# Identification of Clinical Phenotypes in MSM with HIV from a Prospective Study on Acute HCV and STIs # 1273

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## Introduction & Aims

- Clinical phenotyping categorizes patients into distinct groups based on observable characteristics.
- It helps predict outcomes, stratify risk, and identify high-risk patients needing closer monitoring or targeted interventions.
- This study applied clinical phenotyping to identify phenotypes among MSM with HIV in a prospective study on acute/recent HCV and bacterial STIs, assessing their association with distinct risk profiles.

## Baseline Characteristics

| Characteristic | CoRIS N = 348 | Madrid-CoRE N = 181 | All N = 529 |
|---|---|---|---|
| **Demographics** | | | |
| – Age | 37.5 (31; 45) | 48 (41; 55) | 41 (33; 49) |
| – Native-born Spaniard | 207 (59.5) | 120 (66.3) | 327 (61.8) |
| – Caucasian | 309 (88.8) | 158 (87.3) | 467 (88.3) |
| **HIV-related variables** | | | |
| – Prior AIDS-defining categories | 31 (8.9) | 27 (14.9) | 58 (11.0) |
| – Antiretroviral therapy | 347 (99.7) | 181 (100.0) | 528 (99.8) |
| – CD4 cell count | 807 (614; 998) | 796 (586; 998) | 804 (612; 998) |
| – Undetectable HIV RNA | 326 (93.7) | 173 (95.6) | 499 (94.3) |
| **Risk practices for STI/HCV** | | | |
| – CRAI in the previous 2 months | 226 (64.9) | 123 (68.0) | 349 (66.0) |
| – Chemsex | 89 (65.9) | 88 (88.0) | 177 (75.3) |
| – Slamsex | 12 (3.4) | 29 (16.0) | 41 (7.8) |
| **Prior history of HCV/STI** | | | |
| – HVC infection | 9 (2.6) | 181 (100.0) | 190 (35.9) |
| – Any STI | 238 (68.4) | 166 (91.7) | 404 (76.4) |
| – Syphilis | 204 (58.6) | 157 (86.7) | 361 (68.2) |
| – *Neisseria gonorrhoeae* | 98 (28.2) | 66 (36.5) | 164 (31.0) |
| – *Chlamydia trachomatis* | 71 (20.4) | 49 (27.1) | 120 (22.7) |

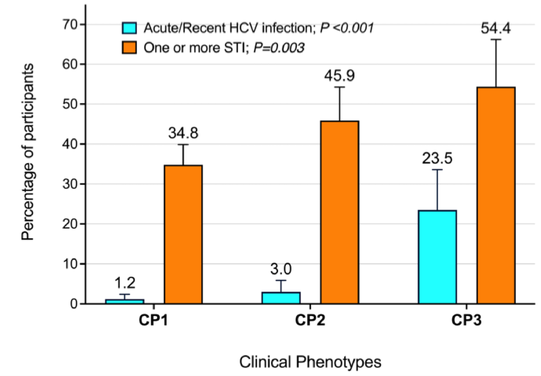
**CRAI**: condomless receptive anal intercourse.

## Factors & Associated Variables (PCA)

| Factor | Associated Variables | Labelling/Explanation |
|---|---|---|
| 1 | CRAI, Use of drugs, Mephedrone, GHB, Snorting of drugs | Risky sexual behavior and drug use |
| 2 | HADS Anxiety, HADS Depression, ADHD | Psychological distress |
| 3 | Ketamine, Ecstasy/MDMA, Amphetamines | Recreational use of psychoactive drugs |
| 4 | Fisting, Intrarectal drug use, Injection drug use, Methamphetamine | Very high-risk sexual behavior and very high-risk drug use |
| 5 | Prior Syphilis, Prior Gonorrhea, Prior HCV | History of STIs |
| 6 | Smoking drugs, Cocaine use | Use of smoked and inhaled stimulants |

**PCA,** Principal component analysis; **CRAI**, Condomless receptive anal intercourse

## STIs & acute/recent HCV across CPs




## Methods I

**Study Design & Population**
- Prospective multicenter study / Madrid (Spain) / May 2022 to Feb 2024
- MSM with HIV ≥18 years from **CoRIS** [1] & **Madrid-CoRE** [2] (10 centers).
- Study Visits: Baseline, 6, and 12 months.

