HIV outbreaks among people who inject drugs in Europe, North America, and Israel

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During 2011–16, HIV outbreaks occurred among people who inject drugs (PWID) in Canada (southeastern Saskatchewan), Greece (Athens), Ireland (Dublin), Israel (Tel Aviv), Luxembourg, Romania (Bucharest), Scotland (Glasgow), and USA (Scott County, Indiana). Factors common to many of these outbreaks included community economic problems, homelessness, and changes in drug injection patterns. The outbreaks differed in size (from under 100 to over 1000 newly reported HIV cases among PWID) and in the extent to which combined prevention had been implemented before, during, and after the outbreaks. Countries need to ensure high coverage of HIV prevention services and coverage higher than the current UNAIDS recommendation might be needed in areas in which short acting drugs are injected. In addition, monitoring of PWID with special attention for changing drug use patterns, risk behaviours, and susceptible subgroups (eg, PWID experiencing homelessness) needs to be in place to prevent or rapidly detect and contain new HIV outbreaks.

Introduction

Three generations of HIV epidemics among people who inject drugs (PWID) can be identified. The first generation occurred in the late 1970s to early 1980s, before there was awareness of HIV/AIDS among PWID as a global public health problem. Examples include New York, USA (peak seroprevalence in the early 1980s of 55–60%),[1] Amsterdam, Netherlands (peak seroprevalence in 1986–87 of 34%),[2] and Edinburgh, UK (peak seroprevalence in the mid-1980s of 65%).[3]

The second generation of outbreaks occurred during the late 1980s and through the 1990s after development of the antibody test, knowledge that HIV outbreaks and HIV transmission among PWID could be controlled through large-scale syringe access programmes, and development of trusting relationships between PWID and local public health authorities.[4] Locations that have had previous HIV epidemics among PWID during this period include France (1993), Italy (1994), Spain (1994), Portugal (1995), and Vancouver, Canada (1997), and Ireland, the Netherlands,[5] and Finland (all before 2001) and Eastern Europe (Estonia, Russia, and Ukraine 2000–10).[6,7]

However, by 2000, the practice of combined prevention and care for HIV among PWID and the concept of monitoring intervention coverage had been fully developed.[8] Combined prevention and care emphasises simultaneous, high coverage of needle and syringe programmes, opioid substitution treatment, and antiretroviral therapy (ART) for HIV infection, within a so-called harm reduction framework. The combined prevention approach has been successful in preventing outbreaks in many areas—eg, Hawaii (USA), Tacoma (WA, USA), and England (UK)—and has interrupted transmission of HIV in high prevalence epidemics among PWID.[9–11]

Despite the many successes of combined prevention and the large evidence base for preventing HIV transmission among PWID, we are now in a third generation of HIV outbreaks among PWID in high-income countries (eg, Estonia, Finland, Iceland, Lithuania, and Sweden).[7,12–17] For the purposes of this Review, we used a WHO definition of an outbreak: "a disease outbreak is the occurrence of cases of disease in excess of what would normally be expected in a defined community, geographical area or season."[18]

Identifying HIV outbreaks

A research group of public health professionals working on outbreaks of HIV among PWID in the WHO European region and North America was formed by the European Monitoring Center for Drugs and Drug Addiction (EMCDDA) to do a review of HIV outbreaks that occurred between 2000 and 2019 in high-income settings.[19] Contacts were established within North American HIV surveillance organisations (Centers for Disease Control and Prevention in the USA and Health Canada) leading to identification of additional outbreaks. Data and related information about HIV outbreaks reported in conferences and in scientific journals were collected from experts in each of the HIV outbreak locations[20–41] (appendix, p 8).

