Establishment of a sentinel surveillance network for sexually transmissible infections and blood borne viruses in Aboriginal primary care services across Australia: the ATLAS project

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Abstract

Background Sexually transmissible infection (STI) and blood-borne virus (BBV) notification data is a mainstay of the Australian National Notifiable Diseases Surveillance System (NNDSS) and is a mandatory requirement in all Australian jurisdictions. The system focuses on STI and BBV diagnoses alone, without testing, treatment or management data, leaving major gaps in the understanding of epidemics, especially among priority populations like Aboriginal and Torres Strait Islander peoples. Further information is required to supplement the NNDSS to better understand epidemics, the impact of interventions and health care delivery against clinical guidelines. Here we describe the rationale, processes and expected outcomes of establishing a national STI and BBV sentinel surveillance network in Aboriginal primary care services—known as the ATLAS network.Methods Researchers invited participation and consultation with Aboriginal Community-Controlled Health Services (ACCHS) clustered in five clinical hubs across four jurisdictions, representative of urban, regional and remote regions. Site-specific participation agreements were developed for each clinical hub and individual ACCHS. De-identified electronic medical record (EMR) data relating to STI and BBV testing, treatment and care are collected passively from each health service via the GRHANITE tm data extraction tool. These data are analysed centrally to inform 12 performance indicators which are included in surveillance reports generated for each health service and clinical hub.Results The ATLAS network currently involves 29 ACCHS representing all five clinical hubs. The ATLAS network provides detailed surveillance reports to individual ACCHS as well as contributing to aggregate comparative analyses at the clinical hub, jurisdictional and national levels. Data derived from the ATLAS network is used to assess clinical practice within each site. Aggregated data will inform clinical guidelines and extend the research potential of participating ACCHS sites. The ATLAS infrastructure can be expanded to include other health services and potentially linked to other data sources using GRHANITE.Conclusions The ATLAS network will supplement the NNDSS and contribute to improved understanding of local, regional and national patterns of clinical care of STI and BBV to inform clinical practice, policy, and program-planning.

Background

Aboriginal and Torres Strait Islander (hereafter, respectfully, Aboriginal) people represent three percent of Australia's total population (1) and are recognised as the First Peoples of Australia. The overall health status of Aboriginal peoples is poor in comparison to the non-Aboriginal population, an inequality largely driven by the ongoing impact of colonisation and poor progress in achieving equitable outcomes in social and economic determinants of health (2).

Aboriginal people are identified as a priority population for control of sexually transmissible infections (STI) and blood-borne viruses (BBV). Despite significant advances in the prevention, treatment and management of STI and BBV, the burden of these diseases among Aboriginal populations is much higher than in other populations in Australia. (3). Diagnosis rates of chlamydia, and gonorrhoea are reported at between 3–5 and 3–30 times higher than those for non-Aboriginal Australians, respectively. An ongoing syphilis outbreak spanning four jurisdictions and amassing over 2,400 cases since 2011 continues to

predominantly affect Aboriginal heterosexual people aged 16–29 living in remote communities of Australia (4). In the case of BBV, increasing notification rates of both hepatitis C and HIV among Aboriginal people are of concern, given that over the last five years, diagnoses rates among non-Aboriginal people have stabilised or decreased (3).

Asymptomatic and untreated STI and BBV can cause significant morbidity and impacts on reproductive health as well as high levels of ongoing transmission (5-8). Importantly, STI play an important role in facilitating HIV transmission (9). Untreated BBV also lead to increased morbidity and mortality from liver failure, hepatocellular carcinoma, and the sequelae of HIV (10). STI and BBV are associated with significant stigma and shame and can play a role in relationship breakdowns and domestic violence, compromising social and emotional wellbeing (11, 12). Accordingly, proactive approaches to diagnose and treat STI and BBV early are required.

Primary health care services in Australia diagnose most STI and BBV nationally and are supported by a comprehensive set of clinical guidelines at both a jurisdictional and national level (13-15). Accordingly, primary care services routinely collect testing, diagnosis, treatment and management data related to STI and BBV. These data are an incredibly valuable but underutilised resource and can be used to help drive clinical and public health interventions (16), as well as provide greater understanding of epidemics, especially among priority populations.

