PLASMA EXCHANGE
A perspective from Africa

By Dr C. Poole
DISCLOSURES

None
OVERVIEW

Vital statistics on South Africa

- Population
- Health care provision

Plasma exchange in South Africa

- Models of plasma exchange service provision
- Clinical indications - volumes
- Clinical indications - 2013 ASFA categories
- TTP

Plasma exchange survey results

- Africa
SA population - 54.96 million
Human Development Index rank 116
Gini coefficient rank = most unequal*
GDP value USD 350.085* million

*Mid-year population estimates, Statistical Reelase P0302, Statistics South Africa, 2015
VITAL STATISTICS OF SOUTH AFRICA

The NEW ENGLAND JOURNAL of MEDICINE

SPECIAL REPORT

Health and Health Care in South Africa — 20 Years after Mandela
Bongani M. Mayosi, M.B., Ch.B., D.Phil., and Solomon R. Benatar, M.B., Ch.B., D.Sc.(Med.)

N ENGL J MED 371;14  NEJM.ORG  OCTOBER 2, 2014
VITAL STATISTICS OF SOUTH AFRICA

Major National Health Challenges

• Health and poverty
• HIV/Aids pandemic and local responses
• Tuberculosis
• Widening disparities in healthcare
### VITAL STATISTICS OF SOUTH AFRICA

- Health and poverty

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Life expectancy at birth (yr)</td>
<td>63</td>
<td>54</td>
<td>60</td>
</tr>
<tr>
<td>Neonatal deaths per 1000 live births (no.)</td>
<td>19</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>Infant deaths per 1000 live births (no.)</td>
<td>46</td>
<td>51</td>
<td>15</td>
</tr>
<tr>
<td>Deaths in children &lt;5 yr of age per 1000 live births (no.)</td>
<td>60</td>
<td>70</td>
<td>45</td>
</tr>
</tbody>
</table>

*Health and Health Care in South Africa – 20 Years after Mandela, Mayosi B, Benatar S. NEJM 371:14 Oct 2014*
VITAL STATISTICS OF SOUTH AFRICA

- Health and poverty

### Table 2. Burden of Disease in Seven Middle-income Countries.*

<table>
<thead>
<tr>
<th>Country</th>
<th>Age-Standardized Death Rate</th>
<th>Age-Standardized Rate of Years of Life Lost†</th>
<th>Age-Standardized Rate of Years Lived with Disability</th>
<th>Life Expectancy at Birth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costa Rica</td>
<td>556</td>
<td>1 462</td>
<td>1 11,705</td>
<td>1 10,447</td>
</tr>
<tr>
<td>Jamaica</td>
<td>676</td>
<td>2 610</td>
<td>2 18,618</td>
<td>2 16,417</td>
</tr>
<tr>
<td>Brazil</td>
<td>854</td>
<td>3 670</td>
<td>4 26,370</td>
<td>4 17,580</td>
</tr>
<tr>
<td>Romania</td>
<td>895</td>
<td>4 712</td>
<td>5 23,494</td>
<td>3 16,325</td>
</tr>
<tr>
<td>Iran</td>
<td>943</td>
<td>5 640</td>
<td>3 29,033</td>
<td>5 16,780</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>1043</td>
<td>6 1043</td>
<td>6 31,524</td>
<td>6 29,881</td>
</tr>
<tr>
<td>South Africa</td>
<td>1133</td>
<td>7 1266</td>
<td>7 34,540</td>
<td>7 48,286</td>
</tr>
</tbody>
</table>

* Data are from the Institute of Health Metrics and Evaluation. 34
† Years of life lost is an estimate of the average number of years that a person would have lived if he or she had not died prematurely.
VITAL STATISTICS OF SOUTH AFRICA
SOUTH AFRICAN NATIONAL BLOOD SERVICE

- Licensed provider of blood products and services nationally in South Africa
- Formed 2001 with amalgamation of 7 regional blood services
- Provide red cell concentrate 810 000 per annum
- Medical division – clinical apheresis unit
SANBS MODEL OF SERVICE PROVISION
PLASMA EXCHANGE IN SOUTH AFRICA 2009 – 2015

Centrifugal plasma exchange kit sales data, 2009 - 2015
South Africa

• Number of procedures per capita (2015): 3379/54.96 million people = 6.1 procedures per 100 000 persons.

