

# Predictive Markers of Coagulopathy in COVID-19 Infection: A Meta Narrative Review

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## Introduction

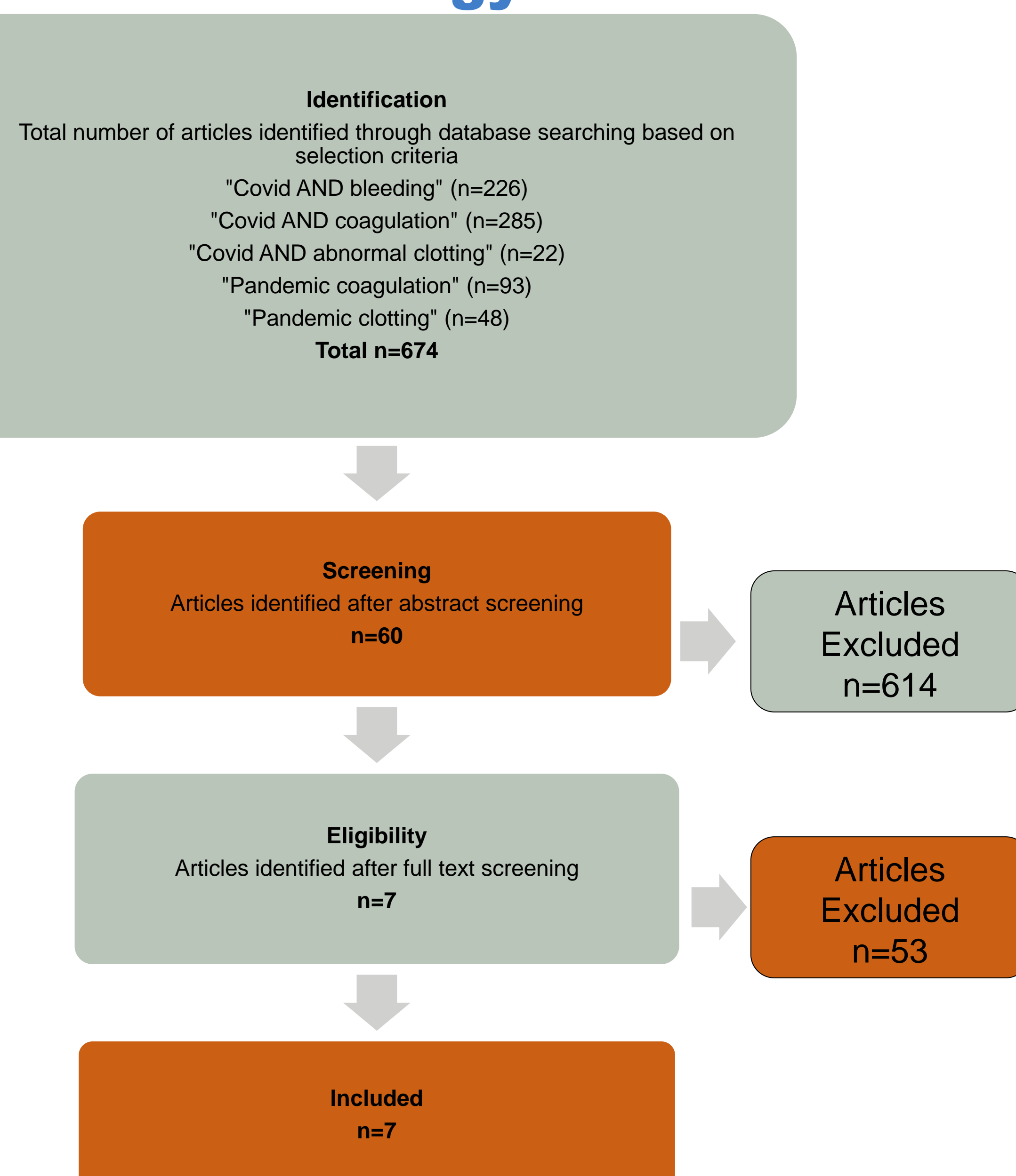
In late 2019, COVID was initially discovered in Wuhan, China, and the COVID-19 pandemic primarily began in early 2020. Along with respiratory distress, COVID-19 patients have an increased risk of the formation of abnormal clotting. In ICU COVID-19 patients, abnormal clotting increases the risk of mortality by around 74% (Montiel et al., 2022).