A strength of the Australian healthcare system is the extensive network of Aboriginal Community Controlled Health Services (ACCHS), established to deliver culturally appropriate and safe health care for Aboriginal people (17). These services were first established in the early 1970s and are governed by an Aboriginal board. There are now over 140 ACCHS across Australia, providing a diverse range of primary care services, spanning medical care, allied health, health promotion and outreach services, to communities. It is estimated that ACCHS provide more than 2.5 million episodes of care annually to nearly 50% of the total national Aboriginal population (18). A recent systematic review provided evidence that ACCHS contribute to improving the health of Aboriginal peoples through several pathways, including; community-controlled governance, providing employment and training, strengthening the broader health system and providing accessible, comprehensive primary health care (19). Accordingly, participation of ACCHS is a critical component of research activity seeking to address disease burden in Aboriginal communities.

As in many other settings, our current understanding of STI and BBV epidemics in Australia is deduced from diagnoses data alone. Once a diagnosis is made for an STI (chlamydia, gonorrhoea, syphilis) or for a BBV (viral hepatitis and HIV), it is a legislative requirement of medical officers or laboratories to report to jurisdictional health departments. These data are then aggregated and reported periodically at the jurisdictional level, by key demographic characteristics. All STI and BBV diagnoses at the jurisdictional level are then collated and forwarded to the NNDSS and subsequently reported nationally. While it is acknowledged that these systems are an important component of infectious diseases surveillance in Australia, there are several constraints of the system. Most notably, the absence of STI and BBV testing data prevents the ability to contextualise changes in diagnoses data or, in the case of hepatitis C, rates of

cure. Further, the system is not complete for Aboriginal status in some of the more populous jurisdictions, and thus may be inaccurately reporting the burden of disease (3, 20). Together, these limitations impact the use of the NNDSS in assessing public health and clinical interventions, or for assessing clinical care and management and finally, for truly understanding epidemics.

More detailed data are required to help inform and evaluate clinical practice and initiatives such as Continuous Quality Improvement (CQI) programs within ACCHS and other primary health care services seeing Aboriginal people. Current levels of data are inadequate to monitor concordance with clinical guidelines. Previous research has demonstrated that while rates of STI and BBV testing are higher for Aboriginal health services than in non-Aboriginal services (21, 22), adherence to testing guidelines is sub-optimal in some health services (23). Further, retesting rates, time to treatment, and HIV and syphilis testing after another STI diagnosis have all been reported as gaps in clinical practice (24-27). There is also a gap in our knowledge of the burden of these infections by residential setting (e.g. urban versus regional) due to most of our information on STI and BBV testing and management in Aboriginal populations being gathered from remote communities.

In this paper we describe the establishment of a sentinel STI and BBV surveillance network of Aboriginal Community Controlled Health Services (ACCHS) and other relevant primary care services in Australia—known as the ATLAS network.

Methods

ATLAS network objective and rationale

The objective of the ATLAS network is to develop and implement an STI and BBV surveillance system representative of ACCHS nationally, to supplement the NNDSS and contribute to improved understanding of local, regional and national patterns of clinical care of STI and BBV.

Electronic medical records (EMR) generally do not have the capacity to extract and analyse population-level STI and BBV data internally, sufficient to evaluate clinical practice and inform CQI. The ATLAS network provides this capacity.

Participating research partners

We invited five peak Aboriginal health service organisations representing regional areas in four Australian jurisdictions to partner in this research. Each organisation represents the views of multiple ACCHS of Australia within their geographical remit and agreed to act as ‘clinical hubs’ for this research. The five clinical hubs are Apunipima Cape York Health Council; the Institute of Urban Indigenous Health; the Aboriginal Health and Medical Research Council of New South Wales; the Aboriginal Health Council of South Australia and the Kimberley Aboriginal Medical Services (Figure 1). These hubs were chosen based on convenience, geographic location and existing collaborative relationships with the research team. Each

clinical hub is committed to oversight of the ATLAS network and other research generated as part of the study.

Figure 1 – Map of CRE-ASH /ATLAS clinical hubs

Site engagement

The ATLAS network aims to have recruited 40–50 ACCHS from within the five clinical hub regions by the end of its funding period in 2020. The research team has committed to an extensive and ongoing community and site engagement process, which commenced while the funding proposal was being developed. Executive staff, sexual health/population health specialist staff and other management from the five clinical hubs and individual ACCHS were consulted about their organisation's participation in the ATLAS network. Executive staff were our links with ACCHS Boards for support and permission to undertake this work. Key contacts within each hub continue to support and strengthen our engagement with the ACCHS participating in the ATLAS network.