Brazil

• Number of procedures per capita (2013): 4162/201 032 714 people = 2.1 procedures per 100 000 persons.
THERAPEUTIC APHERESIS: 2013

- TTP: 835
- GBS: 106
- Renal rejection: 102
- MG: 44
- FH: 36
- Anti-GAD cerebellar ataxia/stiff person syndrome: 27
- Devic's syndrome/NMO: 19
- Nephrotic syndrome (NOS): 9
- Anti-basement membrane disease: 7
- Transverse myelitis: 6
- Cervical polyradiculopathy: 6
- MS: 5
- ANCA positive RPGN: 5
- Limbic encephalitis: 5
- Polyneuropathy: 4
- SLE (cerebritis and/or carditis): 4
- Autoimmune haemolytic anaemia: 3
- Autoimmune haemolytic anaemia: 3
- SLE (NOS): 2
- ITP (steroid and rituximab resistant): 2
- CIDP: 1
- Waldenstrom's macroglobulinemia: 1
### THERAPEUTIC APHERESIS: 2014

<table>
<thead>
<tr>
<th>Condition</th>
<th>Count</th>
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</thead>
<tbody>
<tr>
<td>TTP</td>
<td>677</td>
</tr>
<tr>
<td>GBS</td>
<td>85</td>
</tr>
<tr>
<td>MG</td>
<td>46</td>
</tr>
<tr>
<td>Renal rejection</td>
<td>36</td>
</tr>
<tr>
<td>FH</td>
<td>30</td>
</tr>
<tr>
<td>Devic’s syndrome/NMO</td>
<td>27</td>
</tr>
<tr>
<td>Anti-GAD cerebellar atax/stiff person syndrome</td>
<td>23</td>
</tr>
<tr>
<td>Polynuepathy</td>
<td>14</td>
</tr>
<tr>
<td>ANCA positive RPGN</td>
<td>14</td>
</tr>
<tr>
<td>SLE (NOS)</td>
<td>12</td>
</tr>
<tr>
<td>MS</td>
<td>11</td>
</tr>
<tr>
<td>Transverse myelitis</td>
<td>10</td>
</tr>
<tr>
<td>ADEM</td>
<td>5</td>
</tr>
<tr>
<td>ITP (steroid and rituximab resistant)</td>
<td>5</td>
</tr>
<tr>
<td>Limbic encephalitis</td>
<td>5</td>
</tr>
<tr>
<td>Cryoglobulinaemia</td>
<td>5</td>
</tr>
<tr>
<td>Autoimmune haemolytic anaemia</td>
<td>4</td>
</tr>
<tr>
<td>Vasculitis in multiple myeloma (cutaneous)</td>
<td>2</td>
</tr>
<tr>
<td>ATRA removal in APML</td>
<td>2</td>
</tr>
<tr>
<td>Waldenstrom’s macroglobulinemia</td>
<td>1</td>
</tr>
</tbody>
</table>

**Legend:**
- TTP: Thrombotic thrombocytopenic purpura
- GBS: Guillain-Barré syndrome
- MG: Myasthenia gravis
- FH: Familial haemochromatosis
- ANCA: Antineutrophil cytoplasmic antibody
- RPGN: Rapidly progressive glomerulonephritis
- SLE (NOS): Systemic lupus erythematosus
- MS: Multiple sclerosis
- ADEM: Acute disseminated encephalomyelitis
- ITP: Immune thrombocytopenic purpura
- ATRA: All-trans retinoic acid
- Waldenstrom’s macroglobulinemia
THERAPEUTIC APHERESIS: 2015

- TTP
- Renal rejection
- MG
- Devic’s syndrome/NMO
- Anti-GAD cerebellar ataxis/stiff person syndrome
- FH
- Autoimmune haemolytic anaemia
- Glomerulonephritis (NOS)
- Autoimmune encephalitis
- ANCA positive RPGN
- Recurrent FSGS
- GBS
- Acute pancreatitis
- ITP (steroid and rituximab resistant)
- C3 Glomerulonephropathy
- Hyperviscosity in plasmacytoma
- Hashimoto’s encephalopathy
- HUS
- CIDP
- Transverse myelitis
- Dilated cardiomyopathy

Graph showing patient numbers for each condition:

- TTP: 967
- Renal rejection: 216
- MG: 56
- Devic’s syndrome/NMO: 32
- Anti-GAD cerebellar ataxis/stiff person syndrome: 28
- FH: 22
- Autoimmune haemolytic anaemia: 18
- Glomerulonephritis (NOS): 15
- Autoimmune encephalitis: 15
- ANCA positive RPGN: 14
- Recurrent FSGS: 12
- GBS: 10
- Acute pancreatitis: 8
- ITP (steroid and rituximab resistant): 7
- C3 Glomerulonephropathy: 7
- Hyperviscosity in plasmacytoma: 5
- Hashimoto’s encephalopathy: 5
- HUS: 3
- CIDP: 2
- Transverse myelitis: 1
- Dilated cardiomyopathy: 1
### CLINICAL INDICATIONS BY ASFA 2013 CATEGORIES (2013-2015)

