

Volume 12, October/December 2021

ISSN: 2213-3984

# Clinical Epidemiology *and* Global Health

An Official Publication of  
**INDIAN CLINICAL EPIDEMIOLOGY NETWORK**

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

**ScienceDirect**

Indexed in Scopus, Embase,  
Hinari and Web of Science



[www.cegh.net](http://www.cegh.net)





# Source details

## Clinical Epidemiology and Global Health

Open Access ⓘ

Scopus coverage years: from 2013 to Present

Publisher: Elsevier

E-ISSN: 2213-3984

Subject area: Medicine: Public Health, Environmental and Occupational Health Medicine: Infectious Diseases  
Medicine: Microbiology (medical) Medicine: Epidemiology

Source type: Journal

CiteScore 2020  
**1.6** ⓘ

SJR 2020  
**0.361** ⓘ

SNIP 2020  
**1.040** ⓘ

[View all documents >](#)

[Set document alert](#)

[Save to source list](#)

[CiteScore](#) [CiteScore rank & trend](#) [Scopus content coverage](#)

### i Improved CiteScore methodology

CiteScore 2020 counts the citations received in 2017-2020 to articles, reviews, conference papers, book chapters and data papers published in 2017-2020, and divides this by the number of publications published in 2017-2020. [Learn more >](#)

### CiteScore 2020

$$1.6 = \frac{684 \text{ Citations 2017 - 2020}}{434 \text{ Documents 2017 - 2020}}$$

Calculated on 05 May, 2021

### CiteScoreTracker 2021 ⓘ

$$2.6 = \frac{1.764 \text{ Citations to date}}{675 \text{ Documents to date}}$$

Last updated on 06 March, 2022 • Updated monthly

### CiteScore rank 2020 ⓘ

Category	Rank	Percentile
Medicine		
Public Health, Environmental and Occupational Health	#351/526	33rd
Medicine		
Infectious Diseases	#207/288	28th

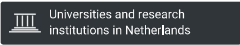
[View CiteScore methodology >](#) [CiteScore FAQ >](#) [Add CiteScore to your site ↗](#)

←

Ads by Google


Stop seeing this ad Why this ad? ⓘ

## Clinical Epidemiology and Global Health

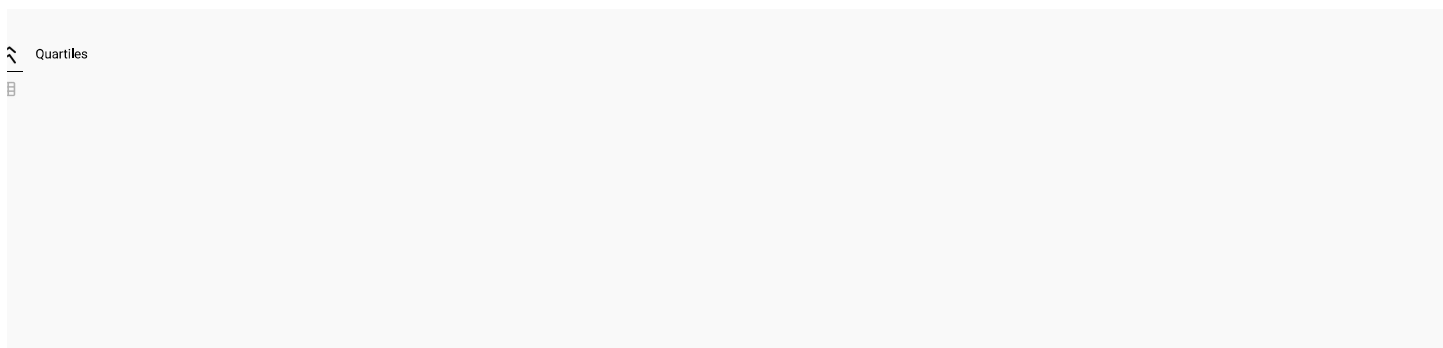
<p><b>COUNTRY</b></p> <p>Netherlands</p> 	<p><b>SUBJECT AREA AND CATEGORY</b></p> <p>Medicine</p> <ul style="list-style-type: none"> <li>Epidemiology</li> <li>Infectious Diseases</li> <li>Microbiology (medical)</li> <li>Public Health, Environmental and Occupational Health</li> </ul>	<p><b>PUBLISHER</b></p> <p>Elsevier BV</p>	<p><b>H-INDEX</b></p> <p>13</p>
<p><b>PUBLICATION TYPE</b></p> <p>Journals</p>	<p><b>ISSN</b></p> <p>22133984</p>	<p><b>COVERAGE</b></p> <p>2013-2020</p>	<p><b>INFORMATION</b></p> <p><a href="#">Homepage</a></p> <p><a href="#">How to publish in this journal</a></p> <p><a href="#">Contact</a></p>

SCOPE

Clinical Epidemiology and Global Health (CEGH) is a multidisciplinary journal and it is published four times (March, June, September, December) a year. The mandate of CEGH is to promote articles on clinical epidemiology with focus on developing countries in the context of global health. We also accept articles from other countries. It publishes original research work across all disciplines of medicine and allied sciences, related to clinical epidemiology and global health. The journal publishes Original articles, Review articles, Evidence Summaries, Letters to the Editor. All articles published in CEGH are peer-reviewed and published online for immediate access and citation.

 Join the conversation about this journal

Quartiles

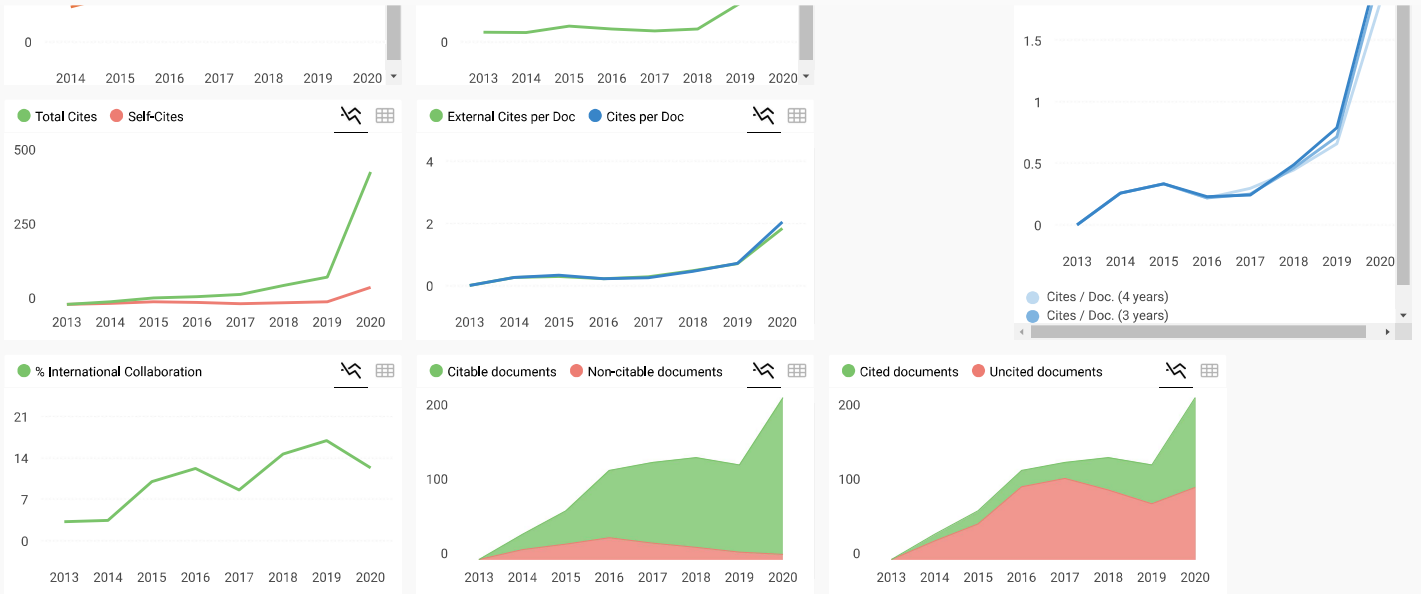


FIND SIMILAR JOURNALS 

options

<p>1</p> <p><b>Iranian Journal of Public Health</b></p> <p>IRN</p> <p>64% similarity</p>	<p>2</p> <p><b>Zeitschrift fur Gesundheitswissenschaften</b></p> <p>DEU</p> <p>60% similarity</p>	<p>3</p> <p><b>BMC Research Notes</b></p> <p>GBR</p> <p>60% similarity</p>	<p>4</p> <p><b>Medical Journal of the Islamic Republic of Iran</b></p> <p>IRN</p> <p>59% similarity</p>	<p>5</p> <p><b>Pan African Medical Journal</b></p> <p>NGA</p> <p>56% similarity</p>
------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------

SJR   ● Total Documents   Citations per document  



**Clinical Epidemiology and Global Health**

← Show this widget in your own website

Just copy the code below and paste within your html code:

`<a href="https://www.scimag`

**Q3** Infectious Diseases  
best quartile

**SJR 2020**  
0.36

powered by scimagojr.com

**SCImago Graphica**

Explore, visually communicate and make sense of data with our new **free tool**.