Between 2011 and 2016, HIV outbreaks occurred among PWID in Greece (Athens),[20–26] Romania (Bucharest),[27–30] Ireland (Dublin),[31,32] Scotland (Glasgow),[33,34] Luxembourg,[35,36] Canada (Saskatchewan),[37,38] USA (Scott County, IN),[39,40] and Israel (Tel Aviv).[41]

All eight outbreak settings had HIV case reporting in place, which was a key factor in detecting that there was an outbreak occurring (table 1). All outbreak settings except two (southeastern Saskatchewan, Canada and Tel Aviv, Israel) had an estimate of the PWID population available for the local area, showing a very large range in estimated population sizes (range 500–18 500 people in the local area). The estimated population size for

	Surveillance of new PWID cases (to identify outbreak)	Estimate of PWID population	Changes in drug use patterns used by PWID	Contact tracing investigation	Increase in HIV testing for PWID	Cohort study to examine incidence and risk factors	Case control or cross-sectional study to examine risk factors and associations	Qualitative interviews with stakeholders	Phylogenic analysis on cases
Study location									
Athens, Greece	Yes	Yes (n=1976)	No	No	Yes	Yes	Yes	Yes	Yes
Bucharest, Romania	Yes	Yes (n=18 500)	Yes	Yes	No	No	No	Yes	Yes
Dublin, Ireland	Yes	Yes (n=13 480)	Yes	Yes	Yes	No	Yes	Yes	Yes
Tel Aviv, Israel	Yes	Yes (n=20 000)*	Yes	Yes	Yes	Yes	No	Yes	Yes
Luxembourg	Yes	Yes (n=1500)	Yes	No	Yes	No	Yes	Yes	Yes
Scott County, IN, USA	Yes	Yes (n=500–600)	Yes	Yes	Yes	No	Yes	Yes	Yes
Glasgow, Scotland, UK	Yes	Yes (n=8862)	Yes	Yes	Yes	No	Yes	Yes	Yes
Southeastern Saskatchewan, Canada	Yes	No	Unknown	Yes	Yes	No	Yes	Yes	Yes
Summary of studies	8 of 8	7 of 8 (range 500–20 000) 500–20 000	6 out of 8	6 out of 8	7 out of 8	2 out of 8	6 out of 8	8 out of 8	8 out of 8

PWID=people who inject drugs. *Estimate is for country level population of PWID.

Table 1: **Methods used to identify and study HIV outbreaks**

Israel was a country-level estimate of 20 000 people. All of the outbreaks occurred in high-income countries except for the outbreak in Romania (classed as a high middle-income country by the World Bank income classification).

Interventions that were used to contain HIV outbreaks

All of the outbreak settings had multiple interventions, with almost all areas implementing or increasing coverage of standard combined prevention of needle and syringe programmes, opioid substitution treatment, and ART (table 2). As described in the publications from the outbreak settings and case histories (appendix pp 1–4), there was considerable variation in time taken to implement various interventions and the current level of coverage of those interventions. Implementation of the interventions often occurred over years; for example, there was substantial community resistance and hostility to implementing interventions in Scott County, IN, USA.

	Education for PWID	Education for service providers	Increased HIV testing	Increased NSP programming or distribution	Increased opiate substitution treatment	Increased antiretroviral therapy
Study location						
Athens, Greece	Yes	Yes	Yes	Yes	Yes	Yes
Bucharest, Romania	Yes	Yes	Yes	Yes	No	No
Dublin, Ireland	Yes	Yes	Yes	Yes	Yes	Yes
Tel Aviv, Israel	Yes	Yes	Yes	Yes	Yes	Yes
Luxembourg	Yes	Yes	Yes	Yes	No	Yes
Scott County, Indiana, IN, USA	Yes	Yes	Yes	Yes	Yes	Yes
Glasgow, Scotland, UK	Yes	Yes	Yes	Yes	Yes	Yes
Southeastern Saskatchewan, Canada	Yes	Yes	Yes	Yes	No	Yes
Summary of studies	8 of 8	8 of 8	8 of 8	8 of 8	5 of 8	7 of 8

PWID=people who inject drugs. NSP=needle and syringe programmes.

Table 2: **Interventions to contain the HIV outbreaks**

Details of the individual outbreaks

Newly reported cases before the outbreaks ranged from less than one case to 20 cases per year, increasing to a range of 16 to 525 cases during the peak year or years of the outbreaks, then decreasing to between two and 108 cases per year at the end of 2018 (table 3). Seven of the eight outbreak settings expanded HIV testing for high-risk populations or PWID, which most likely resulted in a peak of detected cases (table 2). There were a lot of similarities in the methods used to assess the outbreaks (table 1) and interventions implemented to contain the outbreaks (table 2), but there was wide variation in the current status of the outbreaks (table 3). In some outbreaks (eg, Luxembourg, Tel Aviv), the current rate of new cases is back at or close to the pre-outbreak level, whereas in other locations (Athens, Bucharest, Glasgow) the current rate of new cases in 2018 was still higher than the pre-outbreak rate.