<table>
<thead>
<tr>
<th>ASFA CATEGORY</th>
<th>NUMBER OF DIAGNOSES</th>
<th>PROCEDURE NUMBERS</th>
<th>PERCENTAGE OF ALL PROCEDURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>13</td>
<td>3,353</td>
<td>90.43%</td>
</tr>
<tr>
<td>II</td>
<td>5</td>
<td>123</td>
<td>3.32%</td>
</tr>
<tr>
<td>III</td>
<td>4</td>
<td>114</td>
<td>3.07%</td>
</tr>
<tr>
<td>IV</td>
<td>1</td>
<td>12</td>
<td>0.32%</td>
</tr>
<tr>
<td>Not otherwise specified</td>
<td>6</td>
<td>84</td>
<td>2.27%</td>
</tr>
<tr>
<td>Not listed</td>
<td>5</td>
<td>22</td>
<td>0.59%</td>
</tr>
<tr>
<td></td>
<td>34</td>
<td>3,708</td>
<td>1</td>
</tr>
</tbody>
</table>
TTP IN SOUTH AFRICA — SANBS OPERATIONAL ANALYSIS

- No routine ADAMTS-13 assay available in clinical practice
- Diagnosis made by clinical haematologist and/or haematopathologist
- SANBS provides replacement fluid and a mobile plasma exchange service
TTP IN SOUTH AFRICA – SANBS OPERATIONAL ANALYSIS

- January 2011 – September 2015
- 1 733 days / 56.9 months
- 234 individual patients
- 2617 procedures
TTP REGISTRY/REGISTRY-TYPE DATA
The utility of ADAMTS13 in differentiating TTP from other acute thrombotic microangiopathies: results from the UK TTP Registry, Hassan S, et al. British Journal of Haematology 2015

- United Kingdom TTP Registry 2009-2013
  All ADAMTS-13 Tested
  TTP N=350

- Canadian Apheresis Group Registry
  - Not all ADAMTS-13 Tested
  - 1980-2001

TTP-HUS = 171

- Australian TTP/thrombotic microangiopathy registry 2009-2014

Not all ADAMTS-13 Tested TTP N=57
**TTP IN SOUTH AFRICA - INCIDENCE**

Oklahoma TTP-HUS Registry

- $11.29 \times 10^6$ (95% CI: 9.70–12.88) for all patients with clinically suspected TTP-HUS;
- $4.46 \times 10^6$ (95% CI: 3.43–5.50) for patients with idiopathic TTP-HUS; and
- $1.74 \times 10^6$ (95% CI: 1.06–2.41) for patients with severe ADAMTS-13 deficiency (<5% activity).

<table>
<thead>
<tr>
<th>Year</th>
<th>TTP events</th>
<th>Crude Incidence</th>
<th>90% coverage</th>
<th>80% coverage</th>
<th>70% coverage</th>
<th>TTP events in HIV infected</th>
<th>Crude Incidence (HIV)</th>
<th>90% coverage (HIV)</th>
<th>80% coverage (HIV)</th>
<th>70% coverage (HIV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>19</td>
<td>1.7</td>
<td>1.9</td>
<td>2.1</td>
<td>2.4</td>
<td>12</td>
<td>10.0</td>
<td>17.6</td>
<td>19.8</td>
<td>22.6</td>
</tr>
<tr>
<td>2012</td>
<td>46</td>
<td>3.8</td>
<td>4.2</td>
<td>4.8</td>
<td>5.5</td>
<td>30</td>
<td>23.3</td>
<td>39.7</td>
<td>44.7</td>
<td>51.1</td>
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<tr>
<td>2013</td>
<td>55</td>
<td>4.3</td>
<td>4.8</td>
<td>5.4</td>
<td>6.2</td>
<td>26</td>
<td>18.7</td>
<td>44.0</td>
<td>49.6</td>
<td>56.6</td>
</tr>
<tr>
<td>2014</td>
<td>64</td>
<td>5.0</td>
<td>5.5</td>
<td>6.2</td>
<td>7.1</td>
<td>26</td>
<td>18.1</td>
<td>49.6</td>
<td>55.8</td>
<td>63.8</td>
</tr>
<tr>
<td>2015</td>
<td>51</td>
<td>3.9</td>
<td>4.3</td>
<td>4.8</td>
<td>5.5</td>
<td>22</td>
<td>14.9</td>
<td>38.3</td>
<td>43.1</td>
<td>49.3</td>
</tr>
</tbody>
</table>