[Get it](#)

Metrics based on Scopus® data as of April 2021

**Leave a comment**

Name

Email   
(will not be published)


The users of Scimago Journal & Country Rank have the possibility to dialogue through comments linked to a specific journal. The purpose is to have a forum in which general doubts about the processes of publication in the journal, experiences and other issues derived from the publication of papers are resolved. For topics on particular articles, maintain the dialogue through the usual channels with your editor.



[Submit your article](#)

[Guide for authors](#)

Menu

 Search in this journal

## About the journal

[Aims and scope](#)

[Editorial board](#)

[Abstracting and indexing](#)

### Editor-in-Chief

Professor Shally Awasthi, MD, DNB, M Clin Epid,Phd  
King George's Medical University Department of Pediatrics, Lucknow, India  
Epidemiology, Pediatrics and Health economics

[Email this editor](#) ↗

### Associate Editors

Dr. Jyotsna Agarwal, MD  
Dr. Ram Manohar Lohia Institute of Medical Sciences, Department of Microbiology, Lucknow, India  
Microbiology

Dr. Girdhar Aggarwal, PhD  
University of Lucknow, Lucknow, India  
Biostatistics, Clinical Epidemiology

Dr. Avivar Awasthi, MD (Medicine)  
Medical College and Hospital Kolkata, Kolkata, India  
Endocrinology, Epidemiology

Dr. Rajiv Awasthi, MD (Medicine)  
Medical College and Hospital Kolkata, Kolkata, India  
Endocrinology, Epidemiology

Dr. Sujith John Chandy, MBBS, MD, PhD  
Christian Medical College Vellore, Vellore, India  
Medicine Use, Medicine safety

Dr. Arun Chaturvedi, MS, MCh  
Atal Bihari Vajpayee Institute of Medical Sciences & Dr Ram Manohar Lohia Hospital, New Delhi, India  
Epidemiology, Surgical Oncology

Dr. Manoja Das, MD, MBBS  
The INCLEN Trust International, New Delhi, India  
Pediatrics, Public Health, Epidemiology, Vaccines

Dr. Thambu David, MD. DipNB  
Christian Medical College Department of Medicine, Vellore, India  
Epidemiology, Internal Medicine, Infectious disease, Stroke

Dr. Rashmi Kumar, MD, FNAsc, FAMS  
Community Empowerment Lab, Lucknow, India  
Pediatric neurology, Infectious disease

Professor Sandeep Kumar, MS FRCS PhD MMSc

All India Institute of Medical Science - Bhopal, Bhopal, India  
General Surgery, Surgical Oncology, Breast Surgery, Wound healing, Geriatric Surgery, Clinical Epidemiology

Dr. Narayan Bahadur Mathur, MD, FNNF  
Maulana Azad Medical College, New Delhi, India  
Pediatrics, Neonatology

Dr. Saumya Misra, MBA, PhD  
IBS Pune, Pune, India  
Health care Finance, Management

Dr. Bhola Nath, PhD, MD, DNB, MBBS  
All India Institute of Medical Sciences, Bathinda, Bathinda, India  
Epidemiology, NCD and Public Health

Dr. Ansuman Panigrahi, MD, MBBS  
NASI-ICMR Chair-Public Health Research, Rajasthan University of Health Sciences, Rajasthan, India  
Epidemiology, NCD, Public Health

Dr. Archana Patel, MD, DNB, MSCE, PhD  
Datta Meghe Institute of Medical Sciences - Wardha Campus, Wardha, India  
Maternal & Child Health, Clinical Epidemiology, Public Health

Dr. Abraham Peedicayil, MPH, MD, FRCOG  
Sultan Qaboos Comprehensive Cancer Center, Muscat, Oman  
Epidemiology, Gynaecologic Oncology

Dr. Rajamohan Kumar Pillai, MD, MD, MSE, PhD  
Trivandrum Medical College Department of Pediatrics, Trivandrum, Kerala, India  
Epidemiology Clinical health economics, Health Policy

Dr. Rajendra Prasad, MD, DTCD, FAMS  
Era's Lucknow Medical College and Hospital, Lucknow, India  
Pulmonary Medicine

Dr. Manorama Purwar, M.D, D.G.O, MSc(Clinical Epidemiology)  
Indira Gandhi Government Medical College and Hospital, Nagpur, India  
Epidemiology, Reproductive research, Fetal growth, Preterm birth

Dr. Chythra Rao, MD, DNB  
Kasturba Medical College Manipal, Manipal, India  
Epidemiology, NCDs, Maternal & Child health, Vaccine studies, Public Health

Dr. Tuhina Rastogi, PhD  
King George's Medical University, Lucknow, India  
Public Health, Maternal and Child Health and Nutrition, Qualitative Research, Social Medicine

Dr. Ranjitha Shetty, MBBS, MD  
Kasturba Medical College Manipal, Manipal, India  
Women's health, Cancer cervix prevention, Indigenous Health, Geriatric Health, Vaccine Studies

Dr. Jaivir Singh, MD, DPH, FAMS  
King George's Medical University, Lucknow, India  
Epidemiology & Public Health

Dr. Sunit Singhi, MD, FAMS, FIAP, FCCM  
Medanta The Medicity, Gurgaon, India  
Pediatrics, Public Health

Dr. Neeraj Mohan Srivastava, M.Sc, PhD  
Uttar Pradesh Technical Support Unit, Lucknow, Uttar Pradesh, India  
Public Health, Epidemiology, Health Systems, Child Health

Dr. Kurien Thomas, MD, MSc  
Pondicherry Institute of Medical Sciences, Puducherry, India  
Epidemiology, Internal Medicine, Health Policy

Dr. Suresh Ughade, PhD  
Government Medical College and Hospital Nagpur, Nagpur, India

## Editorial Board

Dr. Narendra K. Arora, MD, FAMS, FIAP, FIPHA  
The INCLIN Trust International, New Delhi, India  
Public Health, Immunization and Child Health

Professor Mahendra Bhandari, MS, MCh  
Henry Ford Hospital, Detroit, Michigan, United States of America  
Urology, Public Health

Dr. Francois Chapuis, MD, MPH, PhD  
University Lyon 1 Faculty of Medicine Lyon-Est, Lyon, France  
Clinical research - Ethics

Dr. Robert Fletcher, MD  
Harvard Medical School, Boston, Massachusetts, United States of America  
Epidemiology, Internal Medicine

Dr. Suzanne Fletcher, MD, MSc  
Harvard Medical School Department of Population Medicine, Boston, Massachusetts, United States of America  
Internal Medicine, Clinical Epidemiology

Dr. Nirmal Kumar Ganguly, MBBS, MD, FRC (Path), FNA, FNASC, FASC, FAMS, Fellow - Third world academy  
Global Health Strategies Emerging Economies Pvt Ltd, New Delhi, India  
Immunology, Biotechnology, Public Health, Infectious diseases

Dr. Devendra Kumar Gupta, MS, M.Ch, FRCS, FAMS, D.Sc,  
All India Institute of Medical Sciences, New Delhi, India  
Pediatric surgery, Urology, Malformations

Dr. Trudie Lang, PhD  
University of Oxford, Oxford, United Kingdom  
Public Health

Dr. Mary Ann D. Lansang, MD, MMedSc  
University of the Philippines Manila, Manila, Philippines  
Infectious diseases, Clinical epidemiology, Health policy, Systems research, Monitoring and Evaluation

Dr. Anand Manoharan, MD, PhD  
INDIACLEN, New Delhi, India  
Microbiology

Dr. Jose Martines, MD, PhD  
University of Bergen, Bergen, Norway  
Public Health, Epidemiology, Neonatology, Nutrition

Professor Suneeta Mittal, MD, FRCOG, FICOG, FAMS, FIMCH, FIMSA, FICLS  
Fortis Memorial Research Institute, Gurgaon, India  
Infertility, Reproductive Endocrinology and Reproductive research

Professor Mark Nichter, PhD, MPH  
The University of Arizona, Tucson, Arizona, United States of America  
Medical anthropology, Global Health, Public Health, Tobacco Control

Professor Vinod Paul, MD  
National Institution for Transforming India Aayog, New Delhi, India  
Neonatology, Pediatrics, Public Health

Professor Sanjay Zodpey, MD, PhD  
Public Health Foundation of India, New Delhi, India  
Public Health, Epidemiology, Health Systems

All members of the Editorial Board have identified their affiliated institutions or organizations, along with the corresponding country or geographic region. Elsevier remains neutral with regard to any jurisdictional claims.

