On the path towards elimination of hepatitis C – Models of care to reach people who inject drugs for testing and treatment
Thank you to all study participants who generously contributed to this research.
Disclosures

- Håvard Midgard, Kjersti Ulstein, Øystein Backe and Olav Dalgard: Advisory boards and lecture fees from Abbvie, MSD and Gilead

- The low-threshold HCV-clinic has previously used a mobile FibroScan® from Abbvie

- The GeneXpert® including test kits used in the nurse-led mobile clinic are donated by Bergmann Diagnostika

- An initial pilot project preceding the study from the peer led mobile clinic was funded by Abbvie, MSD and Gilead
Chronic liver disease

- Normal liver
- Chronic hepatitis
  - NASH
  - HCV and HBV
  - AUTO-IMMUNE
  - Other
- Cirrhosis
  - Alcohol
- High mortality
  - Liver failure
  - Hepatocellular carcinoma

20 - 40 years
Burden of HCV related disease attributable to injecting drug use 2013

- Western Europe: 64%
- Eastern Europe: 68%
- Global: 38%

Degenhardt L Lancet Inf Dis 2016
Hepatitis C can easily be cured since 2014 all oral treatment with few or one side effects have been available. After 8-12 weeks of dual treatment 95% achieve sustained virologic treatment.

- Second line line triple therapy cures the remaining few
HCV treatment to people who inject drugs:
The standard model

Modified from Brugmann & Litwin. Clin Infect Dis 2013; Slide courtesy of Jason Grebely
HCV treatment to people who inject drugs: The new model

Modified from Brugmann & Litwin. Clin Infect Dis 2013; Slide courtesy of Jason Grebely
The themes of this session

1. Models of care to reach those hard to reach in low-threshold health services

2. A model of treatment in the specialist health services

3. HCV treatment uptake in a risk population and the progress towards elimination of HCV
1. Hepatitis C treatment and reinfection surveillance among people who inject drugs in a low-threshold program. And new models to reach those hard to reach; results from Point of Care testing and treatment in a nurse led and a peer led mobile clinic
1. Models of care to reach those hard to reach

a. Results from a low-threshold clinic for people who inject drugs (PWID)
   Hepatitis C treatment and reinfection surveillance

b. Results from a nurse led mobile street clinic for PWID
   Point of care test and treat vs traditional “two-step” test and treat

c. Results from a peer led mobile HCV-clinic for PWID
   Point of care test and treat outside the urban centres
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Hepatitis C treatment and reinfection surveillance among people who inject drugs in a low-threshold program in Oslo, Norway

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Acknowledgements

Thank you to all study participants and people who inject drugs who generously contributed to this research.

This project was initiated by the City of Oslo and Akershus University Hospital.
Background and setting

Background

• Low-threshold health services for PWID in Oslo since 1999, NSP since 1988
• Annual health surveys since 2002 -> About 70% Anti HCV+, 45% HCV RNA+ (= chronic HCV infection (CHC))
• In practice no treatment for PWID
• New National Clinical Guidelines for HCV 2012
• Head physician at the low-health services contacted the specialty health services for cooperation

Setting

• Low-threshold HCV clinic established within Oslo’s harm reduction services in April 2013
• Staffed with a general practitioner and two nurses with specialist support
• Network-based flexible ambulant model of care
• The nurses draw blood and operate a mobile transient elastography device
• Individually tailored DAA treatment according to national guidelines

NSP = Needle and syringe program, DAA = Direct Acting Antiviral medication
Methods and aims

Design and Methods:

• Prospective observational study
• Assessments at enrolment, during treatment, end of treatment, and at 4 and 12 weeks after treatment
• Reinfection surveillance: Follow-up HCV RNA testing at 3 month intervals after virologic response

Aims:

• Evaluate DAA treatment effectiveness and reinfection rates in a real-world cohort of PWID
• Demonstrate the feasibility of systematic reinfection surveillance and retreatment
## Results: Characteristics of study participants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median age (IQR)</td>
<td>49 (42-55)</td>
</tr>
<tr>
<td>Male gender</td>
<td>73%</td>
</tr>
<tr>
<td>Unstable housing</td>
<td>54%</td>
</tr>
<tr>
<td>History of injecting drug use</td>
<td>100%</td>
</tr>
<tr>
<td>Recent (past 3 months) injecting drug use</td>
<td>70%</td>
</tr>
<tr>
<td>Current opioid agonist therapy</td>
<td>71%</td>
</tr>
<tr>
<td>Drugs most frequently injected</td>
<td></td>
</tr>
<tr>
<td>Heroin</td>
<td>35%</td>
</tr>
<tr>
<td>Amphetamines</td>
<td>21%</td>
</tr>
<tr>
<td>Mixed</td>
<td>44%</td>
</tr>
<tr>
<td>Liver stiffness $\geq 12.5$ kPa</td>
<td>18%</td>
</tr>
<tr>
<td>Genotype 3</td>
<td>45%</td>
</tr>
</tbody>
</table>

![DAA regimen](image)

Midgard, Ulstein, Backe et al. IJDH 2021
Results: The cascade of care June 2013 - June 2020