**SANBS TTP Data Analysis, unpublished, Lesosky M, Poole C. 2016**

TTP IN SOUTH AFRICA - INCIDENCE

Oklahoma TTP-HUS Registry

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The incidence of thrombotic thrombocytopenic purpura haemolytic uremic syndrome: all patients, idiopathic patients, and patients with severe ADAMTS-13 deficiency, Terrel DR et al. Journal of Thrombosis and Haemostasis, 2005, 3: 1432–1436
Oklahoma TTP-HUS Registry

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SANBS TTP Data Analysis, unpublished, Lesosky M, Poole C. 2016
## TTP IN SOUTH AFRICA-BASELINE

### Courses of Treatment

<table>
<thead>
<tr>
<th>Courses of Treatment</th>
<th>N</th>
<th>Relapse</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>187</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>36</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>3</td>
</tr>
</tbody>
</table>

### Median, IQR, 25%, 75%, and Range

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Median</th>
<th>IQR 25</th>
<th>IQR 75</th>
<th>Range</th>
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<tbody>
<tr>
<td>Age</td>
<td>35</td>
<td>29</td>
<td>43</td>
<td>16-65</td>
</tr>
<tr>
<td>Sex Ratio</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>2.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1</td>
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</tbody>
</table>

### HIV Status

<table>
<thead>
<tr>
<th></th>
<th>HIV-Positive</th>
<th>HIV-Negative</th>
<th>Not Known</th>
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</thead>
<tbody>
<tr>
<td>Number</td>
<td>116</td>
<td>18</td>
<td>100</td>
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</tbody>
</table>

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SANBS TTP Data Analysis, unpublished, Lesosky M, Poole C. 2016
## TTP IN SOUTH AFRICA-BASELINE

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>PROCEDURE RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL ADVERSE EVENTS/TOTAL PROCEDURES</td>
<td>30/2617</td>
</tr>
<tr>
<td>DEATH/TOTAL PROCEDURES</td>
<td>2/2617</td>
</tr>
</tbody>
</table>

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SANBS TTP Data Analysis, unpublished, Lesosky M, Poole C. 2016
<p>| | | | | | |</p>
<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Haemoglobin</strong></td>
<td>6.8</td>
<td>6.0</td>
<td>8.3</td>
<td>3.2</td>
<td>13.6</td>
</tr>
<tr>
<td><strong>Haematocrit</strong></td>
<td>0.2</td>
<td>0.2</td>
<td>0.3</td>
<td>0.1</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Mean Corpuscular Volume</strong></td>
<td>92.2</td>
<td>87.0</td>
<td>97.3</td>
<td>64.3</td>
<td>123.1</td>
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<tr>
<td><strong>Platelets</strong></td>
<td>18.0</td>
<td>13.0</td>
<td>30.0</td>
<td>3.0</td>
<td>147.0</td>
</tr>
<tr>
<td><strong>CD4</strong></td>
<td>167.0</td>
<td>70.2</td>
<td>268.8</td>
<td>8.0</td>
<td>1079.0</td>
</tr>
<tr>
<td><strong>HIVVL</strong></td>
<td>217832.0</td>
<td>28598.2</td>
<td>431186.0</td>
<td>97.0</td>
<td>5624125.0</td>
</tr>
</tbody>
</table>

SANBS TTP Data Analysis, unpublished, Lesosky M, Poole C. 2016
## TTP IN SOUTH AFRICA - BASELINE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Value 3</th>
<th>Value 4</th>
<th>Value 5</th>
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<tbody>
<tr>
<td>Potassium</td>
<td>3.7</td>
<td>3.2</td>
<td>4.0</td>
<td>2.4</td>
<td>7.1</td>
</tr>
<tr>
<td>Urea</td>
<td>9.0</td>
<td>6.3</td>
<td>17.0</td>
<td>2.3</td>
<td>60.4</td>
</tr>
<tr>
<td>Creatinine</td>
<td>113.0</td>
<td>79.0</td>
<td>217.5</td>
<td>6.0</td>
<td>1396.0</td>
</tr>
<tr>
<td>eGFR</td>
<td>28.5</td>
<td>13.2</td>
<td>42.8</td>
<td>3.0</td>
<td>59.0</td>
</tr>
<tr>
<td>Corrected Calcium</td>
<td>2.2</td>
<td>2.1</td>
<td>2.3</td>
<td>1.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.8</td>
<td>0.7</td>
<td>0.9</td>
<td>0.5</td>
<td>1.4</td>
</tr>
<tr>
<td>Lactate Dehydrogenase</td>
<td>1688.0</td>
<td>1099.0</td>
<td>2164.0</td>
<td>165.0</td>
<td>6636.0</td>
</tr>
<tr>
<td>White Cell Count</td>
<td>8.7</td>
<td>5.4</td>
<td>12.4</td>
<td>0.3</td>
<td>31.6</td>
</tr>
</tbody>
</table>