Research governance and ethics

Once support for the ATLAS project was secured from the peak organisations, regional and/or individual health services research governance and ethics committees were approached.

Formal approvals were sought and received from six research governance and Human Research Ethics Committee (HRECs) in total, including three Aboriginal-specific HRECs: the Aboriginal Health Research Ethics Committee in South Australia (EC00185, approval 04-17-732); the Aboriginal Health and Medical Research Ethics Committee (EC00342, approval 1300/17); and the Western Australian Aboriginal Health Ethics Committee (EC00292, approval 805, following approval from the Kimberley Aboriginal Health Planning Forum's Research Subcommittee). Permissions were also obtained from the Far North Queensland Human Research Ethics Committee (as Queensland Health provides much of the primary care services in Aboriginal communities where the Apunipima Cape York Health Council is also active— EC00157, approval HREC/17/QCH/102–1173) and the Flinders University Social and Behavioural Research Ethics Committee (as the Lead Investigator's affiliated institution— EC00194, approval OH-00142).

A critical component of the internal governance processes for the ATLAS project is a Clinical Hub Reference Group, providing critical oversight of and input to all research activities and is an important voice for the Aboriginal communities within which the participating hubs and ACCHS work.

Operation of the ATLAS network

The ATLAS network routinely collects clinical service delivery data from participating ACCHS via their EMR. ACCHS in the network contribute deidentified patient records relating to clinical care (testing, treatment and

management) for in-scope STI and BBV either directly from the ACCHS's EMR or via the third-party data extraction tool GRHANITE^{tm}.

Most EMR require the use of third-party software to perform the extraction and delivery of relevant data in a standardised manner. We explored several different tools before opting for the University of Melbourne's GRHANITE tool (28), software that has been successfully used in other sexual health research and surveillance projects (29-31) and which utilises best-practice approaches to patient deidentification and data encryption (16, 32). For our network, the hash-based deidentification process was a key feature as it is thought to be more secure than the Australian Government's SLK581 (33), retaining no element of personal information in the hashed identifier, yet still facilitates person-based linkage across the ATLAS network irrespective of the EMR from which the data originate. Moreover, the GRHANITE hashed identifier also can facilitate linkage to other projects and/or health services using the same tool. Similarly, the highly automated and monitored data collection process substantially reduces workload for the ATLAS research team once the surveillance infrastructure is established, and enables further automation of the analysis and reporting system post-data delivery.

EMR data are transferred to the ATLAS project's secure databank located at the South Australian Health and Medical Research Institute and cleaned and stored for analysis. The ATLAS data processes utilise a custom-built SQL server accessing R Studio and Stata scripts interfacing with MS Word to produce standardised analyses for all sites participating in the surveillance network.

Data analysis

The STI currently included in the ATLAS project are chlamydia, gonorrhoea, trichomonas, syphilis and HIV. The BBV currently included in ATLAS are hepatitis B and hepatitis C (in addition to HIV).

An initial suite of 12 STI and BBV performance indicators have been developed for the ATLAS network's surveillance reports, reflective of national testing guidelines (13, 14) and having a strong basis in previous research in the sector (24, 26, 34)(see Table 1). Refinement of these performance indicators, including their fit with any current reporting and their application to clinical practice, was conducted in collaboration with the clinical hubs and the services contributing the initial datasets to the ATLAS project. Development of these performance indicators also incorporated input from related research projects involving members of the investigator group, to ensure that the needs of all projects working with the same ACCHS could be met by a singular data collection, analysis and reporting process.

Anticipated outcomes of the ATLAS network

The ATLAS network aims to increase understanding of local, regional and national patterns of clinical care of STI and BBV for the purpose of informing clinical practice, policy, and program-planning, and can be used to identify further research priorities for participating ACCHS. The ATLAS network returns data to

health services on a regular basis, for use in evidence-based CQI processes applying a ‘plan-do-check-act’ cycle through which iterative improvements in service provision can be made (35).

The ATLAS data are also available for additional analyses addressing specific local priorities and other research activities undertaken within the broader Centre of Research Excellence in Aboriginal Sexual Health research program or by authorised collaborators once the appropriate review processes have been completed. For example, the ATLAS surveillance data could be used in the development of STI and BBV diagnosis and treatment cascades, or research examining the testing and treatment of STI and BBV in pregnancy.

Results

Site engagement

To date, 29 ACCHS have joined the ATLAS surveillance network, representing 34 individual clinics and all five clinical hubs. Accordingly, participating ACCHS represent a wide geographical spread, covering metropolitan, regional, remote and very remote communities. Patient populations for these ACCHS range from 420 to 11,200 clients (Table 2).

