Deworming as HIV Prevention for Young Women: Evidence from Zimbabwe

Jon Denton-Schneider (Clark)

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This Paper

HIV status

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Marriage market matching (partner age gap)

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Adult human capital (health and education)

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Childhood health (very cheap and effective interventions!)

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Childhood health (very cheap and effective interventions!)

Can cheap improvements in girls' health (e.g., deworming) reduce their chances of contracting HIV as young women?

Roadmap

1. **Childhood Health and HIV in Zimbabwe**
   - Theory and evidence: Schistosomiasis $\rightarrow$ HIV
2. **Nationwide Deworming in Schools (2012-17)**
   - Rapid morbidity decline in high-schistosomiasis districts
3. **Diff-in-diff: {Pre, Post} $\times$ {High-schisto, Low-schisto}**
   - High-schisto: Young women's HIV $\downarrow$ 45% (2.9 p.p.) more
   - Channels: $\uparrow$ attendance, $\downarrow$ age gap and no. of partners

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Theory: Urogenital Schistosomiasis → HIV

Disease: Inflammatory response to worm eggs getting trapped in nearby tissues → "anaemia, growth stunting, impaired cognition, ... organ-specific effects such as ... urogenital inflammation and scarring" (Colley et al., 2014, p. 2253)

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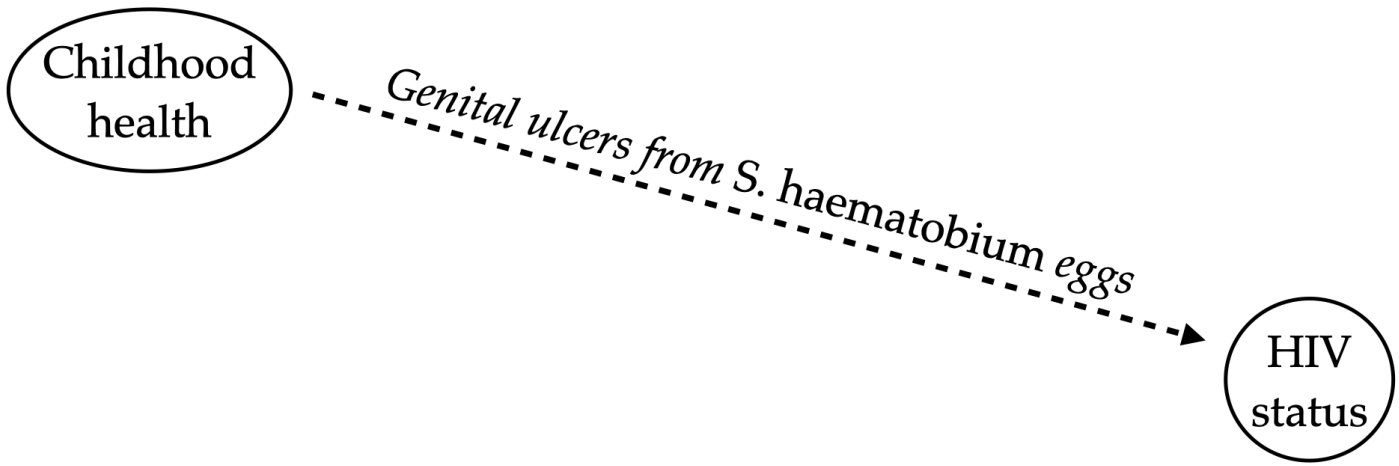

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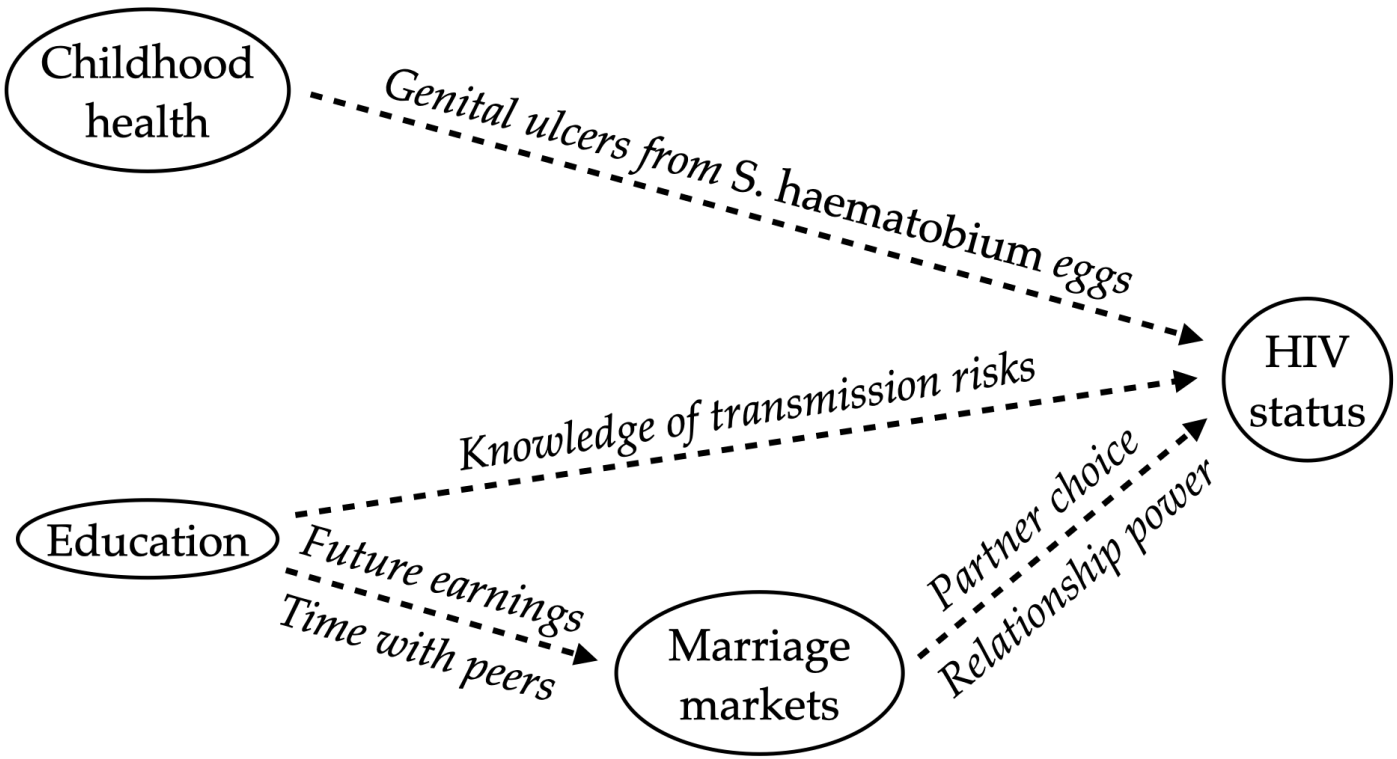

