

**Table S1.** The PICOS framework used to establish the inclusion and exclusion criteria

|  | Inclusion criteria   | Exclusion criteria   |
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| <b>P (population)</b>                    | <ul style="list-style-type: none"> <li>Studies focused on individuals aged 15 years and above.</li> <li>Studies focusing on individuals at risk of HIV/involved in HIV testing.</li> </ul>   | <ul style="list-style-type: none"> <li>Studies focused on individuals less than 15 years.</li> <li>Studies not focused on individuals at risk of HIV/involved in HIV testing.</li> </ul> |
| <b>I (intervention)</b>                  | <p>Studies that utilized ML algorithms to:</p> <ul style="list-style-type: none"> <li>Develop predictive models for HIV testing outcomes.</li> <li>Enhance efficient and accurate HIV testing.</li> <li>Develop predictive models to identify hidden HIV risk factors for improved HIV testing.</li> <li>Optimize HIV testing procedures.</li> </ul>   | <ul style="list-style-type: none"> <li>Studies that do not utilize ML interventions in the context of HIV testing.</li> </ul>  |
| <b>C (comparison)</b>                    | <p>Studies that compare:</p> <ul style="list-style-type: none"> <li>The accuracy/ efficiency of ML techniques and traditional methods in HIV testing interventions.</li> <li>The accuracy/ efficiency of different ML algorithms for improved HIV testing.</li> </ul>  |  |
| <b>O (outcome)</b>                       | <ul style="list-style-type: none"> <li>Studies that reported:</li> <li>The accuracy/ efficiency of ML algorithms employed to improve HIV testing.</li> <li>Which methods are more accurate/ efficient regarding HIV testing; between ML and traditional methods.</li> <li>Best-performing ML algorithms that can improve HIV testing.</li> <li>Predictive models that can enhance early detection of HIV cases.</li> <li>Predictive models that reveal hidden factors associated with HIV risk/ testing/ diagnosis.</li> <li>Sensitivity and specificity of algorithms and ML diagnostic tools in the context of HIV testing.</li> <li>Successes, gaps, opportunities, barriers, and challenges</li> </ul> |  |
| <b>S (Study Design/ Characteristics)</b> | <ul style="list-style-type: none"> <li>Studies that employed ML algorithms prospectively/ retrospectively for improved HIV testing.</li> <li>Studies conducted in English between 2010 to 2024.</li> <li>Studies available in Full text.</li> </ul>  | <ul style="list-style-type: none"> <li>Reviews</li> <li>Studies reported in non-English languages</li> <li>Not available in Full text</li> <li>Conducted before 2010</li> </ul>          |
| <b>Context</b>                           | <ul style="list-style-type: none"> <li>Studies focused on ML and HIV testing conducted in any part of the world.</li> </ul>  |  |