- Treatment uptake 75%
- HCV RNA prevalence 64%
- Lost to follow-up (n=71)
  Retained in care (n=42)
  Deceased (n=7)
  Declined care (n=39)

Midgard, Ulstein, Backe et al. IJDP 2021
Results: Virologic response

ITT analysis excluded:
- Withdrew consent: 2
- Ongoing treatment (n=5)
- Pending results (n=18)

mITT analysis also excluded:
- Loss to follow-up (n=17)

Treatment failure:
- Early discontinuation (n=12)
- Virologic failure (n=5)

<table>
<thead>
<tr>
<th>Analysis</th>
<th>%</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITT analysis</td>
<td>90.0%</td>
<td>306/340</td>
</tr>
<tr>
<td>Modified ITT analysis</td>
<td>94.7%</td>
<td>306/323</td>
</tr>
</tbody>
</table>

Midgard, Ulstein, Backe et al. IJD 2021
Results: Reinfection surveillance (n=297)

- 8 cases detected over 308 PY of follow-up

- Reinfection incidence
  - Overall: 2.60/100 PY
  - Recent PWID: 3.77/100 PY
  - Mixed drug use: 9.56/100 PY

- Reinfection associated with age
  - IRR 0.37 per 10-year increase in age

- All 8 cases successfully retreated (100% SVR)

- Median time to retreatment 40 wks

Midgard, Ulstein, Backe et al. IJDP 2021
Conclusions

- The study consolidate previous data of the effectiveness of DAA treatment among marginalised PWID

- Provide novel data on reinfection rates and associated factors

- Systematic reinfection surveillance and retreatment in a real-world setting is feasible
1. Models of care to reach those hard to reach

a. Results from a low-threshold clinic for people who inject drugs (PWID)
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b. Results from a nurse led mobile street clinic for PWID
   Point of care test and treat vs traditional “two-step” test and treat

c. Results from a peer led mobile HCV-clinic for PWID
   Point of care test and treat outside the urban centres
Point of care HCV-RNA testing in a mobile low threshold health service for people who inject drugs

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¹ Nurses on Wheels, Franciscan Aid, Oslo, ² Akershus University Hospital, ³ Oslo University Hospital, ⁴ University of Oslo.
Background and setting

**Background**

- To reach the elimination goals for HCV, need to
  - Reach those that don’t use stationary services
  - Make Point of Care (POC) test and treat even easier
    - Standard of care: Anti HCV-testing before HCV-RNA test
      -> results in loss to follow-up

**Setting:**

- Nurses on Wheels (NGO) Harm reduction since 2003
  - Van staffed by nurses, outreach in city centre and suburban areas
- Target group: PWID in Oslo unable to benefit from standard care (GP) and stationary low-threshold clinics
- Cooperation with specialist health services (OAT) and municipal services for PWID in Oslo

GP = General Practitioner, OAT = Opioid Agonist Treatment
Methods and aims

Design and Methods:

• Prospective, non-randomized controlled study
• Control group:
  • Standard of care
    • Anti-HCV-test prior to HCV-RNA-test and treatment
• Intervention group:
  • Immediate HCV-RNA test and treatment

Aims:

• Compare HCV-treatment uptake among patients in the two groups
Design and methods

Prospective, non-randomized controlled study
Demographics and patient characteristics

- 98 PWID included
- Median age 38 y
- 65% male
- 18% reported former HCV treatment
- 90% reported recent (6 months) injecting drug use
- 60% reported daily injecting drug use
- 35% received opioid agonist treatment
PERIOD A (n=48):
- None waited 20 min for anti-HCV test result
- Anti-HCV-positive: 27/48 (56%)
- Lost to follow-up before HCV-RNA-test: 14/27 (52%)
- HCV-RNA detected in 4/13 (31%) of anti-HCV+
- Initiated treatment: 3/48 (6.3%)*

PERIOD B (n=50):
- HCV-RNA detected in 9/50 (18%)
- Initiated treatment: 7/50 (14%)*

* p=0.18
Conclusion

- In mobile HCV clinics we recommend immediate POC testing for HCV-RNA instead of POC Anti-HCV screening followed by POC HCV-RNA testing
1. Models of care to reach those hard to reach

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   Point of care test and treat outside the urban centres
Peer support in small towns: A decentralized mobile Hepatitis C virus clinic for people who inject drugs

Midgard H¹,², Bjørnestad R³, Egeland M³, Dahl E³, Finbråten AK⁴, Kielland KB⁵, Blindheim M⁶, Dalgard O¹,⁷

¹ Department of Infectious Diseases, Akershus University Hospital, Lørenskog, Norway. ² Department of Gastroenterology, Oslo University Hospital, Oslo, Norway. ³ ProLAR Nett, Søgne, Norway. ⁴ Unger-Vetlesen Institute, Lovisenberg Diakonal Hospital, Oslo, Norway. ⁵ Norwegian National Advisory Unit on Concurrent Substance Abuse and Mental Health Disorders, Innlandet Hospital Trust, Brumunddal, Norway. ⁶ The Norwegian Directorate of Health, Oslo, Norway. ⁷ Institute of Clinical Medicine, University of Oslo, Oslo, Norway.
Background and aims

