Dual epidemics: the impact of HIV and obesity on pregnancy outcomes among women in South Africa

Angela Bengtson, PhD

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No conflicts to declare.
Obesity during pregnancy is increasing in low and middle income countries

Number of obese pregnant women (BMI ≥ 30) by WHO region from 2005 to 2014.

Figure from: Chen C, Xu X, Yan Y (2018) Estimated global overweight and obesity burden in pregnant women based on panel data model. PLoS ONE 13 (8): e0202183. https://doi.org/10.1371/journal.pone.0202183
Obesity during pregnancy

- Hypertension
- Pre-eclampsia
- Gestational diabetes
- Stillbirth
- Cesarean delivery
- Large for gestational age
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HIV and ART during pregnancy
- **↑** cardio-metabolic
- **↑** weight gain
- Preterm birth
- Small for gestational age
- Low birthweight
Obesity during pregnancy
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HIV and ART during pregnancy
- \( \uparrow \) cardio-metabolic
- DTG: \( \uparrow \) weight gain
- Preterm birth
- Small for gestational age
- Low birthweight

What is the dual impact of obesity and HIV on pregnancy outcomes?

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South Africa: high dual burden of HIV and obesity

**Setting**: Guguletu, South Africa
- 30% of pregnant women living with HIV
- 40% of pregnant women obese

**Design**: secondary analysis of the MCH-ART trial (HIV+) and HU2 (HIV-) comparator cohort
Study population

• Singleton, live births (n=877)
  – 464 women living without HIV
  – 413 women living with HIV
    • Tenofovir + emtricitabine/ lamivudine + efavirenz
    • 96% initiating ART during index pregnancy

• Women enrolled at entry into antenatal care
• Followed through 12 months postpartum
Do associations between pre-pregnancy BMI and pregnancy outcomes differ by HIV status?

Pre-pregnancy Body Mass Index (BMI)

- Normal (18.5 - <25; reference)
- Underweight (<18.5)
- Overweight (25 - <30)
- Obese (≥ 30)
Do associations between pre-pregnancy BMI and pregnancy outcomes differ by HIV status?

Examined associations:
- Overall
- Among HIV-uninfected
- Among HIV-infected
Do associations between pre-pregnancy BMI and pregnancy outcomes differ by HIV status?

Pre-pregnancy Body Mass Index (BMI) → Cesarean section → Birth weight

Preterm birth → LBW

SGA → LGA

Adjusted for:
- Socio-economic
- Poverty
- Maternal age
- Gravidity
- Alcohol use
- Education
- HIV status (overall only)
Results

**Age:** median 28 (IQR 24, 32)

**Gestational age at entry into ANC:** median 20 weeks (IQR 14, 26)

**Pregnant for the first time:** 22%

**Comorbidities at entry into ANC:**
- 7% HIV-uninfected vs 25% HIV-infected hazardous alcohol use
- 22% HIV-uninfected vs 33% HIV-infected stage 1 or 2 hypertension
Results

<table>
<thead>
<tr>
<th>Pre-Pregnancy BMI</th>
<th>HIV-uninfected</th>
<th>HIV-Infected</th>
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<tbody>
<tr>
<td>UNDERWEIGHT (&lt;18.5)</td>
<td>3%</td>
<td>5%</td>
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<td>NORMAL (18.5 - &lt;25.0)</td>
<td>26%</td>
<td>31%</td>
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<td>OVERWEIGHT (25.0 - &lt;30.0)</td>
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<td>OBESE (≥ 30.0)</td>
<td>45%</td>
<td>36%</td>
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HIV-uninfected (N=413) vs HIV-Infected (N=413)
Results

Pre-Pregnancy BMI

- UNDERWEIGHT (<18.5)
  - HIV-uninfected: 3%
  - HIV-Infected: 5%

- NORMAL (18.5 - <25.0)
  - HIV-uninfected: 26%
  - HIV-Infected: 31%

- OVERWEIGHT (25.0 - <30.0)
  - HIV-uninfected: 26%
  - HIV-Infected: 29%

- OBESE (≥ 30.0)
  - HIV-uninfected: 45%
  - HIV-Infected: 36%
## Pregnancy outcomes by HIV status

<table>
<thead>
<tr>
<th>Pregnancy Outcome</th>
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<td>Birthweight, g (median, IQR)</td>
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* unless otherwise noted.
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Women living with HIV had a **fewer cesarean sections** and **LGA infants**.
# Pregnancy outcomes by HIV status

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Women living with HIV had a **more preterm** and **LBW** infants.
Associations between pre-pregnancy BMI category and pregnancy outcomes

- Cesarean section
- Birth weight
- Preterm birth
- LBW
- SGA
- LGA
Associations between pre-pregnancy BMI category and pregnancy outcomes

Obesity associated with cesarean delivery.

