Cost-effectiveness analysis of testing strategies for diagnosing Hepatitis C Virus infection in PWID in resource-constrained countries

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Disclosures

- Nothing to disclose

Background

- HCV seroprevalence in sub-Saharan countries: 1 – 8% [1]
- Drug users have been identified as one of the high-risk groups (estimated seroprevalence: 15-69%) [2]
  - ⇨ Major point in tackling the HCV epidemic in sub-Saharan countries
- Reference testing strategy (anti-HCV antibody (HCV-Ab) test ⇨ HCV-RNA test)
  - ⇨ Limits access to HCV testing and therefore linkage to care and treatment

Need to develop alternative procedures for HCV testing, adapted to resource-constrained countries

[1] Sonderup, Lancet Gastroenterol Hepatol, 2017 ; [2] Degenhardt, Lancet Glob Health, 2017

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Background

- Innovative technologies open up opportunities for scaling-up HCV testing:
  - new biomarker surrogate for HCV RNA, cheaper and more simple to quantify: the **HCV core antigen (cAg)**
  - **point-of-care (POC) tests** for HCV-RNA and HCV-cAg detection are commercially available or in the late-stage development pipeline
  - the data gap regarding the performance of HCV-Ab, HCV-RNA and HCV-cAg testing on **dried blood spot (DBS)** was recently filled

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Objective

To assess the cost-effectiveness of various testing strategies including different biomarkers, DBS sampling and POC diagnostics for hepatitis C infection in PWIDs from a health sector perspective in Senegal

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Methods: strategies

Strategy	Testing sequence	
1 (ref.)	HCV-Ab test (venepuncture) → HCV-RNA (venepuncture)	**TWO-STEP**
2	HCV-Ab (DBS) → HCV-RNA (DBS)	
3	HCV-Ab (POC) → HCV-RNA (venepuncture)	
4	HCV-Ab (POC) → HCV-RNA (DBS)	
5	HCV-Ab (POC) → HCV-RNA (POC)	
6	HCV Ab (venepuncture) → HCV-cAg (venepuncture)	
7	HCV-Ab (DBS) → HCV-cAg (DBS)	
8	HCV-Ab (POC) → HCV-cAg (venepuncture)	
9	HCV-Ab (POC) → HCV-cAg (DBS)	
10	HCV-RNA (POC)	**ONE-STEP**
11	HCV-cAg (venepuncture)	
12	HCV-cAg (DBS)	

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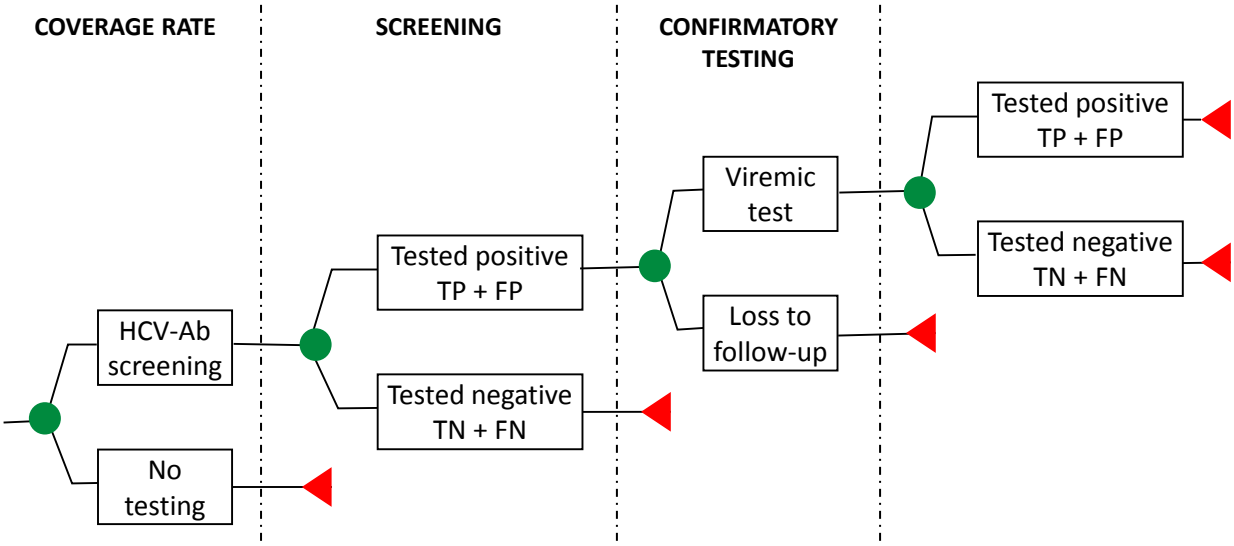
Methods: decision tree