• Marginalized PWID living in rural areas and small towns may face considerable barriers to HCV care

• Point of care (POC) HCV RNA testing enables testing and treatment initiation during one visit

Aims of the study:

1) HCV treatment uptake among HCV RNA positive individuals identified by POC testing in a decentralized mobile clinic

2) The cascade of care among HCV RNA positive individuals
Study setting and methods

• The *hepatitis bus* visited 32 small towns within 12 months, staying 1-3 days at each site

• The tour schedule was organized by a consultant at the Norwegian Directorate of Health

• Health care providers and social workers at local municipalities prepared for the visit a few weeks in advance
Study setting and methods

• Assessments provided by the bus personnel
  • POC HCV RNA testing (GeneXpert®)
  • Liver elastography (FibroScan®)
  • Questionnaire (socio-demographics, clinical data, drug and alcohol use)

• HCV treatment prescribed by local hospital employed specialists following a brief telephone assessment

• Personnel at local municipalities assisted participants with dispensing DAA treatment from the local pharmacy and scheduled on-treatment follow-up on a discretionary basis

• Data on treatment uptake collected retrospectively from the core medical files
## Results: Participant characteristics (n=102)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Overall (n=102)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median age (IQR)</td>
<td>51 (42-56)</td>
</tr>
<tr>
<td>Age groups</td>
<td></td>
</tr>
<tr>
<td>&lt;30</td>
<td>1 (1)</td>
</tr>
<tr>
<td>30-39</td>
<td>18 (18)</td>
</tr>
<tr>
<td>40-49</td>
<td>29 (28)</td>
</tr>
<tr>
<td>50-59</td>
<td>43 (42)</td>
</tr>
<tr>
<td>60-70</td>
<td>11 (11)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>78 (77)</td>
</tr>
<tr>
<td>Female</td>
<td>24 (23)</td>
</tr>
<tr>
<td>Housing status</td>
<td></td>
</tr>
<tr>
<td>Owned accommodation</td>
<td>32 (32)</td>
</tr>
<tr>
<td>Municipal housing</td>
<td>61 (62)</td>
</tr>
<tr>
<td>Prison</td>
<td>4 (4)</td>
</tr>
<tr>
<td>Homeless</td>
<td>2 (2)</td>
</tr>
<tr>
<td>Source of income</td>
<td></td>
</tr>
<tr>
<td>Welfare pension</td>
<td>83 (87)</td>
</tr>
<tr>
<td>Social benefits</td>
<td>8 (8)</td>
</tr>
<tr>
<td>Other</td>
<td>5 (5)</td>
</tr>
<tr>
<td>History of injecting drug use</td>
<td>98 (100)</td>
</tr>
<tr>
<td>Median age at first injecting (IQR)</td>
<td>18 (15-23)</td>
</tr>
<tr>
<td>Recent (past 3 months) injecting drug use</td>
<td>68 (71)</td>
</tr>
<tr>
<td>Drug most frequently injected</td>
<td></td>
</tr>
<tr>
<td>Heroin</td>
<td>31 (46)</td>
</tr>
<tr>
<td>Amphetamines</td>
<td>37 (54)</td>
</tr>
<tr>
<td>Current opioid agonist treatment</td>
<td>37 (37)</td>
</tr>
<tr>
<td>Opioid agonist treatment drug</td>
<td></td>
</tr>
<tr>
<td>Methadone</td>
<td>15 (41)</td>
</tr>
<tr>
<td>Buprenorphine</td>
<td>9 (24)</td>
</tr>
<tr>
<td>Buprenorphine-naloxone</td>
<td>7 (19)</td>
</tr>
<tr>
<td>Other</td>
<td>6 (16)</td>
</tr>
<tr>
<td>HCV treatment experienced</td>
<td>7 (7)</td>
</tr>
<tr>
<td>Somatic comorbidities</td>
<td>17 (17)</td>
</tr>
<tr>
<td>Harmful alcohol consumption</td>
<td>11 (11)</td>
</tr>
<tr>
<td>Stage of liver disease</td>
<td></td>
</tr>
<tr>
<td>F1 (&lt;7 kPa)</td>
<td>45 (40)</td>
</tr>
<tr>
<td>F2 (7-9.5 kPa)</td>
<td>23 (26)</td>
</tr>
<tr>
<td>F3 (9.5-12.5 kPa)</td>
<td>9 (10)</td>
</tr>
<tr>
<td>F4 (&gt;12.5 kPa)</td>
<td>13 (14)</td>
</tr>
<tr>
<td>Median liver stiffness, kPa (IQR; range)</td>
<td>7.0 (5.5-9.4; 3.2-55)</td>
</tr>
</tbody>
</table>
Results: The HCV cascade of care

- Treatment uptake within 6 months
  - 90 of 102 (88%)

- Treatment uptake within 3 months
  - 81 of 102 (79%)

- Treatment uptake at data lock
  - 94 of 102 (92%)

- Treatment completion among those who initiated treatment
  - 85 of 94 (90%)

- Median time enrolment – treatment
  - 13 days (IQR 6-67)

- Median time enrolment – prescription
  - 5 days (IQR 2-60)