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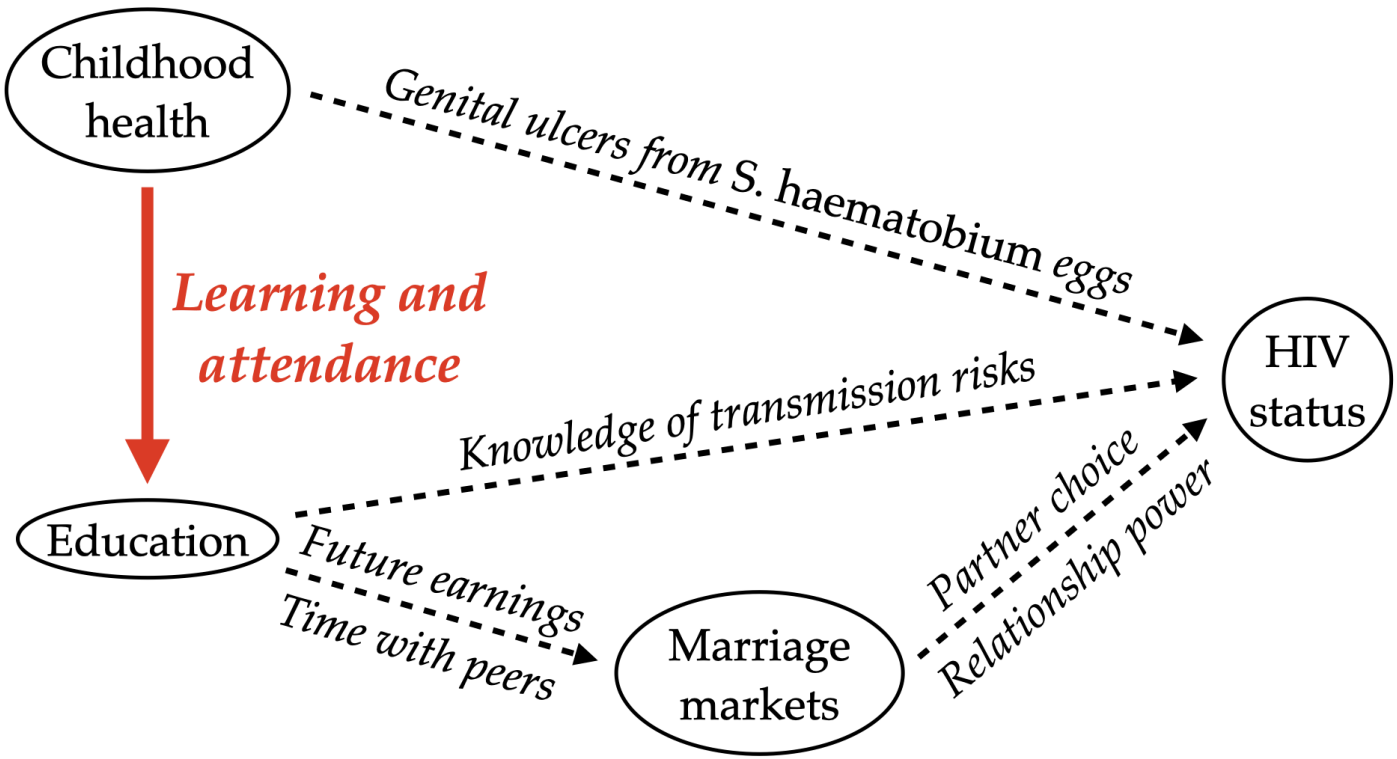
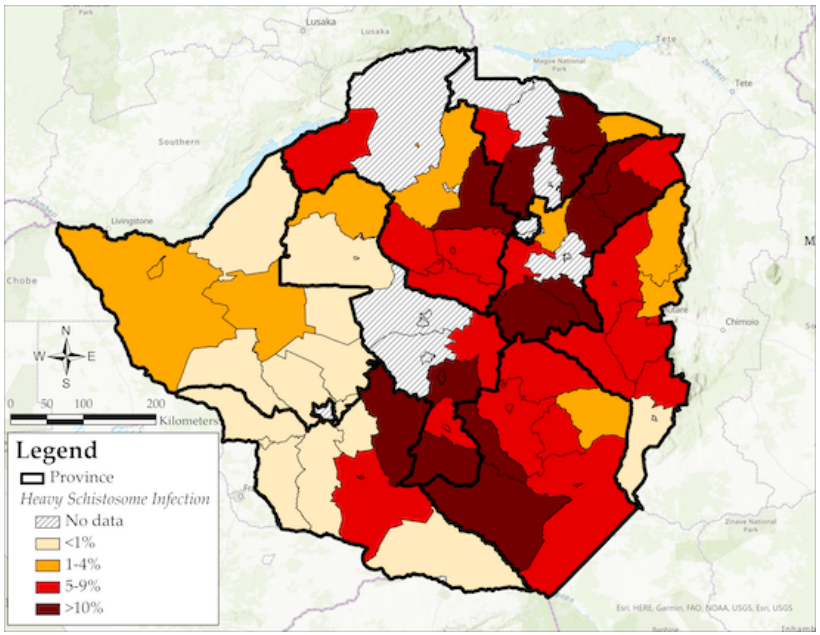
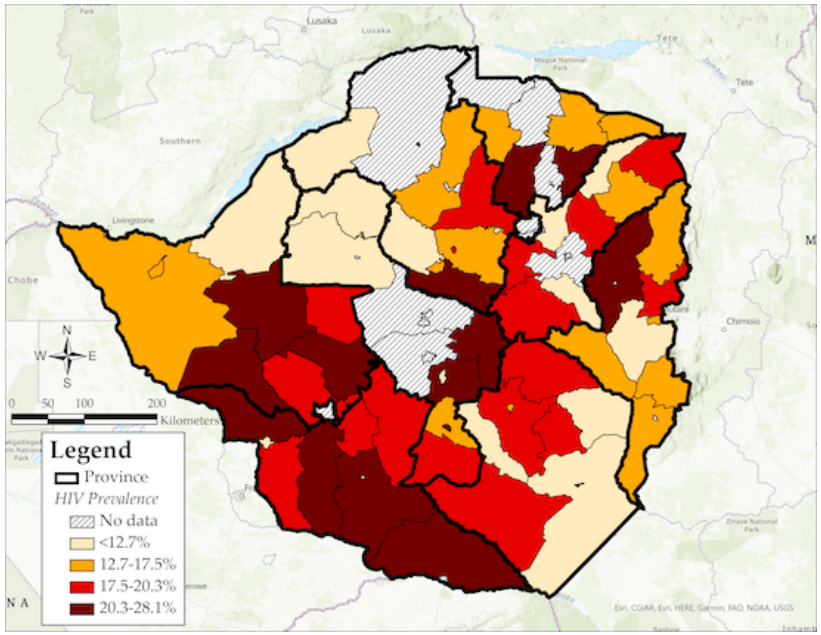