TP: true positive, TN: true negative, FP: false positive, FN: false negative

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Methods: design

Time horizon: immediate

Outcomes

- Effectiveness: true positive (TP) cases diagnosed
- Cost: total cost per targeted individual

Data source

- Test performance and health probabilities: literature review
- Costs: Fann hospital (Dakar, Senegal), 2017 costs

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Methods: costing data

Cost parameters	Base-case (€)	Sensitivity analysis interval
Laboratory HCV-Ab test	23	14 to 23
POC HCV-Ab test	7.6	+/- 50%
Laboratory HCV-RNA test	68.6	45 to 95
POC HCV-RNA (cartridge)	13.68	9.88 - 13.68
Healthcare worker time for HCV-RNA POC	0.6	0.4 - 0.8
Laboratory HCV-cAg test	34.3*	22 - 46
DBS sampling	2.9	+/- 50%
DBS transportation from POC to laboratory	3	+/- 50%

*Assumption: half price of HCV-RNA testing (Centre Pasteur, Yaoundé, Cameroon)

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Methods: model assomptions for the base-case analysis

Seroprevalence: 38.9% (PWID population in Dakar, Senegal)[1]

Uptake rate: 100% for all strategies

Loss to follow-up testing: 20% for two-step strategies including confirmatory tests in laboratory on venous blood samples

⇨**Based on sensitivity analysis**

- Uptake rate: no change in cost-effectiveness ranking
- Loss to follow-up: if > 2% HCV-RNA testing on DBS became more cost-efficient than their equivalent on venous blood samples

[1] Leprêtre, J Int AIDS Soc, 2015

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Results: base-case analysis

Strategy	Cost / subject screened (€)	True positive (TP) cases*	ICER *** (€ / additional true positive case detected)	Diagnostic accuracy (%)	Strategy sensitivity (%)	Strategy specificity (%)
S_5: Ab (POC) → RNA (POC)	13.38	259		98.4	95.0	99.7
S_{12}: RNA (POC)	14.88	260	1155.52	97.4	95.5	98.1
S_8: Ab (POC) → cAg (lab) – Venepuncture	18.25	202	**	90.6	74.3	96.6
S_9: Ab (POC) → cAg (lab) – DBS	23.23	208	**	93.2	76.3	99.6
S_3: Ab (POC) → RNA (lab) – Venepuncture	28.91	217	**	92.0	79.5	96.7
S_6: Ab (lab) → cAg (lab) - Venepuncture	33.79	202	**	90.5	74.3	96.5
S_{10}: cAg (lab) - Venepuncture	34.30	254	**	97.3	93.4	98.8
S_4: Ab (POC) → RNA (lab) - DBS	36.55	266	3958.55	99.1	97.5	99.7
S_{11}: cAg (lab) - DBS	40.25	209	**	91.7	76.7	97.3
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* per 1,000 individuals screened ** Dominated strategy *** Incremental cost-effectiveness ratio