Overall: RR 1.69 (95% CI 1.29, 2.22)
HIV-negative: RR 1.65 (95% CI 1.15, 2.38)
HIV-infected: RR 1.70 (95% CI 1.14, 2.54)
No associations between any BMI category and preterm birth.
Overall or by HIV status.
Birthweight increased with increasing pre-pregnancy BMI.

Overall:  Mean 11.36 (95% CI 5.96, 16.76)
HIV-negative: Mean 11.81 (95% CI 4.11, 19.52)
HIV-infected: Mean 9.92 (95% CI 2.16, 17.68)
Associations between pre-pregnancy BMI category and low birthweight.

Effect estimates adjusted for: SES category, poverty category, maternal age (restricted cubic spline), gravidity (restricted cubic spline), AUDIT-C threshold, education.

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<th>RR (95% CI)</th>
<th>HIV-uninfected</th>
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<tr>
<td>Underweight</td>
<td>1.79 (0.39, 8.19)</td>
<td>1.69 (0.72, 3.92)</td>
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<tr>
<td>Overweight</td>
<td>1.00 (0.35, 2.83)</td>
<td>0.58 (0.28, 1.21)</td>
<td></td>
</tr>
<tr>
<td>Obese</td>
<td>1.43 (0.57, 3.58)</td>
<td>0.50 (0.24, 1.05)</td>
<td></td>
</tr>
</tbody>
</table>
Obese HIV-uninfected women more likely to have a LGA infant, but not HIV-infected women.

Associations between pre-pregnancy BMI category and large for gestational age.

Effect estimates adjusted for: SES category, poverty category, maternal age (restricted cubic spline), gravidity (restricted cubic spline), AUDIT-C threshold, education.
Underweight HIV-uninfected women more likely to have a SGA infant, but not HIV-infected women.

Associations between pre-pregnancy BMI category and small for gestational age.

Effect estimates adjusted for: SES category, poverty category, maternal age (restricted cubic spline), gravidity (restricted cubic spline), AUDIT-C threshold, education.
Proportion of women in each pre-pregnancy BMI category, among all women with each adverse pregnancy outcome
Proportion of women in each pre-pregnancy BMI category, among all women with each adverse pregnancy outcome.

### Overall (N=877)

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<th>Obese</th>
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<tbody>
<tr>
<td>Cesarean</td>
<td>3</td>
<td>20</td>
<td>24</td>
<td>41</td>
</tr>
<tr>
<td>Preterm</td>
<td>5</td>
<td>23</td>
<td>24</td>
<td>37</td>
</tr>
<tr>
<td>LBW</td>
<td>6</td>
<td>21</td>
<td>23</td>
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<td>8</td>
<td>23</td>
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### HIV-infected (n=464)

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<tr>
<td>Cesarean</td>
<td>6</td>
<td>40</td>
<td>37</td>
<td>46</td>
</tr>
<tr>
<td>Preterm</td>
<td>9</td>
<td>37</td>
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</tr>
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<td>LBW</td>
<td>11</td>
<td>40</td>
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Key Findings

In a cohort of pregnant women living with and without HIV, obesity was common.
- 45% of HIV-uninfected
- 36% of HIV-infected

Among women with adverse pregnancy outcomes, largest proportion:
- HIV-uninfected → obese weight
- HIV-infected → normal weight
Key Findings

No evidence of an association between pre-pregnancy BMI category and preterm birth or LBW.

Obesity was associated with LGA and underweight with SGA, among women living without HIV.

But not among women living with HIV.
Limitations and Next Steps

Limitations

• Estimate of pre-pregnancy BMI based on BMI at first ANC
• No information: pregnancy complications, gestational weight gain, indication for cesarean delivery
• Limited precision for stratified estimates

Next steps

• Prospective cohort: HIV and ART use on hypertension and gestational diabetes
• Ideally, after DTG rollout in South Africa
Implications

• Obesity during pregnancy is a growing public health concern in LMICs for both women living with and without HIV.

• Among women living with HIV on EFV-based ART, HIV and ART use may influence fetal growth more strongly than maternal BMI.

• Additional research is needed to clarify how HIV-infection and ART use during pregnancy affect cardio-metabolic health and pregnancy outcomes across the BMI spectrum.

→ Updated WHO guidelines on dolutegravir → weight gain
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