Some concerns, primarily relating to clinical data being extracted from patient records, the integrity of data extracted, safety and storage of data extracted from EMR offsite for analysis, were raised by individual ACCHS and clinical hub representatives during site engagement consultations. Conversely, ACCHS and clinical hubs welcomed positive aspects of the network including; the ability to have patient data collated at the ACCHS level, the development of the 12 performance indicators, the ability to benchmark their service with similar primary health care services, and having data available for STI and BBV to integrate within other CQI activities already underway within their health service.

Data extraction from ACCHS

Four different EMR have been encountered in the ATLAS network to date, (CommuniCare^{tm}, Best Practice^{tm} and Medical Director^{tm} and MMEx^{tm}) The first three of these EMR do not have the capacity to readily extract deidentified line-listed patient data for specific research projects and required development of specific GRHANITE interfaces to facilitate this. The MMEx EMR, the principal system used by ATLAS’s IUIH (Brisbane) and KAMS (Kimberley) clinical hubs, is able to extract and export deidentified line-listed data in the form of .csv files via the proprietary ISA Insights reporting tool. Due to the highly customisable nature of MMEx, the development of these reports has required substantial input from the clinical hubs to identify the relevant source tables and data fields equivalent to that collected in other parts of the network. Further, the increased privacy and linkage capabilities of the GRHANITE tool are considered to have advantages over MMEx’s internal systems and the ATLAS team has worked with GRHANITE’s developers to design and implement an interface for the MMEx EMR to take advantage of this highly desirable functionality.

Data analysis and reporting

Irrespective of the mode of data delivery (GRHANITE or direct-export), baseline surveillance reports addressing the 12 performance indicators are developed for each ACCHS on entry to the surveillance network and ongoing surveillance reports provided at regular intervals thereafter. ACCHS that joined ATLAS early were provided with baseline reports covering 1 January 2016 to 31 December 2017 while later entrants had this baseline period brought forward to 1 January 2017 to 31 December 2018. Early baseline reports have also been updated to match this timeframe. New data are extracted at regular and ongoing intervals, and six-monthly reports are prepared for participating ACCHS approximately three months after the data extraction occurs. Newly-imported data are automatically processed to clean the data and apply transformations to align to a standard data structure. The synthesised database can then be used to produce health service-specific analyses or analyses at a more aggregated level, such as benchmarking within individual clinical hubs as well as comparisons across the ATLAS network more widely (e.g. analyses by remoteness or grouped by patient population size).

The research team are currently developing an analysis and reporting infrastructure whereby ACCHS can access a secure online dashboard and generate their own analyses and reports.

Discussion

In establishing a highly automated data collection and analysis infrastructure, the ATLAS STI and BBV surveillance network is one of the largest clinical surveillance networks operating in Australian ACCHS nationally. Establishment of the network has been a justifiably lengthy process with regular communication, consultation and feedback required of ACCHS and clinical hubs. Engagement with relevant research governance and ethical review committees across the network was also a lengthy and complex process for ATLAS researchers. Five separate approval pathways needed to be followed, with the inherent complication of changes required by one research/ethics committee needing to be duplicated across the network to ensure uniformity, which was often difficult to achieve when approval of the protocol was already in train or had been granted in other parts of the network. The achievements of the ATLAS project in the first half of its funding period must be viewed with consideration of the lengthy time required for these negotiations.

Regular reporting on specific performance indicators to individual ACCHS will contribute to CQI activities in this important area of Aboriginal primary care. As the ATLAS network evolves and grows, the ability of the network to contribute evidence to clinical guidelines policy and program approaches will be monitored. The development of our comprehensive, highly standardised and highly automated data collection and analysis infrastructure will readily facilitate the planned expansion of the ATLAS network. Moreover, the use of GRHANITE and its hashed de-identifier, which cannot be reverse-engineered but is the same for the same individual in every setting, facilitates the synthesis of ATLAS data with that of other surveillance systems using GRHANITE, such as the Australian Collaboration for Coordinated Enhanced Sentinel Surveillance (ACCESS)(29) and Test Treat ANd GO2(36) projects, will give a more complete picture of service access and health care delivery by individuals and/or by regions. This will contribute to

understanding local, regional and national clinical care of STI and BBV to inform clinical practice and STI and BBV policy and guidelines.