**Data Collection**
- Baseline: Demographics, HIV, HCV, and STI history.
- Behavioral: self-reported app data on sexual behavior, substance use, mental health (HADS, ADHD scale).
- Lab Tests (all visits/as needed):
  - HCV: Serology + HCV-RNA if positive.
  - STIs: PCR (gonorrhea, chlamydia) from anus, urethra, and pharynx.
  - Syphilis: EIA/CIA + VDRL/RPR.
  - Other: Blood counts, ALT/AST.

1) Sobrino-Vegas P, et al. Enferm Infecc Microbiol Clin 2011; 29(9): 645-53.
2) Berenguer J, et al. Hepatology 2018; 68(1): 32-47.

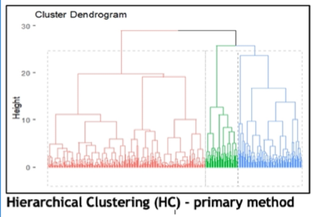
**CoRIS** = Cohort of the Spanish HIV Research Network
**Madrid-CoRE** = Madrid Coinfection Registry
HADS = Hospital Anxiety and Depression Scale
ADHD = Attention-Deficit/Hyperactivity Disorder Scales

## Variables (N=38) included in PCA

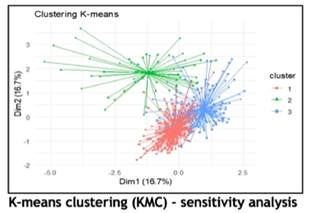
| Demographics | Infections | Mental Health | Drugs | Drug route | Sexual Behavior |
|---|---|---|---|---|---|
| Age<br>Country<br>Ethnicity<br>Education<br>Cohort | Prior AIDS<br>Prior HCV<br>Prior syphilis<br>Prior NG<br>Prior CT<br>HBV | Anxiety<br>Depression<br>ADHD<br>Total Barret score<br>Cognitive impulsivity<br>Motor impulsivity<br>Unplanned impulsivity | Any drug<br>Cocaine<br>Mephedrone<br>Methamphetamine<br>Ketamine<br>GHB<br>MDMA/Ecstasy<br>Marijuana<br>Amphetamines<br>Other | Oral<br>Nasal<br>Smoking<br>Intrarectal<br>Injection | CRAI<br>Chemsex<br>Fisting<br>Nº partners<br>CIAI |

**PCA**, Principal Component Analysis; **NG**, Neisseria gonorrhoeae; **CT**, Chlamydia trachomatis; **ADHD,** Attention-Deficit/Hyperactivity Disorder; **GHB,** Gamma-Hydroxybutyrate; **MDMA**, 3,4-Methylenedioxymethamphetamine; **CRAI,** condomless receptive anal intercourse; **CIAI,** condomless insertive anal intercourse

## Clustering plots (HC & KMC)




Hierarchical Clustering (HC) - primary method




K-means clustering (KMC) - sensitivity analysis

## Conclusions

1. MSM with HIV can be classified into distinct Clinical Phenotypes based on their risk levels for STIs and acute/recent HCV infections:
   - **CP1 (Low to moderate risk):** Characterized by low engagement in risky sexual behaviors and drug use, minimal psychological distress, and a lower history of STIs.
   - **CP2 (High-risk):** Defined by engagement in risky sexual behaviors and drug use, accompanied by moderate psychological distress.
   - **CP3 (Very high-risk):** Marked by high-risk sexual practices (e.g., fisting) and extensive drug use, including methamphetamine consumption and high-risk routes (e.g., injection).
2. These findings underscore the need for targeted prevention, screening, and intervention strategies to address HCV and STI risks in this population.

## Methods II

**Statistical Analysis**
- 38 variables spanning four domains were analyzed
  - Sociodemographic/clinical.
  - Mental health.
  - Sexual behavior.
  - Substance use.
- Principal component analysis (PCA) used for dimensionality reduction.
- Participant clustering
  - Hierarchical clustering (HC) as the primary method.
  - K-means clustering (KMC) for sensitivity analysis.
- Model adequacy assessment
  - Kaiser-Meyer-Olkin (KMO) measure.
  - Bartlett's test.
- Analyses were conducted in R version 4.4.1
  - Packages: Tidyverse, Cluster, Factoextra, NbClust, tidyr.