- DAAs prescribed by 27 hospital employed physicians
  - sofosbuvir/velpatasvir (87%)
  - sofosbuvir/ledipasvir (8%)
  - glecaprevir/pibrentasvir (2%)
  - grazoprevir/elbasvir (2%)
## Results: Factors associated with time to treatment

<table>
<thead>
<tr>
<th>Factor</th>
<th>Primary outcome, n (%)</th>
<th>Unadjusted model</th>
<th>Adjusted model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>HR (95% CI)</td>
<td>p</td>
</tr>
<tr>
<td>Age (per 10-year increase)</td>
<td>N.A.</td>
<td>0.99 (0.76-1.28)</td>
<td>0.916</td>
</tr>
<tr>
<td>Female gender (vs male)</td>
<td>20/24 (83)</td>
<td>0.95 (0.58-1.56)</td>
<td>0.832</td>
</tr>
<tr>
<td>Unstable housing (vs stable)</td>
<td>5/6 (83)</td>
<td>0.82 (0.33-2.02)</td>
<td>0.665</td>
</tr>
<tr>
<td>Welfare pension (vs not)</td>
<td>73/83 (88)</td>
<td>0.83 (0.45-1.53)</td>
<td>0.548</td>
</tr>
<tr>
<td>Recent injecting drug use (vs not)</td>
<td>58/68 (85)</td>
<td><strong>0.60 (0.38-0.95)</strong></td>
<td>0.029</td>
</tr>
<tr>
<td>Current opioid agonist treatment (vs not)</td>
<td>33/37 (89)</td>
<td>1.16 (0.75-1.80)</td>
<td>0.495</td>
</tr>
<tr>
<td>Any somatic comorbidity (vs none)</td>
<td>16/17 (94)</td>
<td>0.91 (0.53-1.57)</td>
<td>0.741</td>
</tr>
<tr>
<td>Harmful alcohol consumption (vs not)</td>
<td>8/11 (73)</td>
<td><strong>0.52 (0.25-1.08)</strong></td>
<td>0.078</td>
</tr>
<tr>
<td>Advanced fibrosis/cirrhosis (vs mild)</td>
<td>17/22 (77)</td>
<td><strong>0.50 (0.29-0.86)</strong></td>
<td>0.012</td>
</tr>
</tbody>
</table>
Conclusion

• HCV treatment uptake within 6 months was high (88%) among HCV RNA positive PWID identified by POC HCV RNA testing and liver disease assessment in a peer-led decentralized mobile clinic

• Treatment uptake was slower in individuals with recent injecting drug use, harmful alcohol consumption and advanced liver fibrosis
2. A model of treatment in the specialist health services

Opportunistic Treatment of Hepatitis C Virus Infection: A pragmatic stepped-wedge cluster randomized trial of immediate versus outpatient treatment initiation among hospitalized people who inject drugs (OPPORTUNI-C)
Opportunistic treatment of HCV infection (OPPORTUNI-C): A randomised controlled trial of immediate treatment initiation among hospitalized people who inject drugs

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Background and aim

- New models of HCV care are needed to reach people who inject drugs (PWID)\(^1\)

- PWID are at risk of hospitalization for skin and soft tissue infections and other drug-related harms\(^2,3\)

- Hospital admissions are not sufficiently utilized for HCV testing and treatment\(^4\)

- Standard of care referral to outpatient treatment often results lack of retention in the care cascade\(^5\)

- We hypothesized that hospitalizations represent opportunities to engage PWID in HCV care more effectively than a referral-based standard of care

**Aim of the study:** Evaluate the efficacy of opportunistic testing and treatment of HCV infection among PWID admitted for inpatient care in departments of internal medicine, addiction medicine, and psychiatry

Study design: Stepped wedge cluster randomisation

Gradual “naturalistic” rollout of a complex intervention, avoids contamination and disappointment effects

Sample size: 224 individuals
Methods: Participants, procedures and outcomes

- **Prior to trial commencement:** *HCV awareness campaign (flyers, posters, electronic newsletters)*
- **HCV screening:** *Risk-based (internal medicine) or universal (addiction and psychiatry) at admission*
- **Inclusion criteria:** *HCV RNA positive, inpatient care, informed consent*
- **Intervention conditions:** *Liver disease assessment, immediate treatment, individualized follow-up*
- **Control conditions (standard of care):** *Referral to outpatient treatment following discharge*
- **Primary outcome:** *Treatment completion within 6 months after enrolment*
- **Outcome assessment:** *Dispensing of the final DAA package (proxy for cure) from the pharmacy*
**Intervention conditions**
HCV screening tests (n=6117)
- HCV RNA negative (n=5920)
- Duplicates (n= 24)
- HCV RNA positive (n=173)
- Excluded
  - Not approached (n=71)
  - Declined (n=4)
  Analytic (ITT) population (n= 98)

**Control conditions**
HCV screening tests (n=3124)
- HCV RNA negative (n=2925)
- Duplicates (n=31)
- HCV RNA positive (n=168)
- Excluded
  - Not approached (n=64)
  - Declined (n=2)
  Analytic (ITT) population (n=102)