The establishment of the ATLAS surveillance network, while lengthy, has enabled trust to be built between the researchers and health services, and supported shared values of spirit and integrity, reciprocity, respect, equity, cultural continuity, and responsibility in all of the networks activities (37). Because of the sensitive nature of the research topic, trust and a highly ethical approach to data collection, management and reporting have been critical. Recognition of the ACCHS' continued ownership of the contributed data has also been key, with an important focus of the project being to facilitate the prompt return of the data in a form readily accessible to health service staff and strengthening capacity for health services to control the analysis process.

Strengths

The ATLAS network has several key strengths that will continue to grow and contribute to the sustainability of the surveillance system. Firstly, the network of relationships built on trust and shared core values between the research team and the ACCHS participating in ATLAS is a true strength of the project. Without this, the surveillance system could not operate. Relatedly, the large number of ACCHS participating in the project contributes critical diversity and representativeness to the surveillance system. Another key strength is the inclusion of urban and inner-regional ACCHS; the burden of STI and BBV in non-remote Aboriginal populations is largely unknown and ATLAS will be the first Aboriginal-specific surveillance network to address this knowledge gap. Expansion of our activities to include data from complementary networks will only strengthen this important component of our work.

Our development of GRHANITE and its ability to interact with MMEx is ground-breaking and substantially contributes to secure access and inclusion of this popular EMR. The automated, regular extraction of data via GRHANITE (and, to some extent, MMEx) also allows the ATLAS infrastructure to process data and populate a highly-automated analysis structure, facilitating the timely return of analyses to the ACCHS. The parallel development of an externally-facing secure online dashboard not only addresses issues of analytic capacity in such a large and complex network but also allows for greater control over the data and analyses for the ACCHS. Moreover, by automating so much of the data collection, analysis and reporting tasks, the sustainability of the ATLAS STI and BBV network is increased and the infrastructure will be easy to support beyond the life of its current funding.

Limitations

The ATLAS STI and BBV surveillance project currently has several limitations, most of which will be overcome as the network matures. A major limitation has been the impact of the time required to establish approval for the implementation of our research. Despite long-standing relationships between the research team and the clinical hubs, significant time has had to be devoted to working with the clinical hubs to determine an acceptable approach to data collection and use and to engage ACCHS within the network.

Ultimately a strength of the ATLAS project, the impact of this (ongoing) relationship-building process on project timelines must be acknowledged. Similarly, complex research governance and ethics approval processes have had a greater impact on ATLAS than would be the case for a non-Aboriginal surveillance system. National mutual acceptance of ethical review is largely inappropriate in the Aboriginal health sector, as one community cannot know or speak on behalf of the many independent and highly diverse Aboriginal communities across the country. Accordingly, in a national research project, a large number of research governance groups and ethics committees must be approached, which leads to complex cycles of feedback and amendments and substantially increases the time to establishment for networks like ATLAS.

More technical limitations have also been encountered, such as the impact of staff turnover within the SAHMRI team as well as some—but not all—of our partnering and participating organisations. Other issues are associated with the difficulties of designing and developing a robust data infrastructure to collect and synthesise data sourced from a large number of EMR systems, all of which seem to be used by each ACCHS in a slightly different manner. Again, the impact of these limitations will largely reduce as the ATLAS system matures and, as in the case of issues associated with the diversity of EMR in the network, will ultimately prove to be a strength of the established surveillance network.

Conclusions

The ATLAS surveillance network is a unique data infrastructure addressing an important knowledge gap in the Aboriginal health sector. ATLAS provides timely and specific performance indicators to individual ACCHS, as well as aggregate comparative analyses, and facilitates CQI within these services. The ATLAS research infrastructure also facilitates sophisticated analyses of STI and BBV epidemiology beyond that covered by our performance indicators and incorporating data collected by other surveillance systems. ATLAS will make an important contribution to improved understanding of local, regional and national patterns of STI and BBV to inform clinical practice, policy, and program planning and implementation. ATLAS is already strengthening relationships between ACCHS and researchers; this strengthening is bound to consolidate as the information exchange process matures.