Further information collected included an estimate of the level of combined prevention coverage (opioid substitution treatment, needle and syringe programmes, ART) at the time of the outbreak, community economic problems associated with the outbreak, and changes in drug use patterns and information on highly susceptible groups (table 3).

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See Online for appendix

	Year outbreak first observed	Pre-outbreak HIV prevention services*	Reduction in prevention services (eg, OST, NSP etc.)?	Pre-outbreak number of HIV cases per year (PWID)* †	Peak outbreak HIV rate (PWID)* †	Previous economic problems	Highly susceptible subgroups	Changes in drug injection patterns	Current HIV case count	Percentage of cases among all cases attributable to PWID during outbreak period
Study location										
Athens, Greece	2011	Low	No	10 to 20	525 cases over a one-year period (2012)	Economic recession	People who are homeless	No	~106 cases per year (2018)	50·4%
Bucharest, Romania	2011	Medium	Yes	5 to 12	308 cases per year	Poverty	MSM, PWID, and CSW	Increase in synthetic drug use (ie, legal highs such as bath salts)	~80 cases per year (2018)	20 to 25%
Dublin, Ireland	2014	High	No	10 to 20	57 cases over two-year period (2014 to 2015)	Economic recession	People who are homeless	Increase in daily "snow blow" (a psychoactive drug) injections	~10 cases per year (2018)	7·4% to 10·1%
Tel Aviv, Israel	2012	High	Yes	~40	73 cases over one-year period (2012)	No	People who are homeless involved in sharing new synthetic cathinones without single paraphernalia and reusing paraphernalia	Increase in synthetic cathinone	~25 cases per year (2016)	14·2% to 15·3%
Luxembourg	2013	Medium	No	<4	68 cases over four-year period (2013 to 2017)	Precarious economic situation of PWID	People who are homeless	Increase in cocaine supply, decrease in heroin supply	4 cases (2018)	10·7% to 22·3%
Scott County, Indiana, USA	2014	None	No	<1	227 cases over three-year period (2015 to 2017)	Low employment rates	Multi-generational family use	Prescription oxymorphone injection	10 cases (2018)	>95%
Glasgow, Scotland, UK	2015	High	No	~10	48 cases over a one-year period (2015)	Austerity	People who are homeless, involved in criminal justice system	Heroin with cocaine injection (so-called "snowballing")	26 cases (2019)	25%
Southeastern Saskatchewan, Canada	2016	Medium	No	<1	16 cases over two-year period (2016 to 2017)	High prevalence of poverty in Indigenous First Nations communities	People who are homeless, First Nations Indigenous populations, and rural residents	Unknown Hydromorphone, cocaine, and morphine were commonly reported	2 cases (2018)	73%
Summary of studies	Range: 2011 to 16	1 none; 1 low; 3 medium; 3 high	2 out of 8	Range: <1 to 20	Range: 16 to 547 HIV cases (during outbreak period)	7 out of 8	People who are homeless: 6 out of 8	5 out of 8	Range: 2 to 93 cases	7·4% to >95%

CSW=commercial sex workers. MSM=men who have sex with men. NSP=needle and syringe programmes. OST=opioid substitution treatment. PWID=people who inject drugs. *Coverage according to UNAIDS Technical Guidelines (for OST: low, 0–20%; medium, 20–40%; high ≥40%). †PWID cases only; coverage according to UNAIDS Technical Guidelines (for NSP: low, 0–100 syringes per PWID; medium, 100–200 syringes per PWID; high, ≥200 syringes per PWID).

Table 3: **Outbreak case details**

The size of the different HIV outbreaks

The size of the different outbreaks is an important epidemiological factor that requires some consideration. Larger outbreaks involve greater burdens of disease, greater possibilities of transmission (eg, injecting drug use or sexual transmission), greater need for resources that control the outbreak, and a greater likelihood of new HIV transmissions in other areas (depending on how many HIV seropositive PWID had travelled to other areas).

