Identifying population-specific HIV diagnosis gaps in Western Africa and assessing their impact on new infections: a modelling analysis for Côte d'Ivoire, Mali and Senegal.

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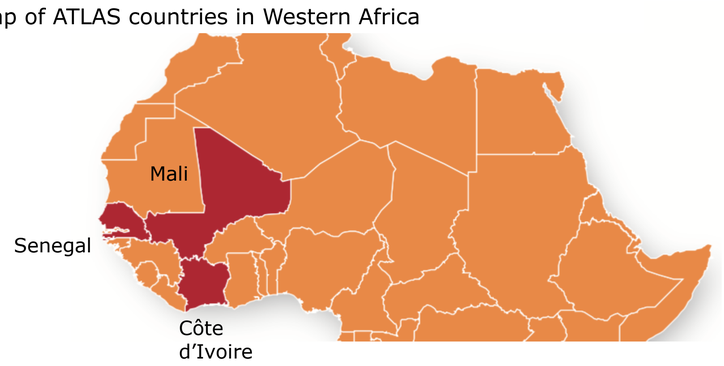
Background & Aim

- Measuring diagnosis gaps among people living with HIV (PLHIV), including key populations (KP) such as female sex workers (FSW), their clients, and men who have sex with men (MSM), and their contribution to HIV transmissions can improve HIV testing programs.
- The ATLAS program[1] distributed 400,000 HIV self-tests (HIVST) over 2019-2021 in Côte d'Ivoire, Mali, and Senegal to help reduce these gaps
- We used mathematical modelling to estimate HIV diagnosis gaps by risk group in the 3 countries (Figure 1), and their contribution to HIV transmission over 2012-2021

Figure 1: Map of ATLAS countries in Western Africa

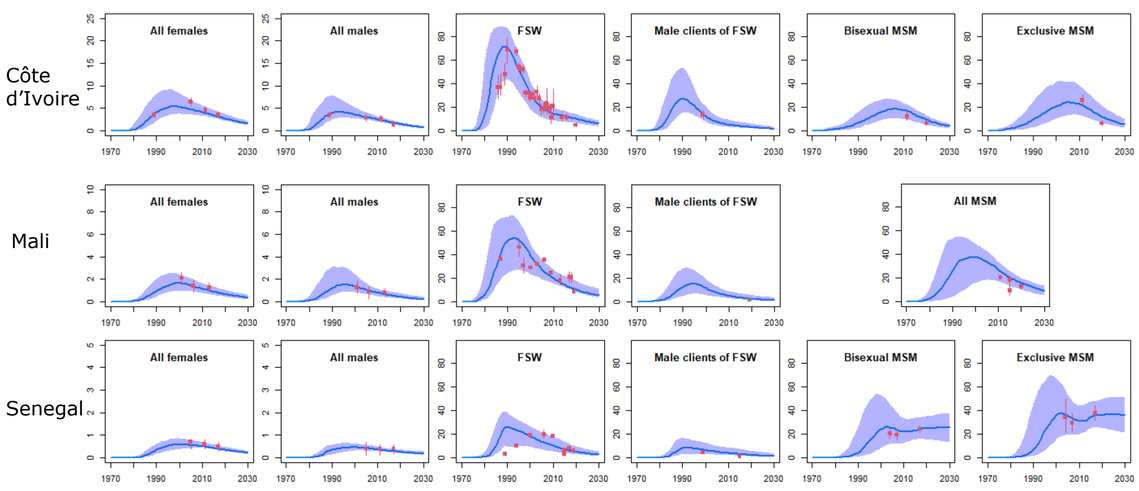


Methods

Deterministic model of HIV transmission by risk groups (15-59 years old)

- Parameterized and calibrated by risk group following a review of demographic, behavioural, HIV (Figure 2) and intervention data (e.g. % PLHIV ever HIV tested, % diagnosed, # annual conventional tests) in each country
- We used each country-specific calibrated model to estimate
  1) Fraction of undiagnosed infections in 2022
  2) Distribution per risk group of undiagnosed infections in 2022
  3) Contribution of undiagnosed PLHIV to HIV transmission by risk groups over 2012-2021 (i.e., transmission population-attributable fraction; tPAF)

Figure 2: Empirical (red dots) and model-fitted (blue shades) HIV prevalence in different modelled risk groups over time in Côte d'Ivoire (top row), Mali (middle row), and Senegal (bottom row). Grey dots represent data only used for comparison.



Results

1) Estimated fractions of undiagnosed infections in 2022 (Table 1)

- A large fraction of HIV infections are undiagnosed in ATLAS countries, especially in Mali (~ 50%)
- HIV diagnostic gaps are 2-3 fold larger among males than females
- Wider gaps among KP than non-KP
  - Among FSW (vs non-KP females) particularly in Côte d'Ivoire and Senegal
  - Among MSM (vs non-KP males) in Côte d'Ivoire and Senegal, but not in Mali (coherent with 2014 data[2] among MSM and all males in Mali)

Table 1. Estimated fraction of PLHIV with an undiagnosed infection in January 2022. Median and 95%UI (2.5th and 97.5th percentiles) of estimates are shown.