By determining predictive markers of coagulopathy in COVID-19 infection, severe cases of COVID-19 can be identified before bleeding and thrombotic manifestations occur and future research can better identify prophylactic measures that can be taken to prevent clotting events. As a result, the prognoses of those with severe COVID-19 infection may be improved.

## Guiding Research Question

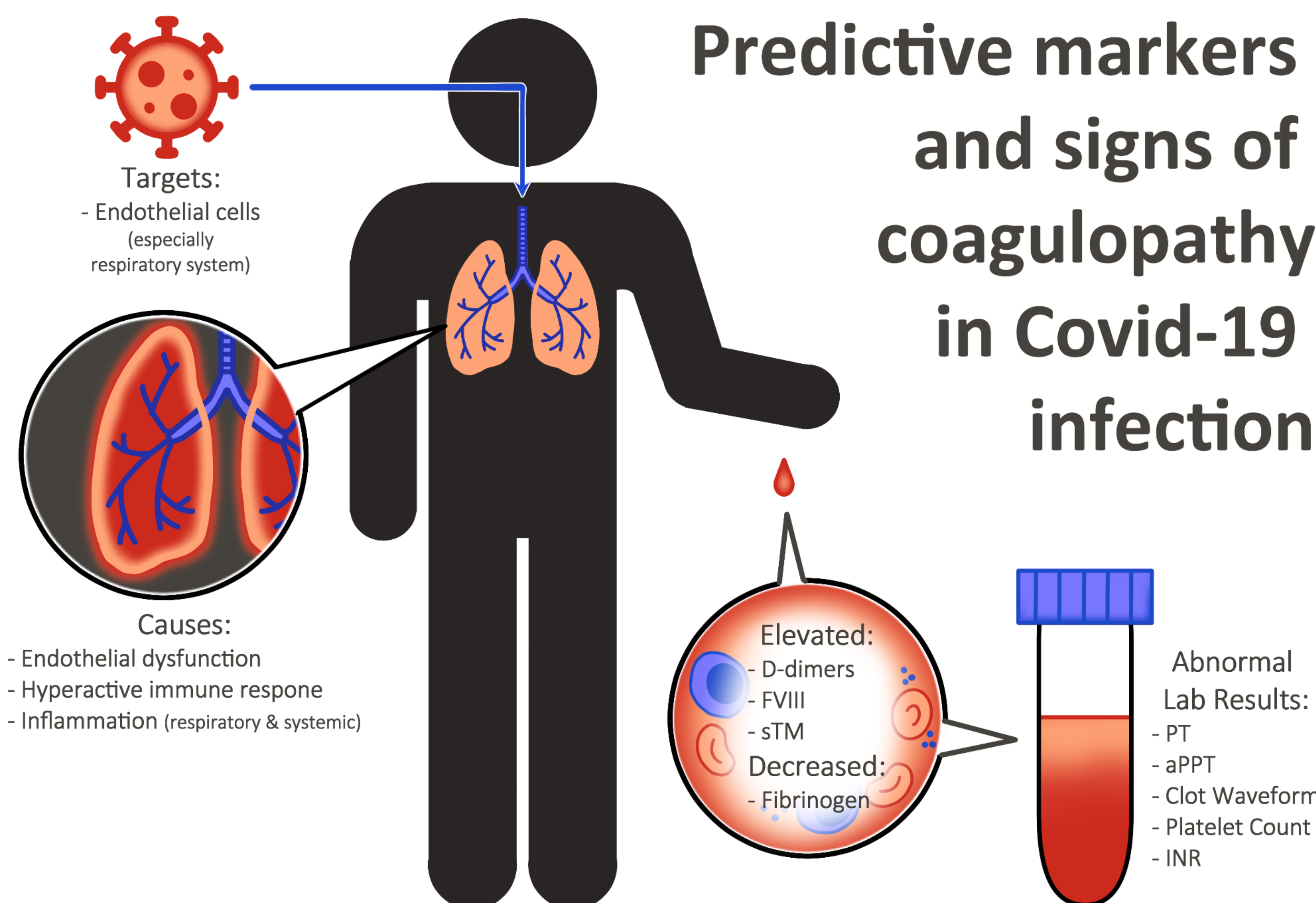
What hemostatic parameters are predictive of coagulopathy in COVID-19 patients?