**Departments approached for participation** (n=7)
- Departments randomised (n=7)

**Trial period:**
1 Oct 2019 - 31 Dec 2021

**Covid-19 lockdown:** April 2020

**HCV tests performed:** 9241

**Viraemic individuals:** 341

**Enrolled participants:** 200
<table>
<thead>
<tr>
<th>Variable, n (%)</th>
<th>All (n=200)</th>
<th>Intervention (n=98)</th>
<th>Control (n=102)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age, mean (SD)</strong></td>
<td>47.4 (12.7)</td>
<td>48.0 (13.0)</td>
<td>46.8 (12.5)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>145 (72.5)</td>
<td>69 (70.4)</td>
<td>76 (74.5)</td>
</tr>
<tr>
<td>Female</td>
<td>55 (27.5)</td>
<td>29 (29.6)</td>
<td>26 (25.5)</td>
</tr>
<tr>
<td><strong>Housing status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rented/owned accommodation</td>
<td>124 (62.0)</td>
<td>64 (65.3)</td>
<td>60 (58.8)</td>
</tr>
<tr>
<td>Drug rehabilitation institution</td>
<td>10 (5.0)</td>
<td>7 (7.1)</td>
<td>3 (2.9)</td>
</tr>
<tr>
<td>Low-threshold institution</td>
<td>28 (14.0)</td>
<td>10 (10.2)</td>
<td>18 (17.7)</td>
</tr>
<tr>
<td>Prison</td>
<td>1 (0.5)</td>
<td>0 (0)</td>
<td>1 (1.0)</td>
</tr>
<tr>
<td>Homeless/on the street</td>
<td>37 (18.5)</td>
<td>17 (17.4)</td>
<td>20 (19.6)</td>
</tr>
<tr>
<td><strong>History of injecting drug use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>183 (91.5)</td>
<td>86 (87.8)</td>
<td>97 (95.1)</td>
</tr>
<tr>
<td>No</td>
<td>17 (8.5)</td>
<td>12 (12.2)</td>
<td>5 (4.9)</td>
</tr>
<tr>
<td><strong>Recent (past 3 months) injecting drug use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>121 (60.5)</td>
<td>58 (59.2)</td>
<td>63 (61.8)</td>
</tr>
<tr>
<td>No</td>
<td>79 (39.5)</td>
<td>40 (40.8)</td>
<td>39 (38.2)</td>
</tr>
<tr>
<td><strong>Current opioid agonist therapy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>90 (45.0)</td>
<td>38 (38.8)</td>
<td>52 (51.0)</td>
</tr>
<tr>
<td>No</td>
<td>110 (55.0)</td>
<td>60 (61.2)</td>
<td>50 (49.0)</td>
</tr>
<tr>
<td><strong>Stage of liver disease</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild or no liver fibrosis</td>
<td>102 (52.0)</td>
<td>51 (52.0)</td>
<td>51 (52.0)</td>
</tr>
<tr>
<td>Intermediate fibrosis</td>
<td>54 (27.6)</td>
<td>25 (25.5)</td>
<td>29 (29.6)</td>
</tr>
<tr>
<td>Compensated cirrhosis</td>
<td>21 (10.7)</td>
<td>14 (14.3)</td>
<td>7 (7.1)</td>
</tr>
<tr>
<td>Decompensated cirrhosis</td>
<td>19 (9.7)</td>
<td>8 (8.2)</td>
<td>11 (11.2)</td>
</tr>
<tr>
<td><strong>Hepatocellular carcinoma</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>9 (4.5)</td>
<td>5 (5.1)</td>
<td>4 (3.9)</td>
</tr>
<tr>
<td>No or not assessed</td>
<td>191 (95.5)</td>
<td>93 (94.9)</td>
<td>98 (96.1)</td>
</tr>
</tbody>
</table>
Primary outcome: Treatment completion

Treatment completion within 6 months
68.4% vs. 35.3% (absolute increase 33.1%)

Mixed effects logistic regression adjusted for secular trends and cluster effects: \( \text{aOR} 4.8 \) (95% CI 1.8-12.8)
The cascade of care: 6 months after enrolment

- Enrolled
- Prescribed
- Initiated
- Completed

<table>
<thead>
<tr>
<th></th>
<th>Intervention</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrolled</td>
<td>98</td>
<td>102</td>
</tr>
<tr>
<td>Prescribed</td>
<td>92</td>
<td>53</td>
</tr>
<tr>
<td>Initiated</td>
<td>84</td>
<td>47</td>
</tr>
<tr>
<td>Completed</td>
<td>67</td>
<td>36</td>
</tr>
</tbody>
</table>
Secondary outcome: Time to treatment initiation

Cox regression adjusted for secular trends and cluster effects:
aHR 3.5 (95% CI 2.3-5.3)
Subgroup analysis: Primary outcome

Accomplished primary outcome, n (%)