---

ISSN: 2213-3984

Copyright © 2022 INDIACLEN. All rights reserved

---



Copyright © 2022 Elsevier B.V. or its licensors or contributors.  
ScienceDirect® is a registered trademark of Elsevier B.V.







[Submit your article](#)

[Guide for authors](#)

Menu

[Search in this journal](#)

## Volume 11

July–September 2021

[Download full issue](#)

[Previous vol/issue](#)

[Next vol/issue](#)

Receive an update when the latest issues in this journal are published

[Sign in to set up alerts](#)

Review article *Open access*

The effectivity role of community mental health worker for rehabilitation of mental health illness: A systematic review

Liana Liana, Heni Dwi Windarwati

Article 100709

[Download PDF](#) [Article preview](#)

Research article *Open access*

A scoping review on barriers to case management of neonatal pneumonia in India

N. Sreekumaran Nair, Leslie Edward Lewis, Vijay Shree Dhyani, Shruti Murthy, ... Bhumika T. Venkatesh

Article 100713

[Download PDF](#) [Article preview](#)

Short communication *Open access*

Prevalence of anaemia among women of reproductive age (15–49): A spatial-temporal comprehensive study of Maharashtra districts

Mithun Mog, Koustav Ghosh

Article 100712

[Download PDF](#) [Article preview](#)

Research article *Open access*

While inadequate birth interval becomes detrimental to health & nutritional outcome in infant and under-five year children; a systematic review through BLR and CPH model

Tanu Das, Tamal Basu Roy

Article 100714

[Download PDF](#) [Article preview](#)

Review article *Open access*

Updates on biomedical waste management during COVID-19: The Indian scenario

Sharad Chand, C.S. Shastry, Shivakumar Hiremath, Juno J. Joel, ... Uday Venkat Mateti

Article 100715

[Download PDF](#) [Article preview](#)

Research article [Open access](#)

## Effect of music therapy on ICU induced anxiety and physiological parameters among ICU patients: An experimental study in a tertiary care hospital of India

Jaskirat Kaur Chahal, Preksha Sharma, Sulena, H.C.L. Rawat

Article 100716

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

## Self-reported and clinically identified loss of smell and taste among persons tested for COVID-19 in Chennai, southern India, July-August 2020: A cross sectional study

Kathiresan Jeyashree, Mohankumar Raju, Manickam Ponnaiah, Sendhilkumar Muthappan, ... Manoj V. Murhekar

Article 100718

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

## Knowledge, attitude, and practices related to antibiotic use and resistance among the general public of coastal south Karnataka, India – A cross-sectional survey

Khyati Bhardwaj, Suchitra Shenoy M, Shrikala Baliga, B. Unnikrishnan, B. Shantharam Baliga

Article 100717

[Download PDF](#) [Article preview](#) 

Review article [Open access](#)

## The dynamics of inflammatory markers in coronavirus disease-2019 (COVID-19) patients: A systematic review and meta-analysis

Roshan Kumar Mahat, Suchismita Panda, Vedika Rathore, Sharmistha Swain, ... Sumesh Prasad Sah

Article 100727

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

## Validation of Circom comorbidity score in critically-ill cirrhotic patients

Maged EL-Ghannam, Yosry Abdelrahman, Hoda Abu-Taleb, Marwa Hassan, ... Mohamed Darwish EL-Talkawy

Article 100728

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

## Predictors of competency on delivery care service among final year undergraduate midwifery students in higher education institutions of Ethiopia, 2019: A cross sectional study

Dereje Nibret Gessesse, Birhanu Wubale Yirdaw, Dawit Gebeyehu Mekonen

Article 100730

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

## Active bleeding control pilot program in India: Simulation training of the community to stop the bleed and save lives from Road Traffic Injuries

Geethanjali Ramachandra, G.V. Ramana Rao, Shailaja Tetali, Devendar Karabu, ... Vinay Nadkarni

Article 100729

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

## Effectiveness of psycho-educational intervention on psychological distress and self-esteem among resident elderly: A study from old age homes of Punjab, India

Sushil Kumar Maheshwari, Rintu Chaturvedi, Preksha Sharma

Article 100733

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

## Medication adherence and glycemic control status among people with diabetes seeking care from a tertiary care teaching hospital, south India

Jeby Jose Ollickal, Palanivel Chinnakali, B.S. Suryanarayana, Ganesh Kumar Saya, ... D.K.S. Subrahmanyam

Article 100742

[Download PDF](#) [Article preview](#) 

FEEDBACK 

Research article [Open access](#)

### Perceptions of essential obstetric care by rural pregnant women and safe motherhood approaches: An interventional study

Dilip Chandrasekhar, Angel Mary William, Anjana A, Annmaria Benny, ... Shahir Ahmed KV Ahamedunni

Article 100731

[Download PDF](#) [Article preview](#) 

Review article [Open access](#)

### Psychological Health amidst COVID-19: A Review of existing literature in the Indian Context

Jaya Shukla, Ram Manohar Singh

Article 100736

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Examining the role of high-risk fertility behaviour in chronic undernutrition among Indian married women age 15-49

Sanjay Kumar Pal, Chander Shekhar

Article 100739

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### COVID-19 pandemic and psychological wellbeing among health care workers and general population: A systematic-review and meta-analysis of the current evidence from India

Rajesh Kumar Singh, Ram Bajpai, Pradeep Kaswan

Article 100737

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### COVID-19 pandemic and its average recovery time in Indian states

Noel George, Naresh K. Tyagi, Jang Bahadur Prasad

Article 100740

[Download PDF](#) [Article preview](#) 

Review article [Open access](#)

### A short review on leptospirosis: Clinical manifestations, diagnosis and treatment

Chinju Susan Chacko, Shravya Lakshmi S, Anjali Jayakumar, Steffy Ligi Binu, ... Nandakumar UP

Article 100741

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Critical analysis of drug related problems among inpatients in the psychiatry department of a tertiary care teaching hospital: A pharmacist led initiative

Anjali Jayakumar, Achsa Shekaina Abraham, Shishir Kumar, Sharad Chand, ... Nandakumar UP

Article 100743

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Knowledge and awareness among physiotherapy students to combat COVID-19: A questionnaire based study

Mandeep Kumar Jangra, Akanksha Saxena, Praharsh Anurag

Article 100748

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Epidemiology of tuberculosis based on histopathological data and nucleic acid amplification techniques in Lebanon from January 2012 to December 2016

Mariam Kabbani, Reeda Bou Said, Georges Aftimos

Article 100750

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Underutilization of the recommended frequency of focused antenatal care services in Northwest Ethiopia: Using Andersen's healthcare service utilization model approach

Asenake Abebaw Tareke, Yohannes Moges Mittiku, Anmut Tagele Tamiru, Bayew Kelkay Rade, Temesgen Worku Gudayu

Article 100746

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Estimation of seroprevalence of novel coronavirus disease (COVID-19) using preserved serum at an outpatient setting in Kobe, Japan: A cross-sectional study

Asako Doi, Kentaro Iwata, Hirokazu Kuroda, Toshikazu Hasuike, ... Yasuki Kihara

Article 100747

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Road traffic accident mortality analysis based on time of occurrence: Evidence from Kerala, India

Vipin N, Rahul T

Article 100745

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Geographical divide led inequality in accessing maternal healthcare services between hills and valley regions of Manipur state, India