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Abbreviations

ACCHS	Aboriginal Community-Controlled Health Service
BBV	Blood-borne virus
CT	*Chlamydia trachomatis* (chlamydia)
CQI	Continuous Quality Improvement
DAA	Direct Acting Antiviral
EMR	Electronic medical record
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HIV	Human Immunodeficiency Virus
HPV	Human Papillomavirus
HREC	Human Research Ethics Committee
NG	*Neisseria gonorrhoeae* (gonorrhoea)
NNDSS	National Notifiable Diseases Surveillance System

STI Sexually Transmissible Infection

TV *Trichomonas vaginalis* (trichomonas)

Declarations

Ethics approval and consent to participate

Approvals were obtained from a total of five registered Human Research Ethics Committees:

- Aboriginal Health Research Ethics Committee (EC00185, approval 04-17-732);
- Aboriginal Health and Medical Research Ethics Committee (EC00342, approval 1300/17);
- Western Australian Aboriginal Health Ethics Committee (EC00292, approval 805);
- Far North Queensland Human Research Ethics Committee (EC00157, approval HREC/17/QCH/102–1173); and
- Flinders University Social and Behavioural Research Ethics Committee (EC00194, approval OH-00142).

Consent to participate was obtained from every ACCHS involved in the ATLAS STI and BBV surveillance network in the form of a formal participation agreement between the ACCHS and the South Australian Health and Medical Research Institute.

Consent for publication

The five clinical hubs participating in the ATLAS project have given consent for publication on behalf for their member services. (Documentation can be provided on request.)

Availability of data and material

The data that support the findings of this study remain the property of the participating ACCHS and so are not publicly available. However, data may be available upon reasonable request and with explicit permission of the participating ACCHS. Please contact the corresponding author for further information.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

JW is the lead investigator of the CRE-ASH and was the lead contributor to the conception, design and implementation of the ATLAS project. CB and JW were the major contributors to writing this manuscript. All authors reviewed, edited and approved the final manuscript.

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Tables

Table 1: ATLAS surveillance reporting Performance Indicators

Performance indicators	Definition
1. **STI Testing Rate**	Proportion of clients tested for STIs (CT, NG, TV, syphilis and HIV) during the reporting period
2. **STI Testing Coverage**	Proportion of current clients tested for STIs at least once in a 12-month period
3. **Unique STI test positivity**	Proportion of clients with at least one positive STI test in a 12-month period
4. **Completeness of STI Testing**	Proportion of clients with a positive CT and/or NG and/or TV result also tested for syphilis and HIV within 30 days of date of initial specimen collection
5. **STI Treatment Interval**	Time (days) from date of positive STI (CT, NG, TV) test to date of treatment
6. **STI Retesting Rate**	Proportion of clients retested at approximately three months (60 to 120 days) following treatment for an initial positive STI (CT/NG/TV) result
7. **STI Repeat Positivity Rate**	Proportion of clients retested at approximately three months (60 to 120 days) after treatment for an initial positive CT/NG result and who retested positive for CT/NG at this time
8. **Hepatitis B Virus (HBV) Testing Rate**	Proportion of clients receiving an HBV test. Among those testing negative, the proportion who subsequently received one or more dose of vaccination.
9. **Hepatitis C (HCV) Testing Rate**	Proportion of clients receiving an HCV antibody test and among those testing positive, the proportion then tested for RNA or viral load.
10. **HCV Treatment Uptake**	Proportion of HCV RNA positive clients prescribed Direct Acting Antiviral (DAA) treatment
11. **HCV Sustained Virological Response**	Proportion of clients who, after having been prescribed DAA treatment, achieve an undetectable viral load
12. **HPV Screening Rate**	Proportion of female clients screened for human papillomavirus in line with national guidelines

Clients: all patients aged 15 years or older attending the health service for a clinical encounter or consultation with a medical doctor, nurse or Aboriginal health practitioner.

Abbreviations: CT *Chlamydia trachomatis*; DAA Direct Acting Antiviral; HBV Hepatitis B Virus; HCV Hepatitis C Virus; HIV Human Immunodeficiency Virus; HPV Human Papillomavirus; NG *Neisseria gonorrhoeae*; STI Sexually Transmissible Infection; TV *Trichomonas vaginalis*

Table 2: Current site engagement descriptors for ATLAS STI and BBV surveillance network

Clinical Hub	ACCHS N	Patient Population Range
Apunipima Cape York Health Council	11	450–4,470
Institute of Urban Indigenous Health	2	4,820–7,640
Aboriginal Health and Medical Research Council of New South Wales	3	3,700–4,830
Aboriginal Health Council of South Australia	6	320–7,800
Kimberley Aboriginal Medical Services	7	420–11,220

Figures

Figure 1

Map of CRE-ASH /ATLAS clinical hubs