Review

RESP

Using time in prison as an ideal opportunity to treat Hepatitis C - PIONEER Framework Proposal

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ABSTRACT

Objectives: Prisons present a unique opportunity to address the high prevalence of hepatitis C (HCV) among inmates, a population disproportionately affected by the disease. Specific conditions within correctional facilities contribute to increased HCV transmission rates. Incarceration offers a strategic chance to reach individuals who are often inaccessible through traditional healthcare systems, transforming prison time into a window for targeted health interventions.
Material and method: This study utilized a qualitative approach, conducting a comprehensive literature review on HCV management within correctional settings and incorporating data and insights from the "Let's End HepC" European project. The findings informed the development of the PIO-NEER framework, which emphasizes evidence-based public health policies to enhance health safety in prisons for hepatitis C.
Results: Effective control of HCV in prisons requires a multifaceted approach, including education, counseling, harm-reduction initiatives such as safe tattooing practices, provision of direct-acting antiviral (DAA) treatments, and improvements in prison conditions. Emphasis should also be placed on fostering respect for prisoners' human rights, implementing preventive measures, and reducing HCV transmission within correctional facilities.
Discussion: Incarceration represents a critical opportunity for diagnosing and treating hepatitis C, contrib-uting to improved health outcomes for inmates and reducing transmission risks within the wider community. By addressing HCV in prisons, incarceration can be reframed as a public health intervention to mitigate community health risks when inmates are reintegrated.

Key words: prisoners; hepatitis C; prevention; public health; incarceration.

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INTRODUCTION

Chronic hepatitis C (HCV) is a liver disease caused by a blood-borne oncogenic virus, primarily transmitted through infected shared injecting equipment, any items that might have blood traces, and unprotected sexual contact[1]. Globally, an estimated 58 million individuals are living with HCV, with approximately 80% remaining undiagnosed[2,3]. Estimates indicate that over 11 million people are currently incarcerated worldwide[4,5], of whom approximately 17.7% are living with HCV[6]. This large burden is influenced by factors such as the prevalence of people who inject drugs (PWID) among inmates, the endemicity of HCV in the prison's geographical area, and systemic conditions within correctional facilities[7,8]. Laws that criminalize behaviors like drug use often contribute to this dynamic by fostering dependence on narcotrafficking and organized crime[9,10].

It is estimated that 58% of the global PWID population has a history of incarceration and represent a major share of the prison population[11,12], further amplifying the risk of transmission in these

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settings due to behaviors such as needle sharing and the use of contaminated objects[13]. Moreover, prison environments often lack adequate harm reduction measures, exacerbating the spread of HCV not only among PWID but also in the broader prison population[14]. Contributing factors include the absence of needle exchange programs, insufficient access to safe drug consumption tools, high rates of unprotected sexual activity among men who have sex with men (MSM), and unsafe skin penetration rituals such as tattooing or piercing under non-sterile conditions[15,16].

Prisons represent a fertile ground for HCV concentration and transmission[7,17], which poses risks not only to incarcerated populations but also to the general population following prisoner release and reintegration into the community[17,18]. The challenges of addressing HCV are further compounded by systemic disparities in prison healthcare. Prisons in low-income countries are often of poor quality[19,20]. In middle-income countries, most prisons face similar issues, and even in facilities where efforts are made to improve health conditions, these frequently fall short. In high-income countries, the separation of prison health system financing from national health services often results in inferior care for incarcerated individuals compared to the general population. Notably, even in some high-income regions, such as the southern United States, prison health systems deliver substandard care[19,20].

Despite these challenges, prisons present a unique opportunity for targeted public health interventions. Incarcerated individuals who are prone to HCV infection can benefit from screening and treatment programs within these controlled environments. The implementation of direct-acting antiviral (DAA) treatment programs in prisons, including regimens with directly observed therapy, has been shown to enhance compliance and cost-effectiveness by minimizing treatment abandonment, a common issue among high-risk populations when unsupervised[8,21]. Furthermore, prison-based interventions can significantly improve continuity across the HCV Cascade of Care, with minimal interphase decay, making these settings pivotal for achieving micro-elimination goals[22].

This article seeks to contribute to the development of public health policies by proposing a framework called "PIONEER," which offers an integrated approach to reducing hepatitis C prevalence in prisons. The framework aims to protect this high-risk population while simultaneously mitigating the risk of transmission to the general population following their release.