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Intervention</th>
<th>Control</th>
<th>Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Age</td>
<td>67/98 (68.4)</td>
<td>36/102 (35.3)</td>
<td>4.8 (1.8-12.8)</td>
</tr>
<tr>
<td>Age 20-34</td>
<td>12/20 (60.0)</td>
<td>9/19 (47.4)</td>
<td>2.2 (0.50-9.7)</td>
</tr>
<tr>
<td>Age 35-49</td>
<td>19/26 (73.1)</td>
<td>15/45 (33.3)</td>
<td>5.9 (1.6-21.9)</td>
</tr>
<tr>
<td>Age 50-80</td>
<td>36/50 (72.0)</td>
<td>12/36 (33.3)</td>
<td>6.5 (1.8-22.8)</td>
</tr>
<tr>
<td>Gender Male</td>
<td>48/96 (60.4)</td>
<td>27/76 (35.5)</td>
<td>5.1 (1.8-15.1)</td>
</tr>
<tr>
<td>Gender Female</td>
<td>19/29 (65.5)</td>
<td>9/26 (34.6)</td>
<td>4.2 (1.1-16.0)</td>
</tr>
<tr>
<td>Housing status Stable</td>
<td>41/64 (64.1)</td>
<td>26/60 (43.3)</td>
<td>2.7 (0.9-7.9)</td>
</tr>
<tr>
<td>Housing status Unstable</td>
<td>26/34 (75.0)</td>
<td>10/42 (23.8)</td>
<td>21.2 (4.8-93.2)</td>
</tr>
<tr>
<td>Recent injecting drug use Yes</td>
<td>41/58 (70.7)</td>
<td>23/63 (36.5)</td>
<td>5.1 (1.6-15.5)</td>
</tr>
<tr>
<td>Current opioid agonist therapy</td>
<td>26/38 (68.4)</td>
<td>17/52 (32.7)</td>
<td>4.4 (1.3-15.5)</td>
</tr>
<tr>
<td>Preferred injected drug Heroin</td>
<td>36/54 (66.7)</td>
<td>20/60 (33.3)</td>
<td>6.0 (1.8-20.5)</td>
</tr>
<tr>
<td>Heroin</td>
<td>21/31 (67.7)</td>
<td>11/32 (34.4)</td>
<td>4.1 (1.3-12.7)</td>
</tr>
<tr>
<td>Amphetamines/mixed</td>
<td>21/31 (67.7)</td>
<td>11/32 (34.4)</td>
<td>4.5 (1.5-13.8)</td>
</tr>
<tr>
<td>Liver cirrhosis yes</td>
<td>14/22 (63.6)</td>
<td>5/18 (27.8)</td>
<td>3.4 (0.9-12.7)</td>
</tr>
<tr>
<td>Liver cirrhosis No</td>
<td>53/76 (69.4)</td>
<td>30/80 (37.5)</td>
<td>5.2 (1.1-24.9)</td>
</tr>
<tr>
<td>Charlson Comorbidity Index 0-1</td>
<td>28/41 (68.3)</td>
<td>24/60 (40.0)</td>
<td>5.0 (1.7-14.2)</td>
</tr>
<tr>
<td>Charlson Comorbidity Index ≥2</td>
<td>39/57 (68.4)</td>
<td>12/42 (28.6)</td>
<td>3.9 (1.2-12.5)</td>
</tr>
<tr>
<td>Discipline Internal medicine</td>
<td>36/57 (63.2)</td>
<td>12/50 (24.0)</td>
<td>6.0 (1.8-19.8)</td>
</tr>
<tr>
<td>Discipline Addiction medicine</td>
<td>20/25 (80.0)</td>
<td>18/40 (45.0)</td>
<td>5.3 (2.0-13.6)</td>
</tr>
<tr>
<td>Psychiatry</td>
<td>11/16 (68.8)</td>
<td>6/12 (50.0)</td>
<td>4.6 (1.2-17.9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.1 (0.40-11.0)</td>
</tr>
</tbody>
</table>

Favors control  Favors intervention
Conclusions

• Opportunistic HCV treatment among hospitalized PWID was superior to a referral-based standard of care in terms of treatment completion and treatment initiation

• 33% absolute increase in treatment completion and 3.5 times increased hazard of treatment initiation

• The intervention effect was homogeneous across subgroups, also among the most marginalized

• Mortality was high and driven by liver disease (hepatocellular carcinoma) and end-stage renal disease

• Hospitalizations for drug-related harms is an opportunity to engage PWID in HCV care that should be utilized for testing and treatment

• The results could inform HCV elimination efforts internationally
3. HCV treatment uptake among marginalized people who inject drugs in Norway: A registry-based study, and the Progress towards elimination of hepatitis C among people who inject drugs in Norway
3. HCV treatment uptake in a risk population and the progress towards elimination of HCV

a. HCV treatment uptake among marginalized people who inject drugs in Norway: A registry-based study

b. Progress towards elimination of hepatitis C among people who inject drugs in Norway
3. HCV treatment uptake in a risk population and the progress towards elimination of HCV

a. HCV treatment uptake among marginalized people who inject drugs in Norway: A registry-based study

b. Progress towards elimination of hepatitis C among people who inject drugs in Norway
HCV treatment uptake among people who inject drugs: A registry-based study

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Acknowledgements

• The people who inject drugs in the city of Oslo who have generously contributed to this study
• Staff at the drug consumption room in Storgata for valuable insights
• Heather Valerio for contributing with valuable statistical insights
Background and aim