Precise quantification of the size of these outbreaks is difficult for several reasons. First, HIV testing and surveillance was inadequate in many areas before the outbreaks, so the pre-outbreak rates were likely to have been underestimated. Second, many outbreaks are technically still ongoing as the rates of new diagnoses are yet to return to pre-outbreak levels. Finally, the number of identified cases also depended on the extent of testing in each area. Despite these difficulties, we consider four

outbreaks—Athens, Bucharest, Glasgow, and Scott County—to have been large with at least 150 new HIV diagnoses above pre-outbreak rates. In all of these large outbreaks the rate of new HIV diagnoses has not returned to the pre-outbreak level (table 3).

In three of the large outbreaks—Athens, Bucharest, and Glasgow—the estimated size of the local PWID population was 5000 or more, which is relatively large in comparison with the other outbreak settings. However, in Scott County, the estimated local PWID population was moderate—500 to 600 people. A high local PWID population increases the likelihood of a large outbreak but is not a necessary condition. Note also that the Tel Aviv outbreak was not large with 73 new HIV infections in 2012 (prior to the outbreak there was an average of approximately 40 cases of HIV among PWID per year for the entire country) despite the estimated PWID population (approximately 20 000 people) for Israel was relatively high.

Common factors among the outbreaks

Limited prevention at the time of the outbreak

In Scott County there was no opioid substitution treatment, no ART, and syringe exchange was non-existent and illegal. In Bucharest, HIV prevention services had been based on international (Global Fund) funding which was stopped. In Athens, the coverage of harm reduction programmes was very low with an estimated coverage of around 16 syringes per PWID per year (in 2010), and had an opioid substitution treatment coverage of around 21% with a 7-year waiting list.[23] In Tel Aviv, service provision was high but declined before the outbreak, no specific reason is given for this decline. Community economic problems also led to reductions in HIV prevention services before the outbreak in Dublin. Saskatchewan had medium coverage for prevention services for PWID in the outbreak area; however, these services were concentrated in urban centres, and Indigenous Canadian PWID who lived on reserves probably did not access these services at the same rate as PWID who lived in the urban centres.

Homelessness

There was a distinct concentration of new HIV infections among PWID experiencing homelessness in six of the eight outbreak settings; the areas where this did not apply were Bucharest and Scott County. Additionally, homelessness was identified as a risk factor for being HIV positive and for HIV seroconversion during the outbreak in Athens.[22,24,25] In Glasgow, the city centre contained many PWID experiencing homelessness, around 60% of whom had a history of frequent (>5 times) incarceration, whose situation might have been negatively affected by austerity budgets.[42]

Community economic problems

Seven of the eight outbreaks were preceded by severe economic problems in the community. The outbreak in Luxembourg was not preceded by severe economic problems but the economic situation of PWID had deteriorated before the outbreak. It is likely that these economic problems contributed to increased homelessness, social problems among PWID, and reductions in combined prevention. Three of the largest outbreak settings (Athens, Bucharest, and Scott County) had severe economic difficulties.

Athens (and all of Greece) had experienced a severe recession, leading to large reductions in public health services.[43] The recession in Greece coincided with economic problems in other Mediterranean and Middle Eastern countries and migration of PWID from those countries to Greece. Some of these PWID who had migrated to Greece were HIV seropositive and started HIV transmission chains in Athens that exacerbated the transmission chains among native Greek PWID. However, subsequent analysis showed that the majority of infections among migrants occurred after migration.[43] Migrant PWID constitute a susceptible group: they had low access to services due to their often illegal status and subsequent analyses have shown that the majority of infections among them occurred after migration.[44] Similar findings have been reported from Catalonia, Spain.[45]

In Bucharest, most of the PWID who were infected with HIV were young men (15–34 years) living in the suburbs with low socioeconomic status, and who had histories of incarceration. Scott County is an economically depressed area and was among the poorest counties in the state of Indiana in terms of both economic and health indicators. In Glasgow, austerity policies have potentially affected the numbers of individuals experiencing homelessness and the services available to support them.[42]

Change in injection patterns

A common factor in six of the eight outbreaks was changes in drug injecting patterns. These changes involved drugs with shorter effect duration, leading to more frequent injection and much greater need for sterile injecting equipment. In Bucharest, short-acting new psychoactive substances, so-called bath salts, were injected. In Scott County, the change was from non-injecting use to injection of oxymorphone, prepared from dissolved prescription tablets. The large volumes of drug solution from the dissolved tablets often led to multiple injections within a single injecting episode.[40]