## Dimensionality reduction by PCA

| Variable | Factor 1 | Factor2 | Factor3 | Factor 4 | Factor 5 | Factor 6 | KMO |
|---|---|---|---|---|---|---|---|
| Use of drugs in prior 2 months | 0.79 | | | | | | 0.7704 |
| Mephedrone | 0.83 | | | | | | 0.8516 |
| GHB | 0.73 | | | | | | 0.8617 |
| Ingestion of drugs | 0.66 | | | | | | 0.8396 |
| Snorting of drugs | 0.84 | | | | | | 0.7650 |
| Condomless Receptive Anal Sex | 0.58 | | | | | | 0.9107 |
| HADS Anxiety | | 0.83 | | | | | 0.6287 |
| HADS Depression | | 0.85 | | | | | 0.6628 |
| Adult ADHD | | 0.76 | | | | | 0.7954 |
| Unplanned impulsivity | | -0.57 | | | | | 0.7468 |
| Ketamine use | | | 0.64 | | | | 0.8873 |
| Ecstasy/MDMA use | | | 0.55 | | | | 0.7501 |
| Amphetamines use | | | 0.69 | | | | 0.8896 |
| Intrarectal use of drugs | | | | 0.49 | | | 0.9126 |
| Injection of drugs | | | | 0.56 | | | 0.8873 |
| Methamphetamine | | | | 0.64 | | | 0.8311 |
| Fisting | | | | 0.40 | | | 0.9616 |
| Prior syphilis | | | | | 0.72 | | 0.7398 |
| Prior gonorrhea | | | | | 0.57 | | 0.7685 |
| Prior HCV infection | | | | | 0.68 | | 0.7502 |
| Smoking drugs | | | | | | 0.47 | 0.6662 |
| Cocaine use | | | | | | 0.66 | 0.7406 |
| | | | | | | Overall | 0.7937 |

**Factors & Factor Loadings:** Each cell contains a factor loading, indicating how strongly a variable contributes to a factor in PCA.
**High values (±1)** → Stronger associations. **Positive** → Direct correlation (e.g., Mephedrone use: 0.83 in Factor 1). **Negative** → Inverse correlation (e.g., Unplanned impulsivity: -0.57 in Factor 3). **Empty cells** → Insignificant loadings (<0.4 or 0.5).
**KMO Measure: ≥ 0.8** → Excellent | **≥ 0.7** → Good | **≥ 0.6** → Adequate | **< 0.6** → Poor. **Overall KMO: 0.7937** → Good suitability for PCA.

## Weighted averages across CPs

| Factor | Clinical Phenotype 1 N = 328 (62.0%) | Clinical Phenotype 2 N = 133 (25.1%) | Clinical Phenotype 3 N = 68 (12.9%) | *P* |
|---|---|---|---|---|
| 1 | -.608 (-.973; -.352) | .993 (.421; 1.48) | 1.41 (.935; 1.72) | <0.001 |
| 2 | -.197 (-.78; .625) | .0456 (-.742; .605) | -.149 (-.845; .791) | 0.698 |
| 3 | -.069 (-.262; .173) | -.452 (-.86; .925) | -.632 (-1.11; -.0928) | <0.001 |
| 4 | -.0653 (-.417; .279) | -.88 (-1.19; -.34) | 1.66 (.987; 2.37) | <0.001 |
| 5 | -.189 (-1.25; .709) | .0214 (-.635; .771) | .491 (-.348; 1.2) | 0.002 |
| 6 | -.294 (-.693; .135) | .424 (-.338; 1.72) | -.341 (-1.03; .608) | <0.001 |

**Factor Scores**: Weighted averages of the variables grouped within each factor.
**Cell Values**: Median [interquartile range] of the weighted factor scores within each phenotype.
**Interpretation of Values**:
- **Positive values** indicate a higher alignment with the factor.
- **Negative values indicate** a lower or opposite alignment with the factor.

**P-Values**: Statistical significance of differences across clinical phenotypes for each factor.
**Risk Categorization: Red (>1.0):** High risk. **Orange (0.0–1.0):** Moderate risk. **Green (≤0.0):** Low risk.

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