SANBS TTP Data Analysis, unpublished, Lesosky M, Poole C. 2016
TTP IN SOUTH AFRICA-BASELINE

SANBS TTP Data Analysis, unpublished, Lesosky M, Poole C. 2016
TTP IN SOUTH AFRICA-BASELINE

TTP Incident cases by month of first TTP procedure
April 2012 - April 2015
All
Seasonal variation

SANBS TTP Data Analysis, unpublished, Lesosky M, Poole C. 2016
PLASMA EXCHANGE IN AFRICA

• Morocco

Medical ICU, Mohamed VIth University Hospital
A single, hospital based service only
2014
0 - 500 procedures per annum
<60%
Spectra Optia and Hemofenix TM
Nurses
Guillain Barre Syndrome, Myesthenia Gravis
No routine calcium or magnesium supplementation
No routine PVE of 1.5
FFP
Not aware of ASFA 2013 Guidelines
PLASMA EXCHANGE IN AFRICA

- Morocco

Centre Régional de Transfusion Sanguine 2002 and 2005
104 TPE procedures were performed on 42 patients
Haemonetic Ultralight
Neurology>nephrology>ICU
Polyradiculoneuropathies, myasthenia gravis, GBS
Albumin 20% solution (92 times), Albumin 4% (10 times) and fresh frozen plasma (twice)

PLASMA EXCHANGE IN AFRICA

- Egypt

University of Cairo
No duration of review stated
577 TPE sessions performed on 114 patients
Cobe Spectra
Neurological cases (84%), thrombotic thrombocytopenic purpura (TTP) (7.6%), hyperviscosity syndromes (3.9%), familial hypercholesterolemia (3.8%), pemphigus (0.3%), and renal rejection (0.3%)
Albumin 2% solution Albumin 4%

Obafemi Awolowo University/Teaching Hospitals Complex

56.7% of respondents had very little or no knowledge of TPE; 40.5% moderate and only 2.7% admitting to having a good knowledge.

Only 18.9% of respondents have ever participated or observed a TPE procedure.

Two case reports

Membrane-based
PLASMA EXCHANGE IN AFRICA

- Ghana

Personal Communication, Dr Owusu-Ofori, 2016
PLASMA EXCHANGE IN AFRICA

• Cameroon

Personal Communication, Dr Claude Tayou Tagny, 2016
PLASMA EXCHANGE IN AFRICA

- Zimbabwe

National Blood Service Zimbabwe
Multiple hospitals, not a national registry/association
0 - 500 procedures per annum
100%
Haemonetics MCS+
Doctors and Nurses
Guillain Barre Syndrome; TTP; Myasthenia Gravis;
High titre levels in pregnancy
No routine calcium or magnesium supplementation
No routine PVE of 1.5
FFP; albumin-saline solution
Not aware of ASFA 2013 Guidelines
South African National Blood Service
Multiple hospitals, not a national registry/association
1000 – 5 000 procedures per annum
80-99%
Optia
Nurses
TTP; ABMR kidney; myasthenia gravis, SPS, FHH
No routine calcium or magnesium supplementation
No routine PVE of 1.5
FFP; cryopoor plasma; albumin-saline solution
Use of ASFA 2013 Guidelines
90% ASFA Category 1
ACKNOWLEDGMENTS

SANBS STS Team

- Sr Esme Van Wyk
- Sr Carolina Strydom
- Sr Nonceba Raphalalani
- Sr Pabalo Masheane
- Sr Lelia Mpophoma
- Sr Sharon Pewa
- Sr Pranitha Naidoo
- Sr Lebogang Mndawe
- Sr Mmamokgotta Masethe
- Sr Malissa Van Eeden
- Sr Alzera Bekker
- Sr Reena Munsamy
- Ms Letitia Mills
- Ms Jennifer Schussler
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THANK YOU
from Africa

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