Novel: Linking childhood health to HIV via learning / attendance

Evidence: Urogenital Schistosomiasis → HIV



Heavy *S. haematobium* Infection:
Students, 2010
Source: Midzi et al. (2014)



HIV Prevalence:
Ages 15-49, 2005 and 2010
Source: DHS data

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Nationwide School-Based Deworming Program

Source: WHO (2012)

Wedza, 17 Sept. 2012 -- In line with the new global momentum towards the control, elimination and eradication of neglected tropical diseases (NTDs) , Zimbabwe launched a mass drug administration against schistosomiasis (bilharzia) and soil transmitted helminthes (intestinal worms) at a function held at Wedza High School.

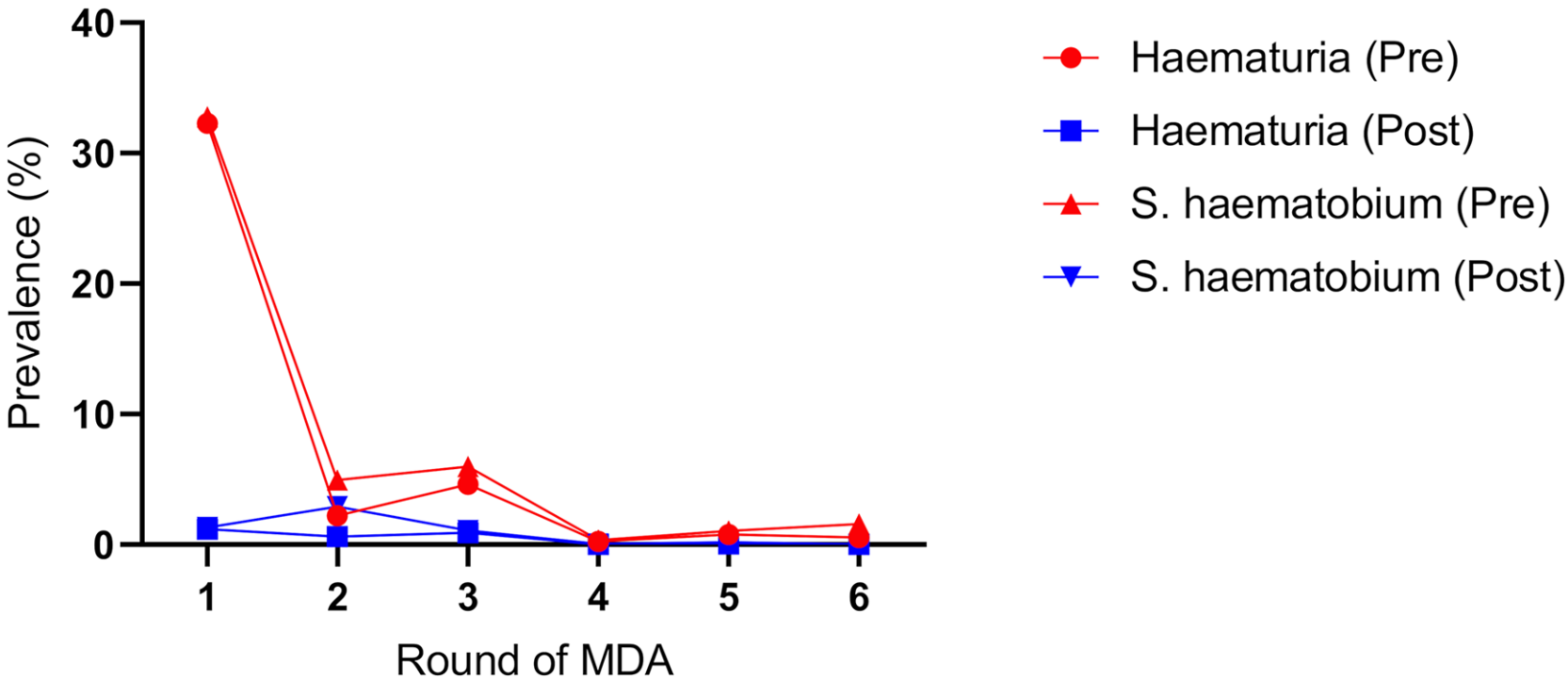
The mass drug administration is the final phase of a process which started with a national prevalence survey in 2010, and the development of the master plan that began in 2011 and completed in 2012.

The National Prevalence Survey of 2010 showed that Mashonaland East Province, under which Wedza district falls was one of the highly affected. The mass drug administration will therefore target people, mainly under the age of 15, and will be delivered through the country ' s network of schools and health facilities in the high burden districts. The mass drug administration was made possible by WHO which donated to the Ministry of Health and Child Welfare Praziquantel (PZQ) used in the treatment of bilharzia, and Albendazole (ALB) for intestinal worms. A total of 2 583 000 PZQ tablets (600mg) , and 2 450 200 ALB tablets (400mg) were donated. These drugs are expected to cover 3 794 638 people mainly under the age of 15 in the high burden districts.

End of 2012 school year: Mass deworming began in schools

$\rightarrow$ Planned to treat 3.8 million students (est. 5.2 million under age 15)

Rapid Reductions in Schisto Morbidity



Source: Mduluza et al. (2020)

2012-17: 6 years of mass drug administration (MDA) in schools

→ Almost all of morbidity reduction occurred in first round (2012)

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Defining Comparison Groups

Prevalence category	Districts (IUs)	Comments and intervention strategies
≥10%	Murehwa, Shamva, Mwenezi, Shurugwi, Chikomba, Mutoko, UMP, Hwedza, Mazowe, Mt. Darwin, Zvimba, Chivi, Insiza, Mberengwa (n = 14)	Morbidity is highest, highest transmitting districts. Highest priority requiring uninterrupted intensified PCT with annual geographic coverage of 100% per district. Complementary strategies urgently required. The goal is to control morbidity (reduce prevalence of heavy infection by any schistosome to <5%) in the first 5 years and prevent transmission.
≥5% but <10%	Buhera, Chimanimani, Makoni, Mutare, Mudzi, Seke, Guruve, Muzarabani, Chegutu, Kariba, Kadoma, Chiredzi, Gutu, Masvingo, Zaka, Gwanda, Chirumhanzu, Zvishavane (n = 18)	Morbidity is high. High transmitting districts requiring MDA regularly according to WHO strategies with geographic coverage of 75–100% per district. Complementary strategies are required. The goal is to control morbidity by reducing the prevalence of heavy infection by any schistosome species in the first 5 years to <5% and prevent transmission.
≥1% but <5%	Mutasa, Nyanga, Goromonzi, Marondera, Rushinga, Makonde, Karoyi, Bikita, Hwange, Lupane, Gokwe North, Glenview/Mufakose, Highfields/Glen Norah, Marlbereign/Warren Park, Mabvuku/Tafara, Chitungwiza-Zengeza, Mbare/Hatfield, Khami (n = 17)	Morbidity is moderate though unjustifiable. Moderate transmitting districts. Regular MDA according to WHO guidelines based on prevalence. In addition, identification of transmission foci for intensified PCT is recommended. Complementary strategies are required. The goal is to eliminate schistosomiasis as a public health problem.
<1%	Chipinge, Binga, Beitbridge, Chitungwiza-Seke (n = 4)	Morbidity is low. Low transmitting districts. PCT to be implemented according to WHO guidelines. In addition, monitoring and surveillance of schistosomaisis transmitting foci for intensified PCT is recommended. Complementary strategies are required. The goal is to interrupt transmission.
0%	Bubi, Nkayi, Tsholotsho, Umguza, Bulilima, Matobo, Magwe, Umzingwane, Gokwe South, Reigate, Imbizo, Mzilikazi, Sizinda, North Central (n = 15)	Detailed surveillance should be done to identify any transmitting foci for intensified PCT. Complementary strategies are required. The goal is to interrupt schistosomiasis.