Prem Shankar Mishra, N. Pautunthang, Strong P. Marbaniang, Anushree K. N

Article 100744

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Clinical review of COVID-19 patients presenting to a quaternary care private hospital in South India: A retrospective study

Prithvi Mohandas, Sathya Periasamy, Manimaran Marappan, Arun Sampath, ... Vijit Koshy Cherian

Article 100751

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Prevalence of oral mucosal lesions in nursing homes elderly people in western Iran

Neda Omidpanah, Fateme Mohamadinejad, Roya Safari faramani

Article 100749

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Factors influencing utilization of cervical cancer screening services among women – A cross sectional survey

Jisa George T

Article 100752

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Use of Quintile Regression to Find Factors Influencing CD4 Cell Count in Iranian Newly Recognized HIV-Infected People (1987–2016)

Maryam Farhadian, Younes Mohammadi, Nasrin Shirmohammadi-Khorram, Mohammad Mirzaei

Article 100753

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Neurobehavioral performance of Indonesian farmers and its association with pesticide exposure: A cross-sectional study

Imelda Nafa Pawestri, Erma Sulistyanyingsih

Article 100754

[Download PDF](#) [Article preview](#) 

Review article [Open access](#)

## Quinary prevention in diabetes care: Need for multidisciplinary approach

D. Dutta, V. Arora, A. Dhingra, A.K. Das, ... S. Kalra

Article 100757

[Download PDF](#) Article preview 

Research article *Open access*

## The use of Janus Kinase inhibitors in hospitalized patients with COVID-19: Systematic review and meta-analysis

Indra Wijaya, Rizky Andhika, Ian Huang, Aga Purwiga, ... Rully Marsis Amirullah Roesli

Article 100755

[Download PDF](#) Article preview 

Research article *Open access*

## Study on age of menarche between generations and the factors associated with it

Balaji Ramraj, V. Meenakshi Subramanian, Vijayakrishnan G

Article 100758

[Download PDF](#) Article preview 

Research article *Open access*

## Quantification of heat threshold and tolerance to evaluate small fiber neuropathy- an indigenously developed thermal model of pain

P. Rama Mohan, Swetha chowdary, A.V. Siva Kumar, K.N. Maruthy, K. Mahesh kumar

Article 100760

[Download PDF](#) Article preview 

Research article *Open access*

## Association between prolonged use of smartphone and the incidence of dry eye among junior high school students

Marlyanti Nurrahmah Akib, Suryana Rannu Pirade, Siti Rukiah Syawal, Muhammad Miftah Fauzan, ... Arifin Seweng

Article 100761

[Download PDF](#) Article preview 

Research article *Open access*

## SARS-CoV2 IgG antibody: Seroprevalence among health care workers

Om Prakash, Bhavin Solanki, Jay Sheth, Govind Makwana, ... Hemant Tiwari

Article 100766

[Download PDF](#) Article preview 

Research article *Open access*

## Complementary feeding practices of tribal mothers to their Infants and Young Children in Kerala

Justin P. Jose, Shanuga J. Cherayi, Sreejith Sudhakar, Kanmani T. Raju

Article 100767

[Download PDF](#) Article preview 

Research article *Open access*

## Prevalence and determinants of Vitamin A deficiency among children in India: Findings from a national cross-sectional survey

Sampurna Kundu, Balram Rai, Anandi Shukla

Article 100768

[Download PDF](#) Article preview 

Research article *Open access*

## COVID-19 in Punjab, India: Epidemiological patterns, laboratory surveillance and contact tracing of COVID-19 cases, March–May 2020

Sahil Sharma, Kapil Goel, Karishma Krishna Kurup, Gagandeep Singh Grover, Rajesh Bhaskar

Article 100769

[Download PDF](#) Article preview 

Research article *Open access*

## Hematological profile and biochemical markers of COVID-19 non-survivors: A retrospective analysis

Mukesh Bairwa, Rajesh Kumar, Kalpana Beniwal, Deepjyoti Kalita, Yogesh Bahurupi

Article 100770

[Download PDF](#) Article preview 

Research article [Open access](#)

### Trends, regional inequalities and determinants in the utilization of prenatal care and skilled birth attendant in Ethiopia: A multilevel analysis

Berhanu Teshome Woldeamanuel, Merga Abdissa Aga

Article 100771

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Impact of malnutrition on scholastic performance among school children in Mysuru

Amogha Shree, M.R. Narayana Murthy

Article 100780

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Determinants or barriers associated with specific routine check-up in antenatal care in gestational period: A study from EAG states, India

Madhurima Sarkar, Tanu Das, Tamal Basu Roy

Article 100779

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Malaria among the Sauria Paharia, a primitive and vulnerable tribe of Jharkhand state, India

M Rajesh Kumar Rao, Manoj Kumar Das

Article 100778

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Transmission dynamics of novel Coronavirus–SARS-CoV-2 in South Sumatera, Indonesia

Rico Januar Sitorus, Irzanita Wathan, Hibsah Ridwan, Hariadi Wibisono, ... Merry Natalia

Article 100777

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Overweight/obesity risks and prevalence of diabetes and hypertension in North Eastern India: An analysis using seemingly unrelated probit model

Strong P. Marbaniang, Hemkothang Lhungdim, Brijesh Yadav, Vinit Kumar Yajurvedi

Article 100764

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### The predictors of high titer of anti-SARS-CoV-2 antibody of convalescent plasma donors

Shinta Oktya Wardhani, Jonny Karunia Fajar, Nina Nurarifah, Djoko Heri Hermanto, ... Harapan Harapan

Article 100763

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### How healthcare workers are coping with mental health challenges during COVID-19 pandemic? - A cross-sectional multi-countries study

Mila Nu Nu Htay, Roy Rillera Marzo, Rafidah Bahari, Ayesha AlRifai, ... Tin Tin Su

Article 100759

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Uptake of PPTCT services among HIV sero-positive pregnant women in Mumbai, India - A descriptive study

Shrikala Acharya, Roshni Cynthia Miranda, Padmaja Keskar

Article 100775

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Study on knowledge of chemotherapy's adverse effects and their self-care ability to manage - The cancer survivors impact

Serma Subathra Arunachalam, Asha P. Shetty, Nandakumar Panniyadi, Chanchal Meena, ... Savitha Kumari

FEEDBACK 

Article 100765

[Download PDF](#) [Article preview](#) 

Research article *Open access*

The waist-height ratio is a potential anthropometric index of insulin resistance: Observations based on oral glucose tolerance test in lean, normo-glycaemic, Asian Indian males from Southern India

Shajith Anoop, Felix Jebasingh K, Dona Maria Philip, Mathews Edatharayil Kurian, ... Nihal Thomas

Article 100762

[Download PDF](#) [Article preview](#) 

Research article *Open access*

Can Generalized Poisson model replace any other count data models? An evaluation

Bijesh Yadav, Lakshmanan Jeyaseelan, Visalakshi Jeyaseelan, Jothilakshmi Durairaj, ... Shrikant I. Bangdiwala

Article 100774

[Download PDF](#) [Article preview](#) 

Research article *Open access*

Assessment of burden of internet addiction and its association with quality of sleep and cardiovascular autonomic function in undergraduate medical students

Amrita Nayak, Kuppusamy Saranya, Jean Fredrick, Ramachandran Madumathy, Senthil Kumar Subramanian

Article 100773

[Download PDF](#) [Article preview](#) 

Research article *Open access*

Biological attributes of age and gender variations in Indian COVID-19 cases: A retrospective data analysis

Savitesh Kushwaha, Poonam Khanna, Vineeth Rajagopal, Tanvi Kiran

Article 100788

[Download PDF](#) [Article preview](#) 

Research article *Open access*

Seroprevalence of hydatid cyst and related risk factors in humans referred to urban health centers of Zahedan city, southeast Iran

Samaneh Abdolahi Khabisi, Malihe Marghzari, Seideh Zeinab Almasi, Alireza Salimi Khorashad, Soudabeh Etemadi

Article 100789

[Download PDF](#) [Article preview](#) 

Research article *Open access*

Assessment of the occupational stress among nuclear medicine technical professionals in India

Sanny Bhushan Kumar, Kevin Fonseca, Ashwani Verma, Ravi Ranjan Kumar

Article 100786

[Download PDF](#) [Article preview](#) 

Research article *Open access*

Association between high pre-pregnancy body mass index and antenatal depression: A study among pregnant women of upper socio-economic strata in North-West Delhi, India