The factors associated with the Glasgow outbreak were the introduction of cocaine injection and PWID experiencing homelessness who were a highly vulnerable group with high (~60%) levels of frequent incarceration.[33] Cocaine injection creates particular problems for HIV prevention among PWID. Opioid substitution treatment is specific to opioid use disorders and is not expected to have a major effect on cocaine injecting. Even the 2016 WHO-recommended standard of 300 syringes per PWID per year[46] might not be adequate to prevent HIV

transmission associated with cocaine injection. Because of the short duration effect of injected cocaine, people can inject cocaine ten to 20 times in a single day.[37,47] PWID often work together to purchase drugs, then divide the drugs and inject together. If multiple injections occur in a group setting, it is difficult to have enough supplies of sterile syringes to avoid sharing. Group injection of cocaine is therefore associated with needle sharing, particularly if members confuse which syringe belongs to whom or if a syringe should become clogged or jammed (panel).[48]

HIV prevention in Glasgow before the outbreak deserves additional comment. Glasgow had implemented HIV prevention for PWID in the 1980s and had a low rate of new HIV diagnoses before the outbreak (panel).[34] The outbreak in Glasgow has multiple similarities to the large HIV outbreak in Vancouver, Canada, in which increased cocaine injection was also followed by a great increase in HIV incidence.[49,50]

Lessons learned from HIV outbreaks among PWID

Overall complacency towards maintaining low HIV incidence among PWID

In all eight outbreak settings, the rates of newly diagnosed cases of HIV among PWID were low before the outbreak. The attitude towards HIV prevention in several of the settings before the outbreaks was one of complacency,[51] which was caused by the low coverage of or declining investments in harm reduction (mainly opioid substitution treatment and needle and syringe programmes), in what had always been low HIV prevalence settings. Scott County might be the clearest example of complacency. Before the outbreak, Scott County had experienced an epidemic of opioid analgesic use that had transitioned from non-injecting to injecting use. Despite this transition, there were essentially no HIV prevention services for PWID, and no needle and syringe programmes as they were illegal at this time. Another example where there was complacency towards maintaining low HIV incidence among PWID is Athens, where HIV prevention programmes existed at a minimal level before the outbreak.

The budget reductions for HIV prevention services that occurred in some outbreak settings (eg, Bucharest and Dublin) is a variant of complacency. A typical cycle in public health exists in which funding for prevention efforts is reduced because problems are not visible, followed by a substantial increase in numbers of cases after prevention efforts are reduced (eg, tuberculosis in the USA).[52]

We would also add that complacent attitudes can exist among front-line service workers, PWID, public health officials, and funding decision makers. Before the outbreak, new cases of HIV among PWID were so rare in Glasgow—approximately ten new cases per year in an estimated PWID population of approximately 9000—that HIV prevention was no longer salient for the staff of drug service agencies or for PWID.

Panel: **Details of HIV outbreak in Glasgow, Scotland, UK**

Dates

- 2015–19 (outbreak ongoing)

Size

- Over 160 new HIV cases among PWID (compared with typically ten new diagnoses per year); HIV prevalence among PWID increased from 0·1% to 4·8% in Glasgow and from 1·1% to 10·8% in Glasgow city centre during the outbreak
- Almost all HIV cases were subtype C and had Glu138Ala and Val179Glu mutations in the reverse transcriptase region that led to resistance to non-nucleoside reverse transcriptase inhibitors

Previous conditions and precipitating factors

- Transmission networks among a population who inject psychoactive drugs within Glasgow city centre, with increased cocaine injecting (reaching up to 77% of PWID in 2017–18)

Highly susceptible subgroups

- PWID experiencing homelessness (approximately 45% of newly identified HIV seropositive PWID were homeless), with high levels of incarceration or involvement in the criminal justice system

Public health response and current situation

- Education of the at-risk population and addiction services staff to increase awareness of the risks of HIV
- Increasing capacity of needle and syringe programmes (eg, greater evening availability), improving the frequency of HIV testing and its accessibility, and proactively supporting the early treatment of newly diagnosed individuals to reduce the risk of onward transmission

PWID=people who inject drugs.