Source: Midzi et al. (2014)

All districts treated simultaneously: "High schisto" vs "low schisto"

$\rightarrow$ Treatment guidelines based on heavy infection rates

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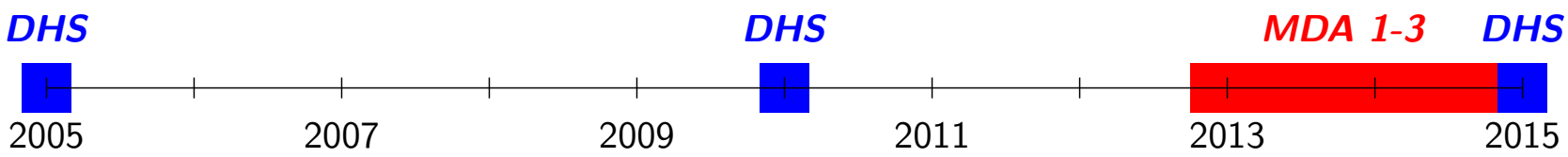
All districts treated simultaneously: "High schisto" vs "low schisto"

$\rightarrow$ "High" $\geq$ 5% heavy infection (N = 43), "low" $<$ 5% (N = 28)

Empirical Strategy: Diff-in-Diff



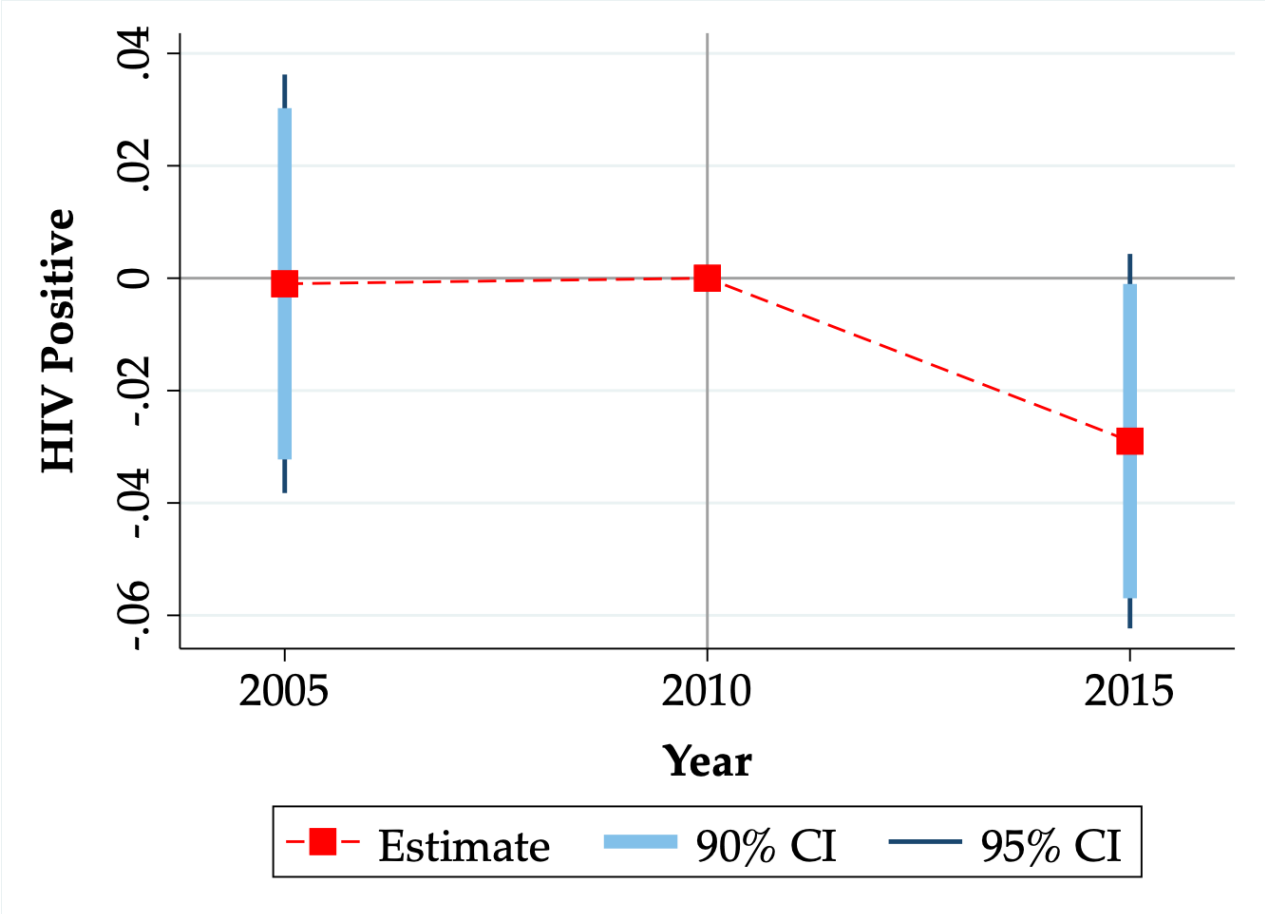
Comparison: {Pre, Post} $\times$ {High-schisto, Low-schisto}

