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# Resistance

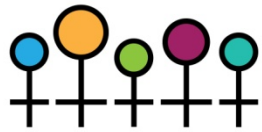
*Last updated: April 27, 2023*

*Together, we can change the course of the HIV epidemic...one woman at a time.*

#onewomanatatime

[www.thewellproject.org](http://www.thewellproject.org)

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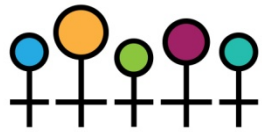


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# What Is Resistance?

HIV drugs are designed to keep the amount of HIV virus in your body under control by ***preventing it from reproducing (making copies of itself)***

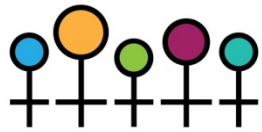
- HIV may change (**mutate**) as it makes copies of itself
  - Changes allow virus to overcome effects of a drug and keep reproducing
  - When this happens, HIV has developed **resistance** to that drug
- Resistance is a major challenge in HIV treatment:
  - Reduces treatment options



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# What Is Resistance?

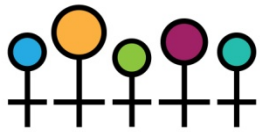
- The best way to ***prevent resistance*** is to stick closely (**adhere**) to HIV drug regimen
- With good adherence, resistance is less likely to develop
- Keeps more treatment options open for the future



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# What Causes Resistance?

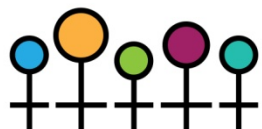
- After entering a CD4 cell (disease-fighting white blood cell), HIV makes many new copies of itself, which then infect other CD4 cells
  - This happens very quickly; HIV can make billions of new viruses every day
- When making new viruses, HIV must copy its genetic information
- Copying happens so fast that mistakes (**mutations**) happen randomly
  - Some mutations are harmless
  - Other mutations can cause big problems and allow a virus to reproduce even when it is exposed to certain HIV drugs



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# What Causes Resistance?

- If a drug does not work against a mutated virus, that virus will reproduce rapidly
  - This causes viral load to go up
  - May have to change drugs to get HIV back under control
- Main reason to use a combination of HIV drugs is to block reproduction at several points in HIV's lifecycle
  - Combination of drugs aimed at several different targets is much better at preventing HIV reproduction than one alone
- With less reproduction:
  - Viral load is lower
  - Mutations and resistance are less likely to occur

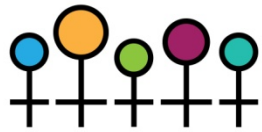


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# Cross-Resistance and Sequencing

***Cross-resistance:*** When mutations cause resistance not just to one drug, but to an ***entire class of drugs***

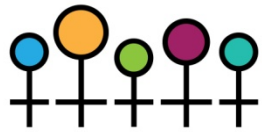
- There are seven classes of HIV drugs:
  - Nucleoside/nucleotide reverse transcriptase inhibitors (NRTIs)
  - Non-nucleoside reverse transcriptase inhibitors (NNRTIs)
  - Protease Inhibitors (PIs)
  - Entry inhibitors
  - Integrase inhibitors
  - Boosting agents
  - Post-attachment inhibitor



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# Cross-Resistance and Sequencing

- Cross-resistance: resistance to entire drug class
- Different classes of HIV drugs:
  - Nucleoside reverse transcriptase inhibitors (NRTIs)
  - Non-nucleoside reverse transcriptase inhibitors (NNRTIs)
  - Integrase inhibitors
  - Protease inhibitors (PIs)
  - Entry and fusion inhibitors
  - Attachment inhibitor
  - Post-attachment inhibitor
  - Capsid inhibitor
  - Boosting agents

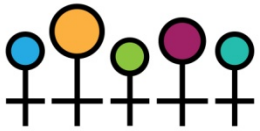


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# Cross-Resistance and Sequencing

- Cross-resistance is *more likely to happen in some classes of HIV drugs* than others
  - NRTIs
  - NNRTIs
  - May limit choices when picking new combination of HIV drugs
- Health care providers think about future HIV regimen options in case current regimen does not work
  - This is called **sequencing** treatment

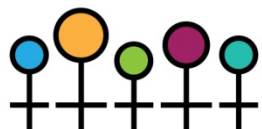




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# How Do I Know if I Have Drug Resistance?

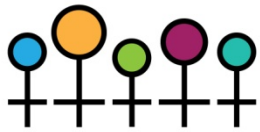
- Resistance is common, can be transmitted with the virus
  - People who just acquired HIV may already have drug-resistant HIV
  - Have fewer HIV treatments to choose from
- People living with HIV who have taken HIV drugs are more likely to have resistant virus, fewer drug choices
- Regular viral load tests are best way to tell if you have drug resistance
  - If HIV drugs are working well, your viral load should be "undetectable"
- Have a drug resistance test if you are taking HIV drugs and:
  - Your viral load does not become undetectable
  - Your viral load goes up after you have been taking the drugs for a while



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# Resistance Testing

- US Department of Health and Human Services guidelines recommend drug resistance testing for people who:
  - Just acquired HIV
  - Are starting HIV care
  - Have never been on HIV drugs and are planning to start
  - Are on HIV drugs and see their viral load go up (usually over 1,000 copies/mL)
  - Have started HIV drugs but viral load is not coming down to undetectable
  - Are pregnant and living with HIV (in certain circumstances)
- Resistance testing is ***not usually recommended*** for:
  - People who have stopped HIV drugs for four weeks or more
  - People with a viral load below 500 copies



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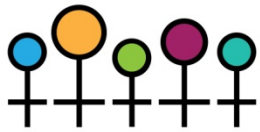
# Ways to Test for Resistance

## **Genotype test:**

- Uses HIV from your blood to check for mutations associated with drug resistance
- Preferred test for those:
  - Who are new to HIV treatment
  - Whose HIV drugs fail to bring their viral load down enough
  - Who are pregnant with detectable virus while on treatment

## **Phenotype test:**

- Exposes your virus to many HIV drugs in a test tube
  - Determines which drugs still work against your HIV
  - Preferred test for people with complex drug-resistance patterns



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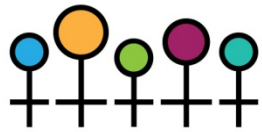
# Ways to Test for Resistance

## Virtual phenotype test:

- Genotype test that goes one step further
  - Takes your genotype and finds similar genotypes in a database
  - Uses their phenotypic test results to predict which drugs will be effective against your virus (and its mutations)

Resistance tests are helpful when choosing a drug regimen, **but**

- Tests are only a guide
- Other factors (past medications, side effects, adherence) should be considered as well



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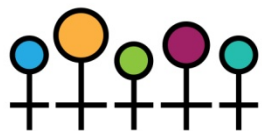
# Preventing Resistance

The best way to avoid resistance is to ***take your medications daily as prescribed***

- Important not to skip doses
- Take medications at the same time every day

**Good adherence** is the best way to prevent resistance

- Follow your medication schedule:
  - Virus will not reproduce as quickly
  - If not reproducing, ***cannot make changes that lead to resistance***



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## Learn More!

- To learn more, please read the full fact sheet on this topic:
  - [Resistance](#)
- For more fact sheets and to connect to our community of women living with HIV, visit:
  - [www.thewellproject.org](http://www.thewellproject.org)
  - [www.facebook.com/thewellproject](http://www.facebook.com/thewellproject)
  - [www.twitter.com/thewellproject](http://www.twitter.com/thewellproject)