• Norway targets HCV elimination by 2023

• Improving HCV treatment uptake among people who inject drugs (PWID) is crucial to achieve the elimination targets

• **Aim of the study:** Assess HCV treatment uptake and associated factors, and HCV RNA prevalence in a large cohort of PWID in Oslo between 2010-2019
**Methods:** Flow chart of study population

- **All users of Oslo’s low-threshold social and health services for PWID (2010-2016)**
- **Linkage to HCV notifications (1990-2019) and prescriptions of HCV treatment, OAT and benzodiazepines (2004-2019)**
- **Factors associated with DAA treatment uptake analyzed using logistic regression**
Results: Treatment rates by year and period
## Results: Factors associated with treatment uptake

<table>
<thead>
<tr>
<th>Factor</th>
<th>Overall treatment uptake</th>
<th></th>
<th>Adjusted OR (95% CI)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unadjusted OR (95% CI)</td>
<td>p</td>
<td></td>
<td>p</td>
</tr>
<tr>
<td><strong>Factor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td>0.62 (0.39-1.00)</td>
<td>0.052</td>
<td>0.69 (0.43-1.12)</td>
<td>0.131</td>
</tr>
<tr>
<td>30-39</td>
<td>0.87 (0.65-1.16)</td>
<td>0.345</td>
<td>0.89 (0.67-1.19)</td>
<td>0.435</td>
</tr>
<tr>
<td>40-49</td>
<td>0.73 (0.55-0.96)</td>
<td>0.024</td>
<td>0.74 (0.56-0.97)</td>
<td>0.031</td>
</tr>
<tr>
<td>50-59</td>
<td>0.86 (0.65-1.14)</td>
<td>0.294</td>
<td>0.88 (0.67-1.16)</td>
<td>0.364</td>
</tr>
<tr>
<td>≥ 60</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (per 10- year increment)</td>
<td>1.05 (0.97-1.14)</td>
<td>0.185</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1</td>
<td>0.001</td>
<td>1</td>
<td>0.001</td>
</tr>
<tr>
<td>Female</td>
<td>0.74 (0.62-0.88)</td>
<td>0.74 (0.62-0.89)</td>
<td>0.043</td>
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</tr>
<tr>
<td>OAT status</td>
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<tr>
<td>Never/former</td>
<td>1</td>
<td>0.043</td>
<td>1</td>
<td>0.043</td>
</tr>
<tr>
<td>Current</td>
<td>1.20 (1.01-1.44)</td>
<td>1.21 (1.01-1.45)</td>
<td>0.043</td>
<td></td>
</tr>
</tbody>
</table>

Lisbon 2022       KB Kielland
Results: Treatment uptake and corresponding HCV RNA prevalence by age and gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age groups</th>
<th>Treatment uptake</th>
<th>HCV RNA prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>20-29</td>
<td>20.3 ± 0.4</td>
<td>48.2 ± 1.7</td>
</tr>
<tr>
<td>Female</td>
<td>20-29</td>
<td>33.0 ± 1.2</td>
<td>40.7 ± 1.2</td>
</tr>
<tr>
<td>Male</td>
<td>30-39</td>
<td>19.6 ± 1.1</td>
<td>39.1 ± 1.3</td>
</tr>
<tr>
<td>Female</td>
<td>30-39</td>
<td>21.7 ± 1.5</td>
<td>47.3 ± 1.8</td>
</tr>
<tr>
<td>Male</td>
<td>40-49</td>
<td>26.6 ± 2.0</td>
<td>42.8 ± 2.2</td>
</tr>
<tr>
<td>Female</td>
<td>40-49</td>
<td>25.8 ± 2.1</td>
<td>47.0 ± 2.3</td>
</tr>
<tr>
<td>Male</td>
<td>50-59</td>
<td>18.0 ± 1.0</td>
<td>50.8 ± 1.4</td>
</tr>
<tr>
<td>Female</td>
<td>50-59</td>
<td>13.8 ± 0.9</td>
<td>42.6 ± 1.2</td>
</tr>
<tr>
<td>Male</td>
<td>60-69</td>
<td>32.3 ± 2.4</td>
<td>47.2 ± 1.6</td>
</tr>
<tr>
<td>Female</td>
<td>60-69</td>
<td>32.3 ± 2.4</td>
<td>47.2 ± 1.6</td>
</tr>
</tbody>
</table>

Overall HCV treatment uptake 2010-2019: 45.9%
Estimated overall HCV RNA prevalence 31 Dec 2019: 23.6%
Conclusions

• Treatment uptake among PWID in Oslo increased in the DAA era

• Strategies to enhance treatment uptake among women and individuals not engaged in OAT should be addressed
3. HCV treatment uptake in a risk population and the progress towards elimination of HCV

a. HCV treatment uptake among marginalized people who inject drugs in Norway: A registry-based study

b. Progress towards elimination of hepatitis C among people who inject drugs in Norway
Elimination of chronic hepatitis C (CHC) among people who have injected drugs in Norway

Knut Boe Kielland
Norwegian National Advisory Unit on Concurrent Substance Abuse and Mental Health Disorders
Innlandet Hospital Trust
SELIHEP
WHO targets for elimination of hepatitis C