	Côte d'Ivoire	Mali	Senegal
All	26% (22-29)	48% (43-51)	22% (17-27)
All females	18% (15-22)	42% (37-44)	11% (8-15)
All males	37% (32-42)	57% (49-64)	38% (31-44)
FSW	31% (22-41)	45% (31-62)	29% (17-43)
Clients	37% (32-43)	57% (48-65)	23% (14-34)
MSM	45% (36-58)	40% (29-52)	57% (38-74)
Key populations (KP)	37% (33-43)	52% (44-59)	42% (33-53)
Non-KP females	18% (14-21)	41% (37-45)	10% (7-14)
Non-KP males	36% (31-42)	62% (52-69)	25% (15-35)

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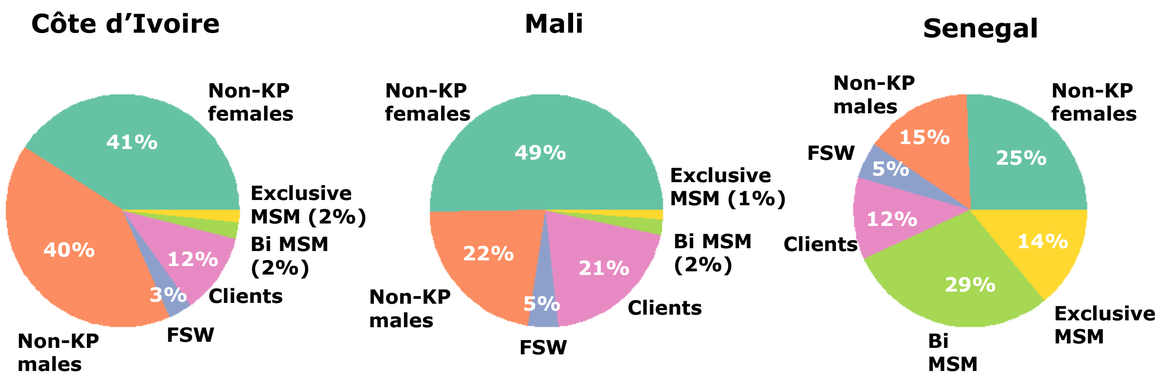
2) Distribution per risk group of undiagnosed infections in 2022 (Figure 3)

- Across countries: most undiagnosed infections are among males and KP
- Côte d'Ivoire: over 80% of undiagnosed infections are among non-KP, due to much larger overall HIV prevalence in this country (~2.1% among adults) than in the other countries (~0.9% in Mali and ~0.3% in Senegal)
- Mali: over 25% of undiagnosed infections are among FSW and their clients
- Senegal: almost 50% of undiagnosed infections are among MSM (disproportionate HIV prevalence and diagnosis gaps in this group)

Figure 3: Estimated distribution per risk group of the undiagnosed infections across countries in 2022



3) Contribution of undiagnosed PLHIV to HIV transmissions (tPAF, Table 2)

- Undiagnosed PLHIV may have contributed to ~ 75% of HIV transmissions over 2012-2021 (tPAF=82% in Mali, 74% in Côte d'Ivoire, 71% in Senegal); especially due to men
- Côte d'Ivoire: tPAF of undiagnosed non-KP ~ 80%
- Mali: tPAF of undiagnosed FSW and clients >40% (importance of sex work in epidemic dynamics, while tPAF undiagnosed MSM ~ 5%)
- Senegal: tPAF of undiagnosed MSM ~33%, and almost 25% for undiagnosed clients

Table 2. Estimated fraction of new HIV transmissions over 2012-2021 contributed by PLHIV of different risk groups with an undiagnosed infection (tPAF). Median and 95%UI (2.5th and 97.5th percentiles) of estimates are shown.

	Côte d'Ivoire	Mali	Senegal
All	74% (67-82)	82% (78-87)	71% (65-77)
All females	41% (34-47)	47% (40-55)	21% (14-30)
All males	60% (52-69)	66% (59-71)	65% (57-72)
FSW	5% (2-12)	19% (8-34)	11% (4-21)
Clients	16% (8-28)	41% (27-57)	23% (11-39)
MSM	3% (1-6)	5% (2-9)	33% (18-51)
Key populations (KP)	21% (11-34)	50% (34-67)	59% (45-69)
Non-KP females	37% (30-44)	29% (21-39)	11% (6-17)
Non-KP males	43% (29-56)	23% (9-37)	10% (4-19)

Conclusion

- Large fractions of infections in the 3 countries are still undiagnosed (up to ~ 50% in Mali), although there remain uncertainties around the coverage of HIV diagnosis among male and KP PLHIV
- HIV testing services and approaches in Western Africa leave members of KP behind, especially MSM
- New efforts are needed to reduce HIV diagnosis gaps, including an increased availability of confidential HIV testing modalities, which could subsequently help further reduce HIV incidence in Western Africa

References

[1] Rouveau et al. BMC Public health, 2021
[2] Hakim et al. PLoS One, 2018

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