Complacency was common across these outbreak sites but it might not have been a factor in all sites. In Tel Aviv, opioid substitution treatment was being expanded before the outbreak. The outbreak in Luxembourg also occurred without a reduction in HIV prevention services.

Community economic problems and vulnerability to substance use

Community economic problems served as a rationale for reductions in HIV prevention services in many outbreak locations. Other ways in which economic problems might have contributed to the outbreaks exist, such as HIV seropositive PWID moving into the area (Athens), increased unemployment, and increased homelessness (an individual-level risk factor for becoming HIV infected in six of the eight outbreaks).[5,45]

We were not able to collect information on the causal pathways for HIV transmission among PWID experiencing homelessness in the outbreak settings. Previous studies of

homeless PWID attending syringe exchange programmes in various locations found higher rates of injecting risk behaviour among these PWID compared with PWID who had stable housing.[45,51–56] Multiple ways in which homelessness could contribute to HIV transmission exist eg, not having safe places to store sterile injection equipment, associating with large numbers of other PWID experiencing homelessness (increasing the likelihood of having different injecting partners in short periods of time), and having pressing competing priorities in addition to safer injecting (eg, obtaining food and shelter).[57–59] These findings suggest that combined HIV prevention measures for PWID might have to be broadened to focus on services for homelessness and other highly susceptible groups of PWID. We would recommend that efforts to reduce homelessness among PWID be done within a harm reduction and housing first[61] framework, in which people do not need to cease drug use before receiving services.

The importance of changes in patterns of drug use

Changes in patterns of drug use occurred in six of the outbreak settings. In Scott County, the change was from non-injecting to injecting use of opioid analgesics. Other changes included shorter-acting drugs (cocaine, novel psycho-active substances) that generated higher frequencies of injection, meaning previous supplies of sterile injecting equipment were probably no longer sufficient to control HIV transmission. Note that an earlier outbreak of HIV occurred among PWID in Vancouver, Canada, in association with a large increase in cocaine injection.[49] Opioid substitution treatment, which is a mainstay of HIV prevention among people who inject opioids, could have little utility for reducing injection of cocaine and other stimulant drugs.[45]

Need for a proactive approach

In contrast to an attitude of complacency, we propose the need for a proactive attitude towards maintaining low HIV incidence. A proactive attitude would include ongoing monitoring of intervention coverage and quality (opioid substitution treatment, needle and syringe programmes, ART),[8,63,63] social and economic environment of drug use,[64] changes in patterns of drug use, and changes in injecting and sexual risk behaviour.[65] Monitoring a local drug use situation should include regular bio-behavioural surveys in addition to standard HIV and viral hepatitis case surveillance (apart from their own public health relevance, increases in viral hepatitis could act as an early warning sign of increases in injecting risk before an HIV outbreak).[7] Monitoring should also include regular evaluation (eg, in stakeholder meetings at both local and national level) of soft information from drug users, outreach workers, drug services, police, and other front-line workers.

Monitoring particularly susceptible subgroups—such as PWID experiencing homelessness, PWID who have migrated to the country, and PWID not in contact with services—is also of vital importance as these are the subpopulations likely to be affected first in the case of an outbreak. Community-based programmes implementing chain referral recruitment (eg, respondent-driven sampling), such as the ARISTOTLE programme in Athens,[22,24,25] or repeated cross-sectional studies[33] as in Glasgow are suitable to identify these hard-to-reach subpopulations. Key factors to be monitored would include drugs being injected, particularly how often drugs were injected, risk behaviours, including sharing and injecting in group settings, ability to obtain and store adequate supplies of sterile injection equipment, and sexual risks (eg, sex work by PWID experiencing homelessness). Rapid oral HIV testing might be used to detect new infections. The key concept in a proactive attitude is to expect and be prepared for changes in the local drug use situation. Another important element of a proactive attitude to monitoring PWID is continually addressing stigmatisation of PWID and community resistance to providing services to PWID—eg, by meaningfully involving PWID and community representatives in the planning and coordination of the monitoring system.

Finally, a proactive attitude should also include contingency planning for rapidly containing any outbreak that is detected.