- Use de Chaisemartin and D'Haultfœuille (2020) estimator

Age-specific focus: Ages 12-17 in 2012 $\rightarrow$ ages 15-20 in 2015

- 17 is last age at which most boys and girls were in school

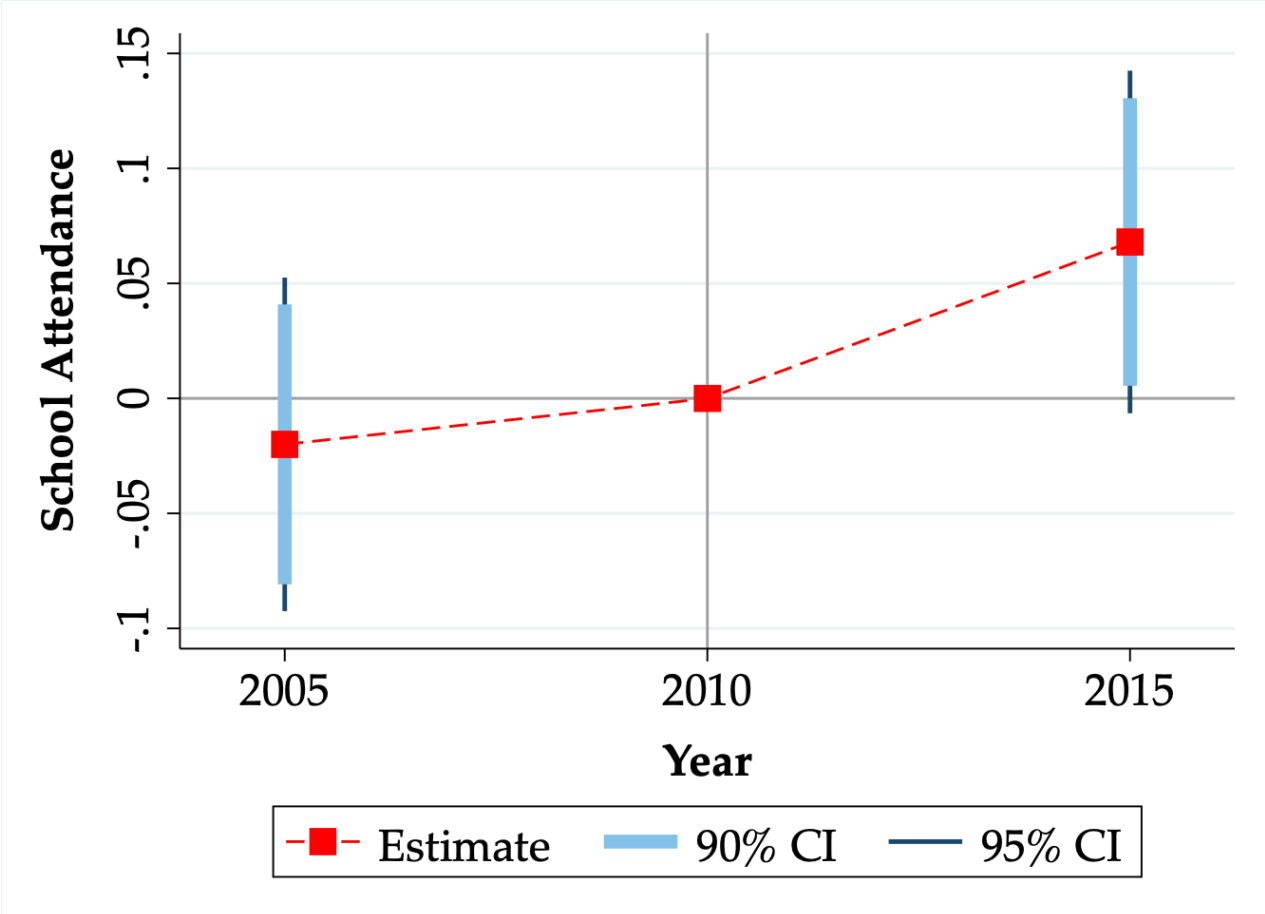
Effect of Deworming on HIV



Notes: Estimates and bootstrapped standard errors are obtained using the procedure developed by de Chaisemartin and D'Haultfœuille (2020). Observations are clustered by district. High equals 1 if a district had high or the highest pre-deworming rates of heavy schistosome infection, and 0 otherwise. Regressions control for age, age squared, altitude, and a quadratic in latitude and longitude.

