How can we control HIV worldwide?

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Abstract

HIV is a virus that weakens a person’s immune system. If the immune system is weak, it can’t defend against diseases — making something as simple as a cold life-threatening. Did you know that about half of the people living with HIV are not getting the treatment they need? As a result, millions of people die from HIV worldwide every year. But what if we provided HIV treatment to more people? What if people could get vaccinated?

Researchers are developing a vaccine that can stop people from getting infected with HIV in the first place. In this study, we found that providing treatment to more people living with HIV will save a lot of lives. However, if we also gave people a vaccine that protects them from getting HIV, we could lead the world towards getting rid of HIV forever.

Introduction

Globally, 36.7 million people are living with HIV (in our model called PLHIV), but only 70% (25.7 million) of people with HIV know that they are, in fact, infected with HIV. Also, of those who know their HIV status, only 77% (19.8 million) are receiving medical treatment. Treatment is considered successful only when people remain on treatment and achieve viral suppression that enables them to live a healthy life and limit their ability to pass HIV on to others. Only 82% (16.2 million) of those on treatment worldwide have achieved viral suppression. PLHIV who are not on treatment can pass HIV on to others and progress to AIDS in about 10 years, and can then die. Therefore, it is important that PLHIV know that they are infected and that they both access and remain on treatment.

In order to save lives of PLHIV and prevent new infections, the Joint United Nations program, or UNAIDS, set a goal. The goal is “90–90–90”: to diagnose 90% of PLHIV, treat 90% of the people diagnosed with HIV, and then make sure that 90% of the people who are on treatment achieve viral suppression, by the year 2020. The subsequent goal is to achieve 95–95–95 by 2030 (See Figure 1).

UNAIDS goals

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<th>Current</th>
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Figure 1: People with HIV who know they are infected

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Researchers are developing and testing several promising HIV vaccines. Once available, a vaccine could prevent people from ever getting HIV. In this study, we explore the impact of meeting the UNAIDS goals and vaccinating people on reducing new infections and stopping deaths caused by HIV.

**Methods**

We created a computer model of the occurrence of HIV in different countries around the world. We used our model to predict how many people worldwide will be infected with HIV and die from it from now until 2035, in these scenarios:

- if the current treatment cascade stays the same,
- if more PLHIV knew that they are infected, were being treated, and achieved viral suppression in order to meet the UNAIDS goal,
- if we vaccinated 70% of the population,
- if we meet the UNAIDS goal (“90–90–90”) and vaccinate 70% of the population.

In general, vaccines do not completely stop everyone who gets vaccinated from getting the disease. Also, we do not know how good the vaccine will be at preventing people from getting HIV. Therefore, we assumed that the vaccine would make people half as likely as they currently are to get infected with HIV. In other words, that would mean that the vaccine had an efficacy of 50%.

**Results**

- We found that if the HIV treatment cascade stays the same, 44.5 million new people will become infected with HIV and 102 million people living with HIV will die between now and 2035.

- If we just meet the UNAIDS goal, we can prevent 28.5 million infections and 66.3 million deaths, and if only provide a vaccine, we can prevent 18.7 million infections and 12.37 million deaths.

- However, if we meet the UNAIDS goals and provide a vaccine, we will be able to prevent as many as 33.7 million HIV infections and 67.3 million deaths worldwide (Figure 2).

> Which treatment option will lead to the lowest amounts of new HIV infections? Which ones to the lowest numbers of death?

**Figure 2: A) Expected new HIV infections and B) HIV deaths from now to year 2035 if we do not change anything, meet the UNAIDS goal, roll out a vaccination program or we meet the UNAIDS goal along with rolling out the vaccination program.**
Discussion

We found that meeting the UNAIDS goal alone has the promise of preventing millions of HIV deaths and infections. However, achieving this goal will be challenging as many countries do not have enough resources to meet the UNAIDS goal on their own. Similarly, a vaccine has the potential to save a lot of new infections as well, but it still will be a few years before a vaccine can be used. Also, once a vaccine becomes available, an obstacle to vaccination programs would be finding and treating the people that are most likely to get infected.

Both strategies have different impacts on HIV. While the UNAIDS goal lets people living with HIV live longer and reduces their ability to transmit the disease to others, vaccination provides protection against HIV so that individuals do not get infected by HIV in the first place. By combining both strategies of increasing access to medication as well as vaccinating people to prevent HIV infection, we see an even bigger benefit than each strategy alone can provide.

Conclusion

Reaching the treatment target set by UNAIDS will not only provide healthier and longer lives to the people living with HIV, it will also have a big impact on reducing the number of new infections worldwide. Also, using a vaccine along with achieving UNAIDS goals can bring us closer to eliminating HIV across all countries. Therefore, along with striving to achieve UNAIDS goals, we must also start vaccinating individuals once a vaccine becomes available.

Glossary of Key Terms

AIDS — a condition caused by HIV infection which weakens the infected person’s immune system so that it can’t fight off diseases, making it more likely for the infected person to die.

HIV (Human Immunodeficiency Virus) — the virus that can lead to Acquired ImmunoDeficiency Syndrome (AIDS), if not treated. Unlike some other viruses, the human body can’t get rid of HIV completely, even with treatment. So once you get HIV, you have it for life.

HIV treatment — medical care given to people with HIV. The treatment involves taking HIV medicines every day and helps people with HIV live longer and healthier lives.

Immune System — a defense system inside people’s bodies that keeps people from getting infected by foreign substances and cells by fighting back.

Population — the people that live in a certain area.

Treatment cascade — the stages of HIV medical care that people living with HIV go through from discovering that they have HIV to being virally suppressed. It also shows the percentage of people living with HIV who are in each stage.

UNAIDS — the Joint United Nations Program on HIV and AIDS is a part of The United Nations that leads and supports HIV control activities worldwide.

Viral Suppression — taking HIV medication every day can lower the amount of virus in a person with HIV to an undetectable level and it lets them live healthier and longer lives.

REFERENCES

http://www.pnas.org/content/114/15/4017

Avert: HIV and AIDS
https://www.avert.org/about-hiv-aids/what-hiv-aids
Check your understanding

1. What does HIV weaken?

2. Why is it important to know your HIV status and be on treatment?

3. Is there a HIV vaccine available right now, and how can vaccine help in reducing HIV infections?

4. How well did we assume the vaccine would work?