Priyanka Arora, Bani Tamber Aeri

Article 100787

[Download PDF](#) [Article preview](#) 

Research article *Open access*

Multivariate approach in analyzing medical data with correlated multiple outcomes: An exploration using ACCORD trial data

Akash Mishra, K.T. Harichandrakumar, Binu VS, Santhosh Satheesh, N. Sreekumaran Nair

Article 100785

[Download PDF](#) [Article preview](#) 

Research article *Open access*

Impact of change in household hygiene conditions on morbidity in India: Evidence from longitudinal survey

N. Brahmanandam, R. Nagarajan

Article 100793

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Income-based inequality in full immunization coverage of children aged 12-23 months in Eastern India: A decomposition analysis

Shantanu Sharma, Sonali Maheshwari, Ajit Kumar Jaiswal, Sunil Mehra

Article 100738

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Chronic viral HBsAg-negative hepatitis B: Epidemiological, clinical and biochemical characteristics in an outpatient descriptive cohort in Burkina Faso

Eric Nagaonlé Somé, Alice Nanelin Guingané, Issaka Zongo, Daouda Sané, ... Roger Sombié

Article 100799

[Download PDF](#) [Article preview](#) 

Short communication [Open access](#)

Yoga and Naturopathy intervention for reducing anxiety and depression of Covid-19 patients – A pilot study

R. Jenefer Jerrin, S. Theebika, P. Panneerselvam, ST. Venkateswaran, ... K. Maheshkumar

Article 100800

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Prevalence of depression and anxiety among mothers of children with neuro-developmental disorders at a tertiary care centre, Puducherry

Nousheen Fatima, Palanivel Chinnakali, Sathish Rajaa, Vikas Menon, ... Venkatesh Chandrasekaran

Article 100792

[Download PDF](#) [Article preview](#) 

Discussion [Open access](#)

COVID-19 and its impacts: The situation in Niger republic

Emmanuella Nzeribe, Udofa Edidiong Michael, Shuaibu Saidu Musa, Mirindi Batumike Marc, ... Don Eliseo Lucero-Prisno

Article 100797

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Perception, preparedness and response of health care personals towards COVID-19 pandemic in Azad Jammu & Kashmir, Pakistan: A cross sectional interview based study

Muhammad Faraz Khan, Majid Mahmood, Muhammad Naseem Hasrat, Bilal Javed, Ozan Javed

Article 100783

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Improving tuberculosis treatment success rate through nutrition supplements and counselling: Findings from a pilot intervention in India

Ajay Kumar Singh, Ankita Siddhanta, Latashree Goswami

Article 100782

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Validation of the Arabic version of the Short Form Leed's Dyspepsia Index (SF-LDQ) amongst patients with type II diabetes

Khaled Alabdulkareem, Quratulain Shaikh, Sultanah Hisham Alsulaiman, Marvi Mahesar, ... Fatima Fadhel AlAmri

Article 100790

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

Prognostic value of inflammatory markers in patients with COVID-19 in Indonesia

Ignatius Bima Prasetya, Cucunawangsih, Jane Olivia Lorens, Veli Sungono, ... Ratna Sari Wijaya

Article 100803

[Download PDF](#) [Article preview](#) 



Research article [Open access](#)

### Evaluation of hypertension treatment in acute ischemic stroke

Lara Haidar, Hiba AlHarfany, Sarah G. Cherri, Diana Malaeb, ... Hassan Hosseini

Article 100776

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Association between opium use and bladder cancer: A case-control study in a high risk area of Iran

Hamideh Rashidian, Ali Akbar Haghdoost, Maryam Hadji, Maryam Marzban, ... Kazem Zendehtdel

Article 100772

[Download PDF](#) [Article preview](#) 

Correspondence [Open access](#)

### COVID-19 as an opportunity for smokeless tobacco control and prohibiting spitting in public places

Prashant Kumar Singh, Shruti Acharya, Pankhuri Jain, Shalini Singh

Article 100794

[Download PDF](#)

Research article [Open access](#)

### Quality of life and mental health status among the caregivers of genetic disease patients in Southern Karnataka, India

Aparna Mohandas, Deepa Bhat, Sunil Kumar D, M.R. Narayana Murthy

Article 100795

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Socio-economic factors associated with increased neonatal mortality: A mixed-method study of Bangladesh and 20 other developing countries based on demographic and health survey data

Md. Akhtarul Islam, Biva Biswas

Article 100801

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Distracted driving: Direct observation of mobile phone use among motorised two-wheeler drivers in the rapidly motorising city of Hyderabad, India

A.P. Sandya, Lakshmi Archana Y, Melissa Glenda Lewis, Tetali Shailaja

Article 100791

[Download PDF](#) [Article preview](#) 

Research article [Open access](#)

### Factors affecting External causes of deaths among adults (15–59 years) in South Indian states: A study using Bayesian model on National Family Health Survey-4 (2015–16) data

Apyayee Sil, Arpan Sil, Preeti Dhillon, Mithun Mog

Article 100796

[Download PDF](#) [Article preview](#) 

Erratum [Open access](#)

### Corrigendum to “Cancer epidemiology and trends in North Khorasan Province of Iran” [6, 2 (2018) 51–55]

Hosein Rafiemanesh, Atefe Zahedi, Mojtaba Mehtarpour, Alireza Zemestani, ... Hamid Salehiniya

Article 100732

[Download PDF](#)

---

[< Previous vol/issue](#)

[Next vol/issue >](#)



Copyright © 2022 Elsevier B.V. or its licensors or contributors.  
ScienceDirect ® is a registered trademark of Elsevier B.V.





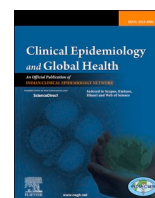
Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Contents lists available at ScienceDirect

## Clinical Epidemiology and Global Health

journal homepage: [www.elsevier.com/locate/cegh](http://www.elsevier.com/locate/cegh)

Original article

The predictors of high titer of *anti*-SARS-CoV-2 antibody of convalescent plasma donors

Shinta Oktya Wardhani<sup>a,\*\*</sup>, Jonny Karunia Fajar<sup>b,\*</sup>, Nina Nurarifah<sup>a</sup>, Djoko Heri Hermanto<sup>a</sup>, Siti Fatonah<sup>c</sup>, Susanthi Djajalaksana<sup>d</sup>, Arie Zainul Fatoni<sup>e</sup>, Putu Moda Arsana<sup>f</sup>, Laksmi Wulandari<sup>g,\*\*\*</sup>, Gatot Soegiarto<sup>h</sup>, Kuldeep Dhama<sup>i</sup>, Harapan Harapan<sup>j,k,l</sup>

<sup>a</sup> Division of Hematology and Oncology, Department of Internal Medicine, Faculty of Medicine, Universitas Brawijaya, Malang, 65145, Indonesia

<sup>b</sup> Brawijaya Internal Medicine Research Center, Department of Internal Medicine, Faculty of Medicine, Universitas Brawijaya, Malang, 65145, Indonesia

<sup>c</sup> Department Clinical Pathology, Faculty of Medicine, Universitas Brawijaya, Malang, 65145, Indonesia

<sup>d</sup> Department of Pulmonology and Respiratory Medicine, Faculty of Medicine, Universitas Brawijaya, Malang, 65145, Indonesia

<sup>e</sup> Department of Anesthesiology and Intensive Therapy, Faculty of Medicine, Universitas Brawijaya, Malang 65145, Indonesia

<sup>f</sup> Division of Endocrinology, Diabetes & Metabolism, Department of Internal Medicine, Faculty of Medicine, Universitas Brawijaya, Malang, 65145, Indonesia

<sup>g</sup> Department of Pulmonology and Respiratory Medicine, Faculty of Medicine, Universitas Airlangga, Surabaya, 60286, Indonesia

<sup>h</sup> Division of Allergy & Immunology, Department of Internal Medicine, Faculty of Medicine, Universitas Airlangga, Surabaya, 60286, Indonesia

<sup>i</sup> Division of Pathology, ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly, 243 122, Uttar Pradesh, India

<sup>j</sup> Medical Research Unit, School of Medicine, Universitas Syiah Kuala, Banda Aceh, 23111, Indonesia

<sup>k</sup> Tropical Disease Centre, School of Medicine, Universitas Syiah Kuala, Banda Aceh, 23111, Indonesia

<sup>l</sup> Department of Microbiology, School of Medicine, Universitas Syiah Kuala, Banda Aceh, 23111, Indonesia

## ARTICLE INFO

## Keywords:

Convalescent plasma  
COVID-19  
Donors  
Predictor  
Titers of antibody

## ABSTRACT

**Background:** Recent evidence suggested that the higher titers of anti-severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) antibody from convalescent plasma donors contributed to the clinical improvement in coronavirus disease 2019 (COVID-19) patients. However, the titers of *anti*-SARS-CoV-2 antibodies varied in each individual, and the precise factors that might govern such variation have not been elucidated.