Women 15-20: HIV ↓ 45% (2.9 p.p.) more in high-schisto districts

Effect of Deworming on Components of Human Capital



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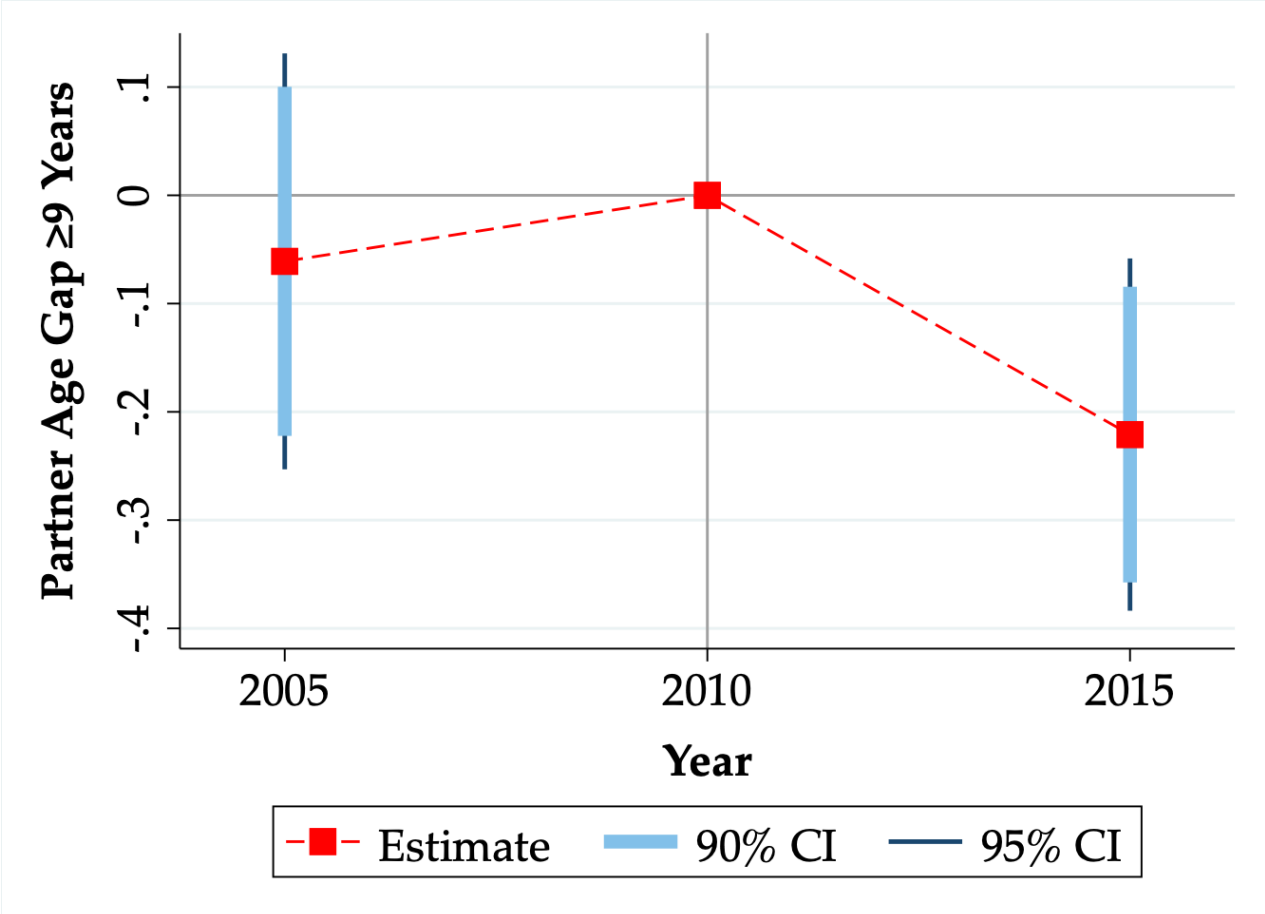