MATERIALS AND METHOD

A comprehensive literature review was conducted to examine the management of hepatitis C within prison environments. This review included a systematic identification and evaluation of academic publications from 2012 onwards. In addition to published research, the study incorporated unpublished evidence, such as insights obtained through personal communications and questionnaire responses from approximately 50 experts involved in the "Let's End Hepatitis C" project. Data shared during hepatitis C-focused conferences further enriched the scope of this investigation, providing valuable perspectives that complemented the findings from the literature.

The search strategy involved independent queries across multiple databases, using the keywords "hepatitis C," "prisons," and "prisoners." This approach initially yielded over 10,300 reports. Subsequent refinement of the search criteria, focusing specifically on the management of hepatitis C in incarcerated populations, resulted in the identification of 858 relevant articles. After applying stringent inclusion criteria detailed in Table 1, 98 articles were selected for review. Additionally, insights from 20 supplementary sources, including unpublished material, were incorporated. Ultimately, 76 articles were deemed highly relevant and directly aligned with the study's thematic focus. These selected articles are cited in the bibliography and visually summarized in Figure 1.

RESULTS

HCV transmission during incarceration

Hepatitis C transmission rates in prisons are significantly higher than among the general population, with infection rates estimated to be 18-20 times greater among incarcerated individuals[17]. Prisons face numerous challenges in controlling the spread of the disease, including systemic issues such as overcrowding, poor infrastructure, restricted access to healthcare services, malnutrition, and the prevalence of high-risk behaviors. These factors not only heighten HCV transmission risks but also contribute to the overall mental, physical, and social deterioration of inmates[23–26]. Behavioral risks include needle sharing, unsafe tattooing, and unprotected sexual activity, particularly among men who have sex with men (MSM). Additionally, practices involving contaminated equipment, such as piercing

and improper sterilization of medical or dental instruments, exacerbate transmission risks within these confined environments.

In most countries, prisoners are treated through separate healthcare systems, often resulting in limited resources and inconsistent care compared to the general population. In impoverished regions, particularly those affected by armed conflict, prisoners may have no access to healthcare services at all[12,16,20,27]. This systemic inadequacy significantly impacts disease control efforts, creating disparities in diagnosis and treatment.

Short-term detention settings, which house a large proportion of individuals with incarceration histories, represent a critical point of vulnerability. Underfunding and the absence of comprehensive health screening guidelines in these settings prevent early diagnosis and management of pre-existing infections, further increasing the likelihood of transmission[12,28]. Even among those not infected upon admission, exposure to high-risk behaviors and the lack of harm-reduction measures during incarceration increase the probability of contracting HCV. These risks vary significantly depending on the population, regional practices, and the specific microenvironment of each prison[23–26].

The period following release from incarceration marks another critical phase in the HCV transmission cycle. Former inmates face heightened risks of relapse into drug use, drug-related mortality, cardiovascular complications, homicide, and suicide[12,29–31]. Contributing factors include social network disruptions, difficulties in securing employment and housing, financial instability, insufficient family support, and exposure to criminal groups or gangs[32]. These challenges underscore the importance of providing pre-release support and continuity of care, which can mitigate health risks and reduce the likelihood of disease transmission. Initiatives such as access to case managers – though resource-intensive – could facilitate consistent healthcare and address social determinants of health, ultimately preventing HCV contraction both during incarceration and post-release[12,33].

Addressing these issues requires comprehensive efforts to improve prison conditions, align healthcare systems with international guidelines, and uphold the human rights of inmates. The need for standardized best practices, including those specific to HCV prevention and care, is supported by international health and human rights frameworks, as well as national prison policies and legislation[24,25,34,35]. These coordinated efforts are essential to reduce HCV prevalence in prisons and protect the broader community from further disease transmission.

Table 1. Inclusion and exclusion criteria of manuscripts for this article.

Inclusion criteria:
Present in the results from the searches: “management of hepatitis C”, “prisons”, “prisoners”.
Participants of the studies were current prisoners or had been incarcerated in the past.
Publication and information collection performed after 2013.
Publication must include a template for the management of hepatitis C.
Exclusion criteria:
Publications or data before 2013.
The study population of the publication is not related to prisons.