## Methodology



**Figure 1.**  
 Article Screening Flow Diagram

**Figure 2.**  
 Predictive Markers and Signs of Coagulopathy in COVID-19 Infection



**Table 1.**  
 Article Key Findings

Authors	Year	Key Findings
Al-Samkari et al.	2020	<ul style="list-style-type: none"> <li>Overall thrombotic complication rate was 9.5%</li> <li>Overall bleeding rate was 4.8%</li> <li>Elevated D-dimer levels predicted critical illness, bleeding/thrombotic complications and death</li> </ul>
Fan et al.	2020	<ul style="list-style-type: none"> <li>Elevated FVIII, vWF, D-dimer, and fibrinogen levels and elevated CWA parameters were associated with the hypercoagulable state in COVID-19 patients</li> </ul>
Gardiner et al.	2022	<ul style="list-style-type: none"> <li>sTM, vWF were significantly higher in COVID-19 patients</li> <li>Endothelial dysfunction plays an important role in COVID coagulopathy</li> </ul>
Luo et al.	2020	<ul style="list-style-type: none"> <li>Coagulation parameters such as D-dimers, fibrinogen, and PT were predictive of mortality in severe COVID patients</li> </ul>
Montiel et al.	2022	<ul style="list-style-type: none"> <li>Endothelial oxidative stress leading to endothelial dysfunction is a likely pathogenic factor in COVID coagulopathy</li> </ul>
Nikolaidis et al.	2021	<ul style="list-style-type: none"> <li>Decreased nitric oxide corresponds to increased COVID-19 severity</li> </ul>
Dayna Nguyen, Hey-Min Jeon, Jeongwu Lee	2022	<ul style="list-style-type: none"> <li>Upregulation of F3 in lung epithelial cells is associated with hypercoagulation.</li> </ul>

## Selection Criteria

**Database:** PubMed, NIH, CDC, The Lancet  
**Search Terms:** "COVID and bleeding", "COVID and coagulation", "COVID and abnormal clotting", "pandemic coagulation", "pandemic clotting", "COVID related deaths"  
**Dates of Coverage:** 2020 - 2023  
**Type of Research:** Primary

## Limitations

- Sample sizes used in the articles were relatively small and thus not an accurate representation of the overall population infected with COVID-19.
- While there were common markers noted in the articles, some articles studied different parameters. This makes it difficult to accurately compare the markers.

## Conclusion

- Common biomarkers with highly predictive capabilities for hypercoagulability were identified within the 7 articles.
- The most common predictive hemostatic parameters identified were:
  - Elevated FVIII
  - Elevated Von Willebrand Factor (vWF)
  - Elevated D-dimer
  - Decreased fibrinogen
- The common biomarkers could be used for early detection or determination of worsening condition so that early antithrombotic treatment can be administered.

## Future Research

Most articles focused on elevated D-dimer as an early marker of coagulopathy in COVID-19 patients. However, according to Gardiner et al. (2022), soluble thrombomodulin (sTM) proved to be the best predictor in their study. Other tests and values, such as clot waveform analysis (CWA), were noted as potential options for routine monitoring in ICU COVID-19 patients. However, further testing outside the scope of this review is necessary to determine the validity of their usage.

## References

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