Goal: To eliminate viral hepatitis as a major public health threat by 2030

2016 Relative targets for hepatitis C in 2030

• Compared with the 2015 baseline:
  • 80% decline in incidence
  • 65% decline in mortality

2021 Absolute targets for 2030

• An annual HCV incidence of
  – ≤5 per 100 000 persons in the general population
  – ≤2 per 100 people who inject drugs (PWID)

Prevalence may serve as proxy for incidence in a disease which most often is without clinical symptoms the first 20 years
Estimated development of PWID (former and current) and CHC in Norway 1980-2030

Estimated development of PWID (former and current) and CHC in Norway 1980-2030

- Total number of PWID
- Number of former PWID
- Number of current PWID
- Number of CHC among all PWID

- Prevalent cases CHC among current and former PWID 31 December
- Deaths among PWID with CHC
- Re-infection after successful antiviral treatment

Number of current PWID
Number of former PWID
Total number of PWID
Number of CHC among all PWID
Estimated development of PWID (former and current) and CHC in Norway 1980-2030

- Total number of PWID
- Number of former PWID
- Number of current PWID
- Number of anti-viral treatments resulting in cure (SVR)
- Number of CHC among all PWID

Key:
- Green line: Number of current PWID
- Black line: Total number of PWID
- Red line: Treatments with accomplished SVR (SVR estimated: 1997-2013: 60%, 2014-15: 80%, 2016+: 95%)
- Blue line: Re-infection after successful antiviral treatment
- Orange line: Emigrated among PWID with CHC (0.15%)
- Light blue line: Prevalent cases CHC among current and former PWID 31 December
- Dark blue line: Deaths among PWID with CHC

Number of current PWID
- 1980: 0
- 2030: 250,000

Number of former PWID
- 1980: 0
- 2030: 200,000

Total number of PWID
- 1980: 100,000
- 2030: 500,000

Number of anti-viral treatments resulting in cure (SVR)
- 1997-2013: 60%
- 2014-2015: 80%
- 2016+: 95%
Estimated development of CHC among former and current PWID in Norway 1960-2030

- Treatments with accomplished SVR (SVR estimated: 1997-2013: 60%, 2014-15: 80%, 2016+: 95%)
- Prevalent cases CHC among current and former PWID 31 December
HCV test results among PWID in Oslo 2002-2022

HCV RNA+  Anti-HCV+

2002: 79% 49% 79% 46%
2003: 76% 48% 76% 46%
2004: 74% 42% 74% 42%
2005: 73% 40% 73% 40%
2006: 73% 39% 73% 39%
2007: 68% 33% 68% 33%
2008: 71% 43% 71% 43%
2009: 68% 43% 68% 43%
2010: 67% 43% 67% 43%
2011: 59% 46% 59% 46%
2012: 61% 46% 61% 46%
2013: 60% 46% 60% 46%
2014: 60% 46% 60% 46%
2015: 60% 46% 60% 46%
2016: 60% 46% 60% 46%
2017: 26% 14% 26% 14%
2018: 14% 9% 14% 9%
2019: 9% 9% 9% 9%
2020: 9% 9% 9% 9%
2021: 9% 9% 9% 9%
2022: 9% 9% 9% 9%
CHC among HCV-exposed PWID in Oslo 2002-2022
(= HCV RNA/anti-HCV ratio)

HCV RNA+/anti-HCV+
Estimated number of CHC among current and former PWID in Norway 2015-2030

First-time Incident cases of chronic hepatitis C among PWID
Treated with SVR (SVR estimated: 1997-2013: 60%, 2014-15: 80%, 2015+:95%)
Re-infection after successful antiviral treatment
Emigrated among PWID with CHC (0.15%)
Deaths among PWID with CHC
Prevalent cases CHC among current and former PWID 31 December
Estimated number of CHC among current and former PWID in Norway 2015-2030

- First-time Incident cases of chronic hepatitis C among PWID
- Treated with SVR (SVR estimated: 1997-2013: 60%, 2014-15: 80%, 2015+:95%)
- Re-infection after successful antiviral treatment
- Emigrated among PWID with CHC (0.15%)
- Deaths among PWID with CHC
- Prevalent cases CHC among current and former PWID 31 December
Estimated CHC incidence and prevalence among PWID
2015-2030 compared to 2015

- CHC prevalence among PWID 31 Dec each year 2015-2030 compared to 2015
- CHC incidence among PWID 2015-2025 as fraction of the incidence in 2015

Reduction 80% compared to 2015
CHC incidence per 100,000 in Norway

WHO target for 2030
CHC incidence in Norway per 100 current PWID

WHO target for 2030
Conclusions

• We estimate that WHO’s relative target for 2030 concerning incidence of CHC will be reached in 2025

• The absolute target of an incidence of less than 2/100 PWID may have been reached in 2018

• The absolute target of incidence less than 5/100 000 in the general population was accomplished in 2021

• We are working on the relativ targets for HCV-related mortality
THANK YOU!

Questions and Comments are welcome!
Study implications

- Oslo municipal hepatitis C elimination strategy (2018)

- New national treatment guidelines for hepatitis C (2022)