**Objectives:** To assess the factors associated with high titers of *anti*-SARS-CoV-2 antibody among COVID-19 convalescent plasma (CCP) donors.

**Methods:** A cross-sectional study was conducted in Saiful Anwar General Hospital, Malang, Indonesia. Information of interest including demographic characteristics, clinical symptoms, comorbidities, laboratory findings, and the titers of *anti*-SARS-CoV-2 antibody among COVID-19 CCP donors were collected. The correlation was assessed using multiple logistic regression.

**Results:** A total of 50 COVID-19 CCP donors with the titers of *anti*-SARS-CoV-2 antibody of more than 1:320 and 33 donors with the titers of less than 1:320 were analyzed. Our analysis revealed that CCP donors with history of cough, fever, dyspnea, and pneumonia significantly had higher titers of *anti*-SARS-CoV-2 antibody compared to asymptomatic donors. Moreover, CCP donors with elevated levels of eosinophils and immature granulocytes and low levels of albumin had higher levels of *anti*-SARS-CoV-2 antibody. The titer of antibody was not affected by comorbidities of donors.

**Conclusions:** CPP donors who had experience of symptomatic COVID-19 with high eosinophils level, high immature granulocytes and low albumin level have higher titers of *anti*-SARS-CoV-2 antibody than those who experienced asymptomatic COVID-19. Our current findings may be used as the additional baseline criteria for selecting the donors of CCP for the management of COVID-19.

\* Corresponding author.

\*\* Corresponding author.

\*\*\* Corresponding author.

E-mail addresses: [shinta\\_oktya.fk@ub.ac.id](mailto:shinta_oktya.fk@ub.ac.id) (S.O. Wardhani), [gembayok@gmail.com](mailto:gembayok@gmail.com) (J.K. Fajar), [laksmi.wulandari@fk.unair.ac.id](mailto:laksmi.wulandari@fk.unair.ac.id) (L. Wulandari).

<https://doi.org/10.1016/j.cegh.2021.100763>

Received 29 December 2020; Received in revised form 10 April 2021; Accepted 23 April 2021

Available online 10 May 2021

2213-3984/© 2021 The Author(s). Published by Elsevier B.V. on behalf of INDIACLEN. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

The management of coronavirus disease 2019 (COVID-19) remains a major challenge. Since the consolidation project from World Health Organization (WHO) suggests a weak efficacy of hydroxychloroquine, remdesivir, interferon regimens, and lopinavir to treat COVID-19<sup>1</sup> and the vaccines are still being developed, a treatment using passive immunization concept might be promising. Convalescent plasma (CCP), a treatment by transferring neutralizing anti-viral antibodies and other immunomodulators via plasma transfusion, had been historically proven to provide the clinical improvement of similar infectious diseases<sup>2,3</sup>; and therefore, CCP is proposed as one of the promising treatments of COVID-19.<sup>4</sup> However, the use of CCP to treat COVID-19 patients have raised the dilemma due to the different responses among the patients.<sup>5</sup> A specific setting of CCP administration needs to be validated.

While the US Food and Drug Administration (FDA) has suggested that the titers of *anti-SARS-CoV-2* antibody of more than 1:160 is considered as the effective CCP,<sup>6</sup> the evidence regarding the outcomes of CCP remained controversial.<sup>7</sup> Recent studies indicated that the titers of *anti-SARS-CoV-2* antibody of more than 1:320 from CCP donors provided clinical improvement for treating COVID-19 patients.<sup>8,9</sup> However, the titers of *anti-SARS-CoV-2* antibody varied in each individual, and these titers might be affected by a wide variety of conditions such as host, perinatal, extrinsic, behavioral, and nutritional factors<sup>10</sup> as well as magnitude of transmission of the COVID-19 in region.<sup>11</sup> Some studies have been conducted in US and China,<sup>12,13</sup> however, no study has been conducted in Indonesia to assess the factors of the host and disease course that might affect the titers of *anti-SARS-CoV-2* antibody. Therefore, this study was conducted to assess the predictors of the titers of *anti-SARS-CoV-2* antibody among Indonesian CCP donors.

## 2. Methods

### 2.1. Study design and patients

Between July and November 2020, a cross-sectional study was conducted in Saiful Anwar General Hospital, Malang, Indonesia to assess the factors that might affect the titer of *anti-SARS-CoV-2* antibody among the donors of CCP. We used total sampling method to recruit the participants. All participants met the criteria for CCP transfusion as recommended by the FDA.<sup>6</sup> Three investigators contacted each participant privately. Samples were collected from healthy COVID-19 patients who had been asymptomatic for >14 days (the 15th day). Participants with any of the following criteria were excluded: pregnant woman, having the history of transfusion reaction, and treated with immunoglobulin in the last 30 days. Our study protocols conformed with the principle outlined in the Declaration of Helsinki and had been approved by Indonesian Health Research Ethics Committee of the National Research and Development Agency (No. LB.02.01/2/KE.351/2020) and all participants provided written informed consent.

### 2.2. Outcome measures

The predictor variables in our study were symptoms, comorbidities, and laboratory findings. Disease symptoms included diarrhea, fever, cough, dysgeusia, dyspnea, and pneumonia. The comorbidities were obesity, overweight, diabetes mellitus, and hypertension. The laboratory findings were hemoglobin, leukocytes, thrombocytes, eosinophils, basophils, neutrophils, lymphocytes, neutrophil-lymphocyte ratio (NLR), immature granulocytes, total proteins, albumins, globulins, and total cholesterol. The outcome was the titer of *anti-SARS-CoV-2* antibody, divided into less than and more than 1:320, as recommended by previous studies.<sup>8,9</sup> CCP was collected by plasmapheresis using Haemonetics MSC® plus (Haemonetics, Boston, Massachusetts, US).

### 2.3. Measurement of anti-SARS-CoV-2 antibody

Blood samples were collected and stored at  $-20^{\circ}\text{C}$  and were tested for *anti-SARS-CoV-2* IgM and IgG levels using qualitative lateral flow immunochromatographic assay (ICA) (SD Biosensor, Ye Suwon-shi, Korea). The testing was conducted in accordance to the manufacturer's recommendations and the protocols of the previous studies.<sup>14,15</sup> To determine the antibody titer, two-fold dilutions of plasma (starting at a 1:20 dilution) was carried out. Infectious virus was added to the plasma dilutions at a final concentration of  $1 \times 10^4$  TCID<sub>50</sub>/mL (100 TCID<sub>50</sub> per 100  $\mu\text{L}$ ). The samples were incubated for 1 h at room temperature, and then 100  $\mu\text{L}$  of each dilution was added to 1 well of a 96-well plate of Vero E6-TMPRSS2 cells in sextuplet for 6 h at  $37^{\circ}\text{C}$ . The inocula were removed, the fresh media was added, and the plates were incubated at  $37^{\circ}\text{C}$  for 2 days. The cells were fixed with 4% formaldehyde and then stained with Naphthol Blue Black (Millipore Sigma, Darmstadt, Germany). The antibody titer was calculated as the highest serum dilution that prevent the cytopathic effect in 50% of the wells.

### 2.4. Statistical analysis

The association between the predictor covariates and the titers of *anti-SARS-CoV-2* antibody was performed using multiple logistic regression. All significant tests were two tailed and the P value < 0.05 was considered statistically significant. All analyses in our present study were conducted using a Statistical Package of Social Science 17.0 software (SPSS Inc, Chicago, IL).

## 3. Results

A total of 50 participants with the titer of *anti-SARS-CoV-2* antibody more than 1:320 and 33 participants with the titers of *anti-SARS-CoV-2* antibody less than 1:320 were included in our study. Initially, we included 99 participants; 16 participants were excluded due to pregnant status, having the history of transfusion reaction, and having the history of immunoglobulin therapy in the last 30 days. The baseline characteristics of participants are presented in Table 1.