Women 13-18: Attendance ↑ 10% (6.8 p.p.) more in high-schisto

Effect of Deworming on HIV Risks: Partner Age Gap (I)



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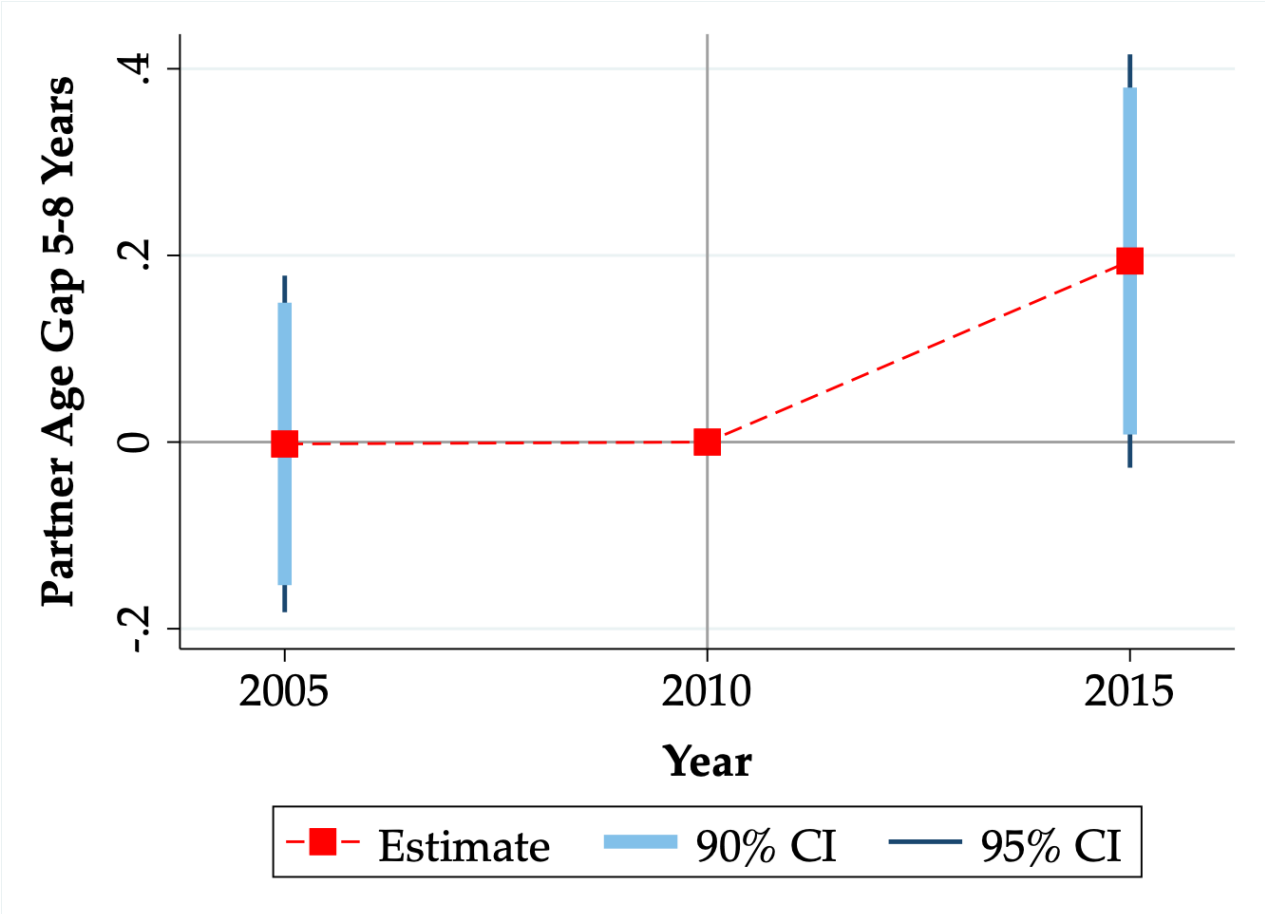
Women 15-20: Age gap above 75 pctile ↓ 84% (22.1 p.p.) more