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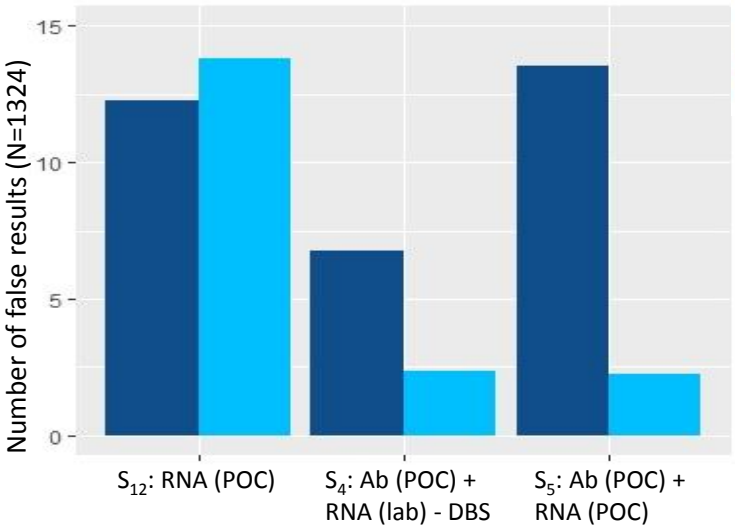
Results: false positive and false negative rates



Population:
- Drug users in Dakar, N= 1324 [95%CI: 1281 - 1367][1]

[1] Leprêtre, J Int AIDS Soc, 2015

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Results: sensitivity analyses

Comparison « S_5: HCV-Ab (POC) + HCV-RNA (POC) » and « S_{12}: HCV-RNA (POC) »

⇨ Thresholds for which S_{12} would become more cost-effective than S_5:

- Seroprevalence: > 49.1% *(base-case value: 38.8%)*
- Cost of HCV-Ab POC: > €9.1 *(base-case value: €7.6)*
- Cost of HCV-RNA POC: < €11.3 *(base-case value: €13.68)*

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Budget impact analysis: drug users in Dakar

- Budget impact analysis: drug users in Dakar (N=1324)

Strategy	Estimated budget (€)
S_5: Ab (POC) → RNA (POC)	17,712
S_{12}: RNA (POC)	19,701
S_4: Ab (POC) → RNA (lab) - DBS	48,387

⇨ The following potential expenditures should also be taken into account:
- Initial investment for diagnostics (HCV-RNA POC device, laboratory platform)
- Human resources and training

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Conclusion

- Limitations:
  - Costs
  - Risk of re-infection not taken into account (HCV-Ab)
- POC or DBS-based strategies appeared to be the most cost-effective
- In high-risk groups, HCV-Ab screening may be optional
- One-step or two-step strategy?
  - Need to carefully assess the price of tests and seroprevalence
  - Impact of false positives: additional treatment cost?
  - Impact of false negatives: which catch-up strategy ?

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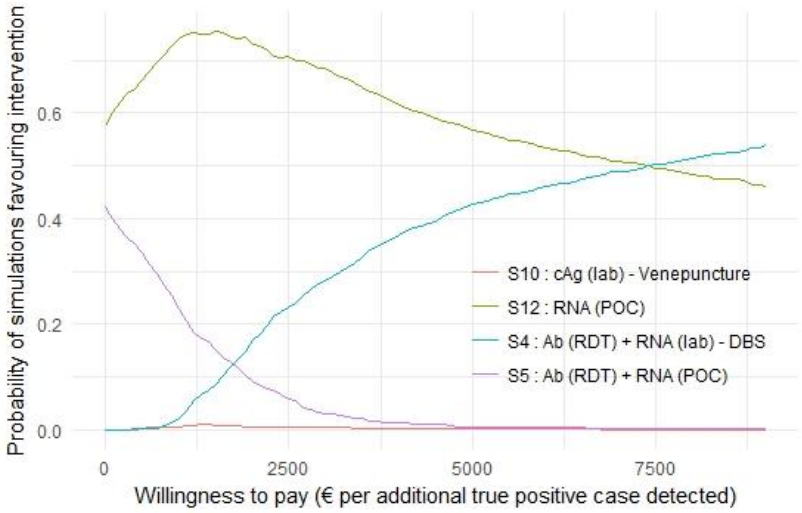
Acknowledgments

- Members of the TAC (Treatment Africa Hepatitis C) study
- ANRS (National Agency for Research on AIDS and Hepatitis)
- INHSU: academic scolarship
- Karine Lacombe and Gilles Hejblum

Probabilistic sensitivity analysis



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