Our findings suggested that the history of fever, cough, dyspnea, and pneumonia among the CCP donors was associated with increased titer of *anti-SARS-CoV-2* antibody compared to asymptomatic patients. Our study also found that participants with the high level of eosinophiles and immature granulocytes, and low albumins level were associated with high titers of *anti-SARS-CoV-2* antibody.

## 4. Discussion

Our study found that donors that experienced symptomatic COVID-19 had higher levels of *anti-SARS-CoV-2* antibody compared to those with asymptomatic participants. Our study conformed with the previous studies that found symptomatic CCP donors were associated with high titer of *anti-SARS-CoV-2* antibody.<sup>12,13</sup> The report assessing the potential factors on the titers of antibody was limited, and therefore, the speculation theory in this context remained controversial. A recent clinical evidence showed that high antibody titer was found in critically ill COVID-19 patients than non-critically ill patients.<sup>16</sup> Moreover, patients with high level of C-reactive protein (CRP), low level of lymphocytes, and old age, which are commonly found in severe COVID-19 patients, were associated with high level of *anti-SARS-CoV-2* antibody.<sup>17</sup>

It was proposed that the binding of specific antibody to the virus through Fc $\gamma$  receptors (Fc $\gamma$ Rs) which are highly expressed in lung epithelial cells may facilitate the entry of virus into immune cells.<sup>18</sup> The evidence also revealed that immunoglobulin therapy by blocking Fc $\gamma$ Rs was considered the potential therapy in COVID-19 patients.<sup>19</sup> These evidences suggest that disease progression might play a pivotal role to govern the titers of antibody. Therefore, in our current study, those individual donors experienced with more predominant symptomatic

**Table 1**  
Baseline characteristics of patients included in our analysis.

Characteristics	Antibody titers		OR	95%CI	p
	>1:320 (n = 50)	<1:320 (n = 33)			
Age (years)	37 (23–55)	35 (19–59)	1.18	0.53–2.63	0.679
Male, n (%)	38 (76.0)	21 (63.6)	1.81	0.69–4.73	0.227
Symptoms, n (%)					
Diarrhea	9 (18.0)	5 (15.2)	1.23	0.37–4.06	0.735
Fever	46 (92.0)	6 (18.2)	51.75	13.40–199.91	<0.0001
Cough	45 (90.0)	3 (9.1)	90.00	20.00–404.99	<0.0001
Dysgeusia	6 (12.0)	3 (9.1)	1.36	0.32–5.88	0.677
Dyspnea	35 (70.0)	1 (3.0)	74.67	9.33–597.81	<0.0001
Pneumonia	32 (65.3)	1 (3.0)	56.89	7.16–451.93	<0.0001
Comorbidity, n (%)					
No comorbidity	39 (78.0)	30 (90.9)	0.36	0.09–1.39	0.136
Obesity	4 (8.0)	1 (3.0)	2.78	0.30–26.07	0.370
Overweight	2 (4.0)	0 (0.0)	3.45	0.16–74.26	0.429
Diabetes	1 (2.0)	2 (6.1)	0.32	0.03–3.64	0.356
Hypertension	4 (8.0)	0 (0.0)	6.48	0.34–124.54	0.215
Laboratory findings					
Hemoglobin (gr/dl)	14.7 (11.1–17.1)	14.5 (12.1–16.7)	1.00	0.45–2.22	1.000
Leukocytes (/ $\mu$ l)	6980 (4750–11570)	6650 (4320–13440)	1.14	0.51–2.53	0.748
Thrombocyte ( $\times 10^3/\text{mm}^3$ )	276 (66–430)	258 (66–429)	1.64	0.74–3.65	0.226
Eosinophils (Abs)	0.19 (0.02–0.42)	0.17 (0.01–0.61)	5.06	2.20–11.66	<0.0001
Basophils (Abs)	0.03 (0.00–0.09)	0.03 (0.01–0.07)	1.00	0.45–2.22	1.000
Neutrophils (Abs)	3.76 (1.58–8.60)	3.70 (2.17–9.98)	1.06	0.48–2.36	0.884
Lymphocytes (Abs)	2.36 (1.44–3.81)	2.23 (1.16–3.85)	1.19	0.54–2.65	0.665
NLR	1.62 (0.52–4.32)	1.60 (0.89–4.67)	1.48	0.67–3.30	0.334
Immature granulocytes	0.03 (0.01–0.10)	0.02 (0.01–0.07)	6.13	2.64–14.26	<0.0001
Total proteins (gr/dl)	7.73 $\pm$ 0.46	7.85 $\pm$ 0.41	0.61	0.27–1.36	0.227
Albumins (gr/dl)	4.70 $\pm$ 0.34	4.86 $\pm$ 0.30	0.41	0.18–0.92	0.030
Globulins (gr/dl)	3.03 $\pm$ 0.34	2.99 $\pm$ 0.37	1.23	0.55–2.73	0.613
Total cholesterols (mg/dl)	199 (136–343)	203 (127–389)	0.93	0.42–2.07	0.866

Note, data were presented as mean  $\pm$  SD or n (%); NLR, neutrophil-lymphocyte ratio; OR, odd ratio, CI, confidence interval.

COVID-19 had higher level of *anti*-SARS-CoV-2 antibody than those asymptomatic donors of CCP.

Our data also suggested that COVID-19 patients with elevated level of eosinophiles and immature granulocytes, and low albumin level were associated with high level of *anti*-SARS-CoV-2 antibody. There is no study available as comparison of our present findings. The underlying mechanism of our findings might be due to the fact that those laboratory findings are commonly found in severe COVID-19 patients,<sup>20,21</sup> and high *anti*-SARS-CoV-2 antibody was associated with severe COVID-19 patients.<sup>16</sup> Moreover, in the case of viral infection, high level of eosinophils was also suggested to associate with elevated level of antibody.<sup>22</sup> An increased level of immature granulocytes was also correlated with high risk of viral infection and elevated level of antibody.<sup>23</sup> Low level of albumin might be affected by the clearance mechanism of antibody, suggesting that negative association might underly between albumin level and titer of *anti*-SARS-CoV-2 antibody.<sup>24</sup>

To the best of our knowledge, our study is the first report regarding the predictors of *anti*-SARS-CoV-2 antibody titer in Indonesia. Our current study might provide the baseline data for selecting CCP donors for COVID-19. We expected that a Medical Council should elaborate the precise guideline to determine the prominent candidate of CCP donors for the management of COVID-19. However, further studies are warranted to investigate other predictors to predict high titer of *anti*-SARS-CoV-2 antibody in CCP donors.

Some limitations also need to be discussed. First, we did not involve some potential confounding factors, including genetics, prenatal factors, preexisting immunity, geographic location, family size, smoking, alcohol consumption, exercise, and sleep.<sup>10</sup> Second, a small sample size in our current study should be interpreted with caution. Third, our current study was cross-sectional which is observational in nature and therefore unable to determine the holistic cause-effect relationship.

## 5. Conclusion

Our study suggests that symptomatic COVID-19 individuals with elevated levels of eosinophiles and immature granulocytes, and low levels of albumins are the prominent predictors of high titer of *anti*-SARS-CoV-2 antibody in CCP donors. Our current study may provide the additional criteria for selecting the CCP donors for the management of COVID-19.

## Ethics approval and consent to participate

Participants had provided written informed consent prior to involve in the study. Our study had been approved by local ethical committee (No. LB.02.01/2/KE.351/2020).

## Availability of data and materials

Data used in our study were presented in the main text.

## Consent for publication

Not applicable.

## Funding source

This study received no external funding.

## Authors contributions

Idea/concept: SOW, JKF. Design: SOW, JKF. Control/supervision: SOW, PMA, LW, GS, KD, HH. Data collection/processing: NN, DHH, SF, SD, AZF. Extraction/Analysis/interpretation: JKF. Literature review: SOW, JKF, LW, GS, KD, HH. Writing the article: JKF. Critical review: LW, GS, KD, HH. All authors have critically reviewed and approved the final

draft and are responsible for the content and similarity index of the manuscript.

#### Declaration of competing interest

None.

#### Acknowledgement

We thank to RSUD dr. Saiful Anwar for supporting this project.