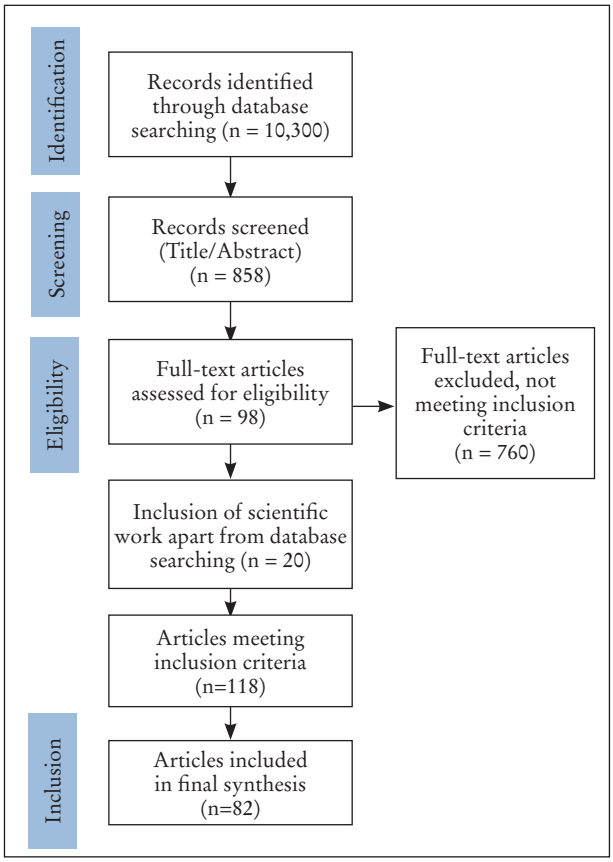

Figure 1. Flow diagram of the study selection aggregated over the topic areas reviewed.

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From prevention to reintegration: A framework for HCV management in prisons

The United Nations Office on Drugs and Crime (UNODC) and the World Health Organization (WHO)[36] advocate for the implementation of comprehensive, evidence-based interventions in prison settings to address the transmission of blood-borne and sexually transmitted infections. These guidelines encompass measures such as prevention education, communication and counseling, periodic testing, needle and syringe programs (NSPs), opioid substitution therapy (OST), condom programs, vaccination, and the diagnosis and treatment of viral hepatitis. Such interventions are essential for supporting all steps of the HCV Cascade of Care, ultimately reducing disease prevalence and limiting transmission routes both during incarceration and post-release[12].

Educational Programs

Health education initiatives are a cornerstone of HCV prevention in prisons. Programs that include peer-based education and address topics beyond the disease itself—such as stigma, drug use, employment, and community reintegration—have shown significant promise in modifying prisoner behavior and improving adherence to the HCV Cascade of Care[37]. Structured educational sessions have proven particularly effective when they are brief, easily implementable, and tailored to address specific prisoner concerns. Including prison staff in these initiatives enhances their impact and facilitates the integration of such programs into existing correctional frameworks[12,21,38,39].

HCV counseling and testing

Providing counseling and testing services to prisoners is critical for identifying those at risk, mapping prevalence and incidence rates, and informing financial and logistical planning for prevention and treatment initiatives[26]. While these measures are adopted in some prison systems, they remain limited in scope globally. By 2022, only nine countries had implemented NSPs in at least one national prison, while 59 countries had introduced OST programs in similar settings[40]. The availability of such harm reduction services is essential for tackling HCV transmission effectively within carceral environments.

Introducing rapid testing technologies can further enhance the scope of screening efforts, especially in resource-limited or high-turnover settings[21,39,41]. Universal screening measures—such as blood testing upon admission, annual evaluations, and release screenings—could improve case identification and reduce transmission risks[18,42]. However, implementing such systems requires addressing challenges such as resource limitations, time constraints, and concerns about privacy and stigma related to disclosing infection status[43].

Even in the absence of direct-acting antiviral (DAA) treatments, screening has been shown to reduce high-risk behaviors by approximately 50% among individuals who test positive for HCV[44]. Additionally, opt-in and opt-out testing models offer practical approaches for increasing participation while respecting individual autonomy[42,45].

Innovative models of care

Innovative care models have demonstrated the feasibility of decentralized and accessible HCV management in prisons. In Australia, nurse-led programs reduced HCV PCR-positive rates by over 90%, primarily by shifting treatment delivery from tertiary hospitals to prison facilities[42,46], which increased accessibility and treatment uptake. Similarly, in Catalonia, the "Liaison Nurse" model has played an important role in reinforcing the continuity of HCV care and treatment between prison settings and extra-prison health services, contributing to the continuity of care and sustained treatment adherence after release[47,48].