Effect of Deworming on HIV Risks: Partner Age Gap (II)



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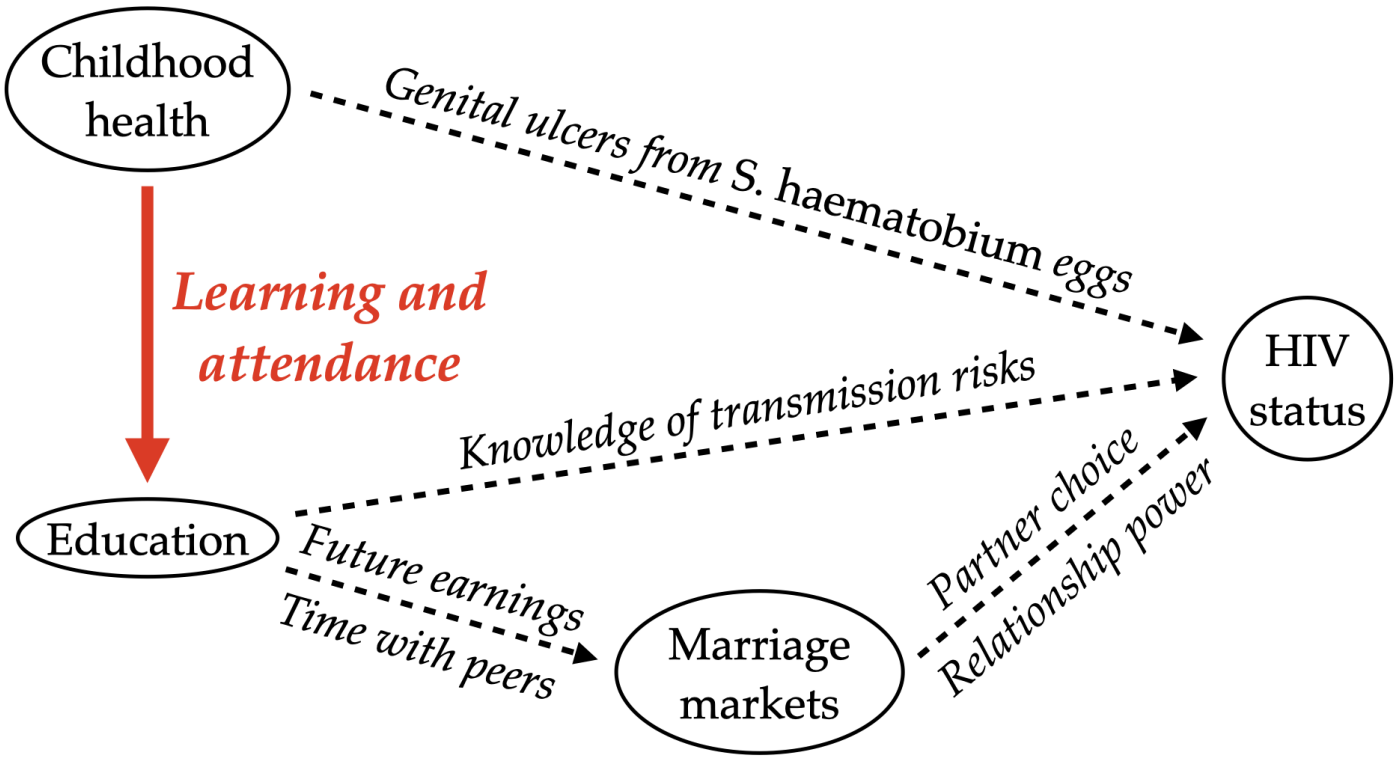
Women 15-20: Age gap in 50-75 pctile ↑ 49% (19.4 p.p.) more

Summary: Revisiting Hypotheses



Novel: Linking childhood health to HIV via learning / attendance and its effects on marriage market matching

Conclusion

1. **Childhood health:** Improving it for girls lowers their chances of contracting HIV as young women, most likely by increasing their human capital, which changes their marriage market matches

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2. **Cost-effectiveness:** Very cheap to improve childhood health $\rightarrow$ potentially very cheap to avert (very expensive) HIV infections for high-risk group

3. **Marriage markets:** Helps us understand role of childhood health (as part of human capital), especially in non-Western context