#### References

- 1 Consortium WHO, Pan H, Peto R, et al. Repurposed antiviral drugs for covid-19 - interim WHO solidarity trial results. *N Engl J Med.* 2020;384(6):497–511.
- 2 Arabi YM, Hajeer AH, Luke T, et al. Feasibility of using convalescent plasma immunotherapy for MERS-CoV infection, Saudi Arabia. *Emerg Infect Dis.* 2016;22:1554–1561.
- 3 Soo YO, Cheng Y, Wong R, et al. Retrospective comparison of convalescent plasma with continuing high-dose methylprednisolone treatment in SARS patients. *Clin Microbiol Infect.* 2004;10:676–678.
- 4 Sun M, Xu Y, He H, et al. A potentially effective treatment for COVID-19: a systematic review and meta-analysis of convalescent plasma therapy in treating severe infectious disease. *Int J Infect Dis.* 2020;98:334–346.
- 5 Simonovich VA, Burgos Pratz LD, Scibona P, et al. A randomized trial of convalescent plasma in covid-19 severe pneumonia. *N Engl J Med.* 2020;384(7):619–629.
- 6 FDA. *Recommendations for Investigational COVID-19 Convalescent Plasma.* US Food & Drugs Administration: US Food & Drugs Administration; 2020.
- 7 Abolghasemi H, Eshghi P, Cheraghali AM, et al. Clinical efficacy of convalescent plasma for treatment of COVID-19 infections: results of a multicenter clinical study. *Transfus Apher Sci.* 2020;59, 102875.
- 8 Islam A, Rafiq S, Karim S, Laher I, Rashid H. Convalescent plasma therapy in the treatment of COVID-19: practical considerations: Correspondence. *Int J Surg.* 2020;79:204–205.
- 9 Liu STH, Lin HM, Baine I, et al. Convalescent plasma treatment of severe COVID-19: a propensity score-matched control study. *Nat Med.* 2020;26:1708–1713.
- 10 Zimmermann P, Curtis N. Factors that influence the immune response to vaccination. *Clin Microbiol Rev.* 2019;32.
- 11 Arnold BF, van der Laan MJ, Hubbard AE, et al. Measuring changes in transmission of neglected tropical diseases, malaria, and enteric pathogens from quantitative antibody levels. *PLoS Neglected Trop Dis.* 2017;11, e0005616.
- 12 Madariaga MLL, Guthmiller JJ, Schrantz S, et al. Clinical predictors of donor antibody titre and correlation with recipient antibody response in a COVID-19 convalescent plasma clinical trial. *J Intern Med.* 2020;289(4):559–573.
- 13 Chen W, Zhang J, Qin X, et al. SARS-CoV-2 neutralizing antibody levels are correlated with severity of COVID-19 pneumonia. *Biomed Pharmacother.* 2020;130, 110629.
- 14 Klein SL, Pekosz A, Park HS, et al. Sex, age, and hospitalization drive antibody responses in a COVID-19 convalescent plasma donor population. *J Clin Invest.* 2020;130:6141–6150.
- 15 Gomaa MR, Kandeil A, Mostafa A, et al. Prevalence of severe acute respiratory syndrome coronavirus 2 neutralizing antibodies in Egyptian convalescent plasma donors. *Front Microbiol.* 2020;11, 596851.
- 16 Liu W, Fontanet A, Zhang PH, et al. Two-year prospective study of the humoral immune response of patients with severe acute respiratory syndrome. *J Infect Dis.* 2006;193:792–795.
- 17 Wu F, Wang A, Liu M, et al. *Neutralizing Antibody Responses to SARS-CoV-2 in a COVID-19 Recovered Patient Cohort and Their Implications.* 2020.
- 18 Spiekermann GM, Finn PW, Ward ES, et al. Receptor-mediated immunoglobulin G transport across mucosal barriers in adult life: functional expression of FcRn in the mammalian lung. *J Exp Med.* 2002;196:303–310.
- 19 Fu Y, Cheng Y, Wu Y. Understanding SARS-CoV-2-mediated inflammatory responses: from mechanisms to potential therapeutic tools. *Viral Sin.* 2020;35:266–271.
- 20 Ponti G, Maccaferri M, Ruini C, Tomasi A, Ozben T. Biomarkers associated with COVID-19 disease progression. *Crit Rev Clin Lab Sci.* 2020;57:389–399.
- 21 Mudatsir M, Fajar JK, Wulandari L, et al. Predictors of COVID-19 severity: a systematic review and meta-analysis. *F1000Res.* 2020;9:1107.
- 22 Ramirez GA, Yacoub MR, Ripa M, et al. Eosinophils from physiology to disease: a comprehensive review. *BioMed Res Int.* 2018;2018, 9095275.
- 23 Daix T, Guerin E, Tavernier E, et al. Immature granulocytes: a risk factor of infection after cardiac surgery. *Cytometry B Clin Cytom.* 2018;94:887–894.
- 24 Lakota K, Zigon P, Mrak-Poljsak K, Rozman B, Shoenfeld Y, Sodin-Semrl S. Antibodies against acute phase proteins and their functions in the pathogenesis of disease: a collective profile of 25 different antibodies. *Autoimmun Rev.* 2011;10:779–789.





# RUMAH SAKIT UMUM DAERAH Dr. SAIFUL ANWAR MALANG

Jl. Jaksa Agung Suprpto No.2 Malang

KOMISI ETIK PENELITIAN KESEHATAN

TERAKREDITASI SNARS EDISI 1 INTERNASIONAL



18 Februari 2018 s.d. 18 Februari 2021

Jl. Jaksa Agung Suprpto No.2 MALANG 65111

Telp. ( 0341 ) 362101, Fax. ( 0341 ) 369384

E-mail : staf-rsu-drsaifulanwar@jatimprov.go.id

Website : www.rsusaifulanwar.jatimprov.go.id

## KETERANGAN KELAIKAN ETIK PELAKSANAAN PENELITIAN

("ETHICAL CLEARANCE")

No: 400/122/K.3/302 /2020

KOMISI ETIK PENELITIAN KESEHATAN RSUD Dr SAIFUL ANWAR MALANG, SETELAH MEMPELAJARI DENGAN SEKSAMA RANCANGAN PENELITIAN YANG DIUSULKAN, DENGAN INI MENYATAKAN BAHWA PENELITIAN DENGAN

JUDUL : FEASIBILITY COVID-19 CONVALESCENT PLASMA SEBAGAI TERAPI PADA PASIEN COVID-19 DI RSUD Dr. SAIFUL ANWAR MALANG

PENELITI UTAMA : dr. DJOKO HERI HERMANTO, SpPD-KHOM  
PENELITI ANGGOTA : dr. PUTU MODA A, SpPD-KEMD  
dr. SHINTA OKTYA W, SpPD-KHOM  
dr. HERWINDO PUDJO B, SpPD  
dr. NINA NURARIFAH, SpPD  
dr. SITI FATHONAH, SpPK  
Dr. dr. CESARIUS SINGGIH WAHONO, SpPD-KR  
dr. MAIMUN ZA, SpPK  
Dr. dr. SUSHANTY DJAJALAKSANA, SpP(K)  
dr. YANI JANE SUGIRI, SpP(K)  
dr. TRIWAHJU ASTUTI, M.KES, SpP(K)  
dr. NGAKAN PUTU PARSAMA PUTRA, SpP(K)  
dr. SURYANTI DWI PRATIWI, SpP(K)  
dr. IIN NOOR CHOZIN, SpP(K)  
dr. UNGKY AGUS SETYAWAN, SpP  
dr. REZKI TANTULAR, SpP  
dr. HERI SUTANTO, SpPD  
dr. DEWI INDIASTARI, SpPD  
dr. NINIEK BUDIARTI, SpPD-KPTI  
dr. ARIE ZAINUL FATONI, SpAn-KIC  
dr. RUDI VITRALUDYONO, SpAn  
dr. WENING PRASTOWO, SpF. SH  
dr. M.FAHRUL, SpF  
DINI LATIFATUN NAFIATI, M.PSI  
ALUMNI

UNIT / LEMBAGA / TEMPAT PENELITIAN

RSUD Dr. SAIFUL ANWAR MALANG

**DINYATAKAN LAIK**

MALANG, 27 APRIL 2020  
KETUA TIM KOMISI ETIK PENELITIAN

dr. HIDAYAT SUJUTI, PhD, Sp.M