribution of four main Chest X-Ray findings in confirmed COVID-19 cases can be used to make a provisional diagnosis where PCR result can't be awaited.

### AUTHOR'S CONTRIBUTION

**Hassan KMB:** Conceived idea, Designed methodology, Statistical Analysis, Manuscript writing of study

**Hassan TB:** Statistical analysis, Data interpretation, Literature review

**Sarwa S:** Final review and proof reading

**Bokhari SARS:** Data Collection, Review of Chest X-Ray Reports

**Khan U:** Data Collection

**Siddique HJ:** Manuscript final reading and approval

**Aamir MO:** Data Collection

**Disclaimer:** None.

**Conflict of Interest:** None.

**Source of Funding:** None.

### REFERENCES

- Rothan HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. *J of Autoimmun.* 2020. [Internet]: Available from ; Website [https://pubmed.ncbi.nlm.nih.gov/32113704/]. Accessed on May 01, 2020
- Udugama B, Kadhiresan P, Kozlowski HN, Malekjahani A, Osborne M, Li VYC, et al. Diagnosing COVID-19: The Disease and Tools for Detection. *ACS nano.* 2020. [Internet]: Available from : Website: [https://europemc.org/article/pmc/pmc7144809]. Accessed on May 01, 2020
- Ai T, Yang Z, Hou H, Zhan C, Chen C, Lv W, et al. Correlation of Chest CT and RT-PCR Testing in Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases. *Radiology.* 2020; [Internet]: Website: [https://pubs.rsna.org/doi/10.1148/radiol.2020200642]. May 01, 2020
- Gualano G, Musso M, Mosti S, Mencarini P, Mastrobattista A, Pareo C, et al. Usefulness of bronchoalveolar lavage in the management of patients presenting with lung infiltrates and suspect COVID-19-associated pneumonia: A case report. *Int J Infect Dis.* 2020; [Internet]: Available from: Website: [https://www.ijidonline.com/article/S1201-9712(20)30334-9/pdf]. Accessed on May 02, 2020
- Chan JFW, Yip CCY, To KKW, Tang THC, Wong SCY, Leung KH, et al. Improved molecular diagnosis of COVID-19 by the novel, highly sensitive and specific COVID-19-RdRp/HeI real-time reverse transcription-PCR assay validated in vitro and with clinical specimens. *Journal of Clinical Microbiology.* 2020. [Internet]: Website: [https://covid19.elsevierpure.com/en/publications/improved-molecular-diagnosis-of-covid-19-by-the-novel-highly-sens]. Accessed on May 02 2020
- Li B, Li X, Wang Y, Han Y, Wang Y, Wang C, et al. Diagnostic value and key features of computed tomography in Coronavirus Disease 2019. *Emerging Microbes and Infections.* 2020. [Internet]: Website: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7191895/]. Accessed on May 02 , 2020
- Ataç GK, Parmaksız A, İnal T, Bulur E, Bulgurlu F, Öncü T, et al. Patient doses from CT examinations in Turkey. *Diagnostic Interv Radiol.* 2015; [Internet]: Website: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4557329/]. Accessed on May 03 2020
- Jacobi A, Chung M, Bernheim A, Eber C. Portable chest X-ray in coronavirus disease-19 (COVID-19): A pictorial review. *Clinical Imaging.* 2020. [Internet]. Website: [https://www.clinicalimaging.org/article/S0899-7071(20)30101-7/fulltext]. Accessed on May 04 2020
- Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet.* 2020; [Internet]: Website: [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30566-3/fulltext]. Accessed on May 04, 2020
- Cellina M, Orsi M, Toluian T, Valenti Pittino C, Oliva G. False negative chest X-Rays in patients affected by COVID-19 pneumonia and corresponding chest CT findings. *Radiography.* 2020; Website: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7211752/]. Accessed on May 05, 2020
- Ye Z, Zhang Y, Wang Y, Huang Z, Song B. Chest CT manifestations of new coronavirus disease 2019 (COVID-19): a pictorial review. *Eur Radiol.* 2020; [Internet]. Website: [https://pubmed.ncbi.nlm.nih.gov/32193638/]. Accessed on May 05 2020
- Wong HYF, Lam HYS, Fong AHT, Leung ST, Chin TWY, Lo CSY, et al. Frequency and Distribution of Chest Radiographic Findings in COVID-19 Positive Patients. *Radiology.* 2019; [Internet]: Website: [https://pubmed.ncbi.nlm.nih.gov/32216717/]. Accessed on May 05, 2020
- Borghesi A, Zigliani A, Golemi S, Carapella N, Maculotti P, Farina D, et al. Chest X-ray severity index as a predictor of in-hospital mortality in coronavirus disease 2019: A study of 302 patients from Italy. *Int J Infect Dis.* 2020; [Internet]: Website: [https://www.ijidonline.com/article/S1201-9712(20)30328-3/fulltext]. Accessed on May 06, 2020
- Borghesi A, Zigliani A, Masciullo R, Golemi S, Maculotti P, Farina D, et al. Radiographic severity index in COVID-19 pneumonia: relationship to age and sex in 783 Italian patients. *Radiol Medica.* 2020; [Internet]: Website: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7194500/]. Accessed on May 06, 2020

15. Ralph AP, Ardian M, Wiguna A, Maguire GP, Becker NG, Drogumuller G, et al. A simple, valid, numerical score for grading chest x-ray severity in adult smear-positive pulmonary tuberculosis. *Thorax*. 2010; [Internet]. Website: [<https://pubmed.ncbi.nlm.nih.gov/20861290/>]. Accessed on May 06, 2020
16. Jin Y, Yang H, Ji W, Wu W, Chen S, Zhang W, et al. Virology, epidemiology, pathogenesis, and control of covid-19. *Viruses*. 2020. [Internet]. Website: [<https://pubmed.ncbi.nlm.nih.gov/32230900/>]. Accessed on May 07, 2020
17. Yoon SH, Lee KH, Kim JY, Lee YK, Ko H, Kim KH, et al. Chest radiographic and ct findings of the 2019 novel coronavirus disease (Covid-19): Analysis of nine patients treated in korea. *Korean J Radiol*. 2020; [Internet]. Website: [<https://pubmed.ncbi.nlm.nih.gov/32100485/>]. Accessed on May 07, 2020
18. Shi H, Han X, Jiang N, Cao Y, Alwalid O, Gu J, et al. Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: a descriptive study. *Lancet Infect Dis*. 2020; [Internet]. Website: [[https://www.thelancet.com/article/S1473-3099\(20\)30086-4/fulltext](https://www.thelancet.com/article/S1473-3099(20)30086-4/fulltext)] Accessed on May 07, 2020
19. Pezzotti W. Chest X-ray interpretation: Not just black and white. *Nursing (Lond)*. 2014; [Internet]. Website: [[https://www.nursingcenter.com/cearticle?an=00152193-201401000-00012&Journal\\_ID=54016&Issue\\_ID=1648425](https://www.nursingcenter.com/cearticle?an=00152193-201401000-00012&Journal_ID=54016&Issue_ID=1648425)] Accessed on May 07, 2020