Need for further research

To our knowledge, this is the first comparative analysis of 2010–19 outbreaks of HIV infection among PWID in North America, Europe, and Israel. This study included a modest number of outbreaks and most of the data had to be collected retrospectively. Despite these limitations, we identified many common factors that occurred in the outbreaks: inadequate prevention programming before the outbreak, community economic problems (including PWID experiencing homelessness, who are a highly susceptible group), and changes in patterns of drug use. We have not yet identified causal pathways that would permit us to classify various factors as necessary or sufficient causes of an outbreak. There have been several additional HIV outbreaks in the past 3 years among PWID that have been reported since this research project began—eg, in the USA (Lowell and Lawrence, MA,[66] Seattle, WA,[67] and multiple countries in West Virginia)[68] and Taiwan.[69] Such outbreaks need to be included in future analyses. It will also be essential to include comparisons with areas that have varying degrees of HIV prevention services, homelessness among PWID, and changes in patterns of drug use but have not experienced outbreaks so that causal pathways for outbreaks can be identified.

Three particular questions should be considered when identifying the causal pathways for outbreaks. First, what are the conditions that generate stable low HIV prevalence and very low HIV incidence in PWID populations? Second, what types of perturbations in a stable low prevalence or very low HIV incidence situation could generate outbreaks? The data presented here suggest

Search strategy and selection criteria

We searched the literature and news reports for documentation of HIV outbreaks that occurred in among people who inject drugs (PWID) in North America or the WHO European region (which includes Israel). Data for this Review were identified through searches of MEDLINE, PubMed, and Web of Science, as well as from references from relevant articles using the search terms "HIV," "Disease Outbreaks," and "Substance Abuse, Intravenous" or "Injection Drug Use". Articles that were published from January, 2009 to November, 2019 in the English language were included. The unit of analysis was each outbreak site. A standardised template for data collection was developed for structured comparisons of the outbreaks. The initial template included the following variables for each outbreak: dates, size, previous conditions, potential precipitating factors, vulnerable subgroups of PWID, and public health responses for the outbreaks. The template was used to generate case histories for each outbreak. The template was refined and additional data collected through multiple rounds of data collection and analysis by the group members. The tables in the Review served as the final templates.

inadequate HIV prevention services or reductions in HIV prevention services, increases in homelessness, and changes in drug injection patterns all might facilitate outbreaks. Finally, how can incipient HIV outbreaks within PWID populations be quickly identified and contained, particularly outbreaks due to changes in patterns of drug injection? Answering these questions will require a larger sample of outbreaks (which unfortunately is likely to be available soon), as well as analyses of sites where outbreaks have not occurred.

This Review suggests a need for re-examining the present technical guidelines for HIV prevention and care for PWID, particularly for settings in which cocaine or other short-acting drugs are being injected. Even a standard of one syringe per PWID per day (~300 syringes per year) might not be enough for short-acting drugs. Recommendations for opioid substitution treatment might not be meaningful in situations in which stimulant drugs are being injected. Specific guidelines for highly susceptible sub-populations, such as PWID experiencing homelessness, might be needed. The fact that a large outbreak occurred in Glasgow, with its long history of effective HIV prevention, shows the need for adapting HIV prevention guidelines to the current outbreak era that includes a wide variety of injected drugs and susceptible subgroups, such as PWID who are homeless.

Conclusions

Despite the success of combined prevention and care for HIV among PWID in many areas in North America and Europe,[70] multiple outbreaks of HIV among PWID have occurred over the past decade. There is important variation among these outbreaks; however, common factors in many of the outbreaks have included inadequate or disrupted HIV prevention services, community economic problems, changes in the patterns of drugs injected, and PWID experiencing homelessness as a highly susceptible subgroup. Successful long-term maintenance of low rates of new HIV infections among PWID needs to be based on a proactive attitude, high coverage of combined prevention programmes (particularly for highly susceptible subpopulations), continuous monitoring of the local drug use situation, and previous planning for addressing an outbreak.

Contributors

LW and VS conceived and assembled a European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) working group to compare HIV outbreaks among people who use drugs in Europe. DCDJ and DB assembled HIV outbreaks from North America. DCDJ and JF wrote the different versions of the manuscript and LW and JF handled data management. AOA, VA, DB, DC, CS-D, JMD, MF, DJG, AH, REJ, EKa, EKe, IK, SK, AM, VS, SS, and LW all contributed data and important information for the particular HIV outbreaks included in the report. All authors were involved in revising the manuscript and have approved the final manuscript for submission.

Declaration of interests

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