Additionally, telemedicine has emerged as a transformative approach to care delivery in prisons. A notable example involves using telemedicine for pre-treatment assessments, which has significantly increased treatment uptake and reduced the burden of HCV among inmates[49–51]. These models highlight the potential of innovative healthcare delivery systems to overcome logistical barriers and expand access to care within correctional settings.

Needle and syringe programs (NSPs)

NSPs play a pivotal role in harm reduction strategies by reducing needle sharing and associated HCV transmission risks. Despite limited adoption worldwide, these programs have demonstrated substantial benefits, including increased rates of needle return and decreased instances of unsafe injecting practices[52-54]. In countries where NSPs have been implemented, significant reductions in needle sharing have been observed, with corresponding increases in distributed needle return rates[52,54].

Different NSP delivery models have been introduced to accommodate prison-specific

challenges, including anonymous syringe dispensing machines, harm-reduction kits, and peer-distribution programs[53]. However, institutional resistance remains a barrier to implementation in many regions, driven by concerns that NSPs might encourage drug use within prisons. Evidence, however, consistently shows minimal adverse outcomes in countries with available NSPs, including no increase in drug use, no HCV seroconversions, and no reported use of syringes as weapons[53,55–59].

Ensuring confidentiality is critical for encouraging prisoner participation in NSPs, as many individuals fear being labeled as drug users and facing potential repercussions[58]. By addressing these concerns, NSPs can serve as a vital component of comprehensive HCV prevention strategies.

Opioid substitution therapies (OSTs)

OSTs are highly effective in reducing HCV transmission, with studies linking them to a 50% reduction in infection rates[26,52,60]. Initiating OST within prisons reduces behaviors such as injecting drug use and syringe sharing, while continuing treatment post-release improves adherence, retention, and overall health outcomes[56,61,62]. OSTs also significantly reduce the risk of drug-related mortality after release. When combined with NSPs, OSTs provide a synergistic effect, enhancing the effectiveness of HCV prevention interventions[52,54,57,63].

Condom distribution programs

Despite their proven effectiveness in reducing sexually transmitted infections, including HCV, condom programs remain underutilized in prisons. Only 48 countries have implemented such initiatives, which are particularly beneficial for populations at higher risk, such as MSM and during conjugal visits[64,65]. Studies suggest that these programs are well-accepted by inmates and do not increase consensual or non-consensual sexual activity nor pose threats to prison security or operations[64]. However, stigma surrounding sexual activity in prison settings continues to hinder broader adoption[66].

Addressing gaps and expanding interventions

The integration of NSPs, OSTs, and condom programs, alongside educational initiatives and innovative care models, is critical for comprehensive HCV prevention in prisons. Overcoming barriers such as stigma, political resistance, and resource constraints will require concerted efforts from policymakers, healthcare providers, and prison authorities. Expanding these interventions aligns not only with public health goals but also with the protection of basic human rights for incarcerated individuals.

Proposal for PIONEER Framework

The proposed PIONEER framework provides a structured approach to managing HCV within prisons and during reintegration into the community. It is organized into four interrelated components: problem identification, solution formulation, output evaluation, and outcome assessment. The framework emphasizes iterative improvements tailored to each country's legal, economic, and social context.

DISCUSSION

The global strategy to eliminate hepatitis C (HCV) by 2030, facilitated by the widespread availability of direct-acting antiviral (DAA) treatments, has highlighted the critical need for targeted public health policies[67]. Despite the progress made, only 11 countries are currently on track to achieve this ambitious goal[68]. Correctional facilities, as high-risk environments for HCV transmission, present both challenges and opportunities for advancing disease control efforts. Successful examples, such as Australia's national strategy[69], the elimination of HCV in Portugal's Custóias prison[70], and the JAILFREE-C pilot project in Spain[71], illustrate the importance of comprehensive and context-specific measures across the HCV Cascade of Care. These initiatives have shown that they are only feasible and cost-effective but also highly impactful in mitigating the disease burden within correctional settings.

Tailored public health policies must be designed and adapted to the realities of correctional facilities, ensuring alignment with national and regional contexts and continuous monitoring through robust epidemiological surveillance systems[72]. Micro-elimination strategies, which break down national elimination goals into smaller, focused objectives for key populations such as prisoners, people who inject drugs (PWID), sex workers, and men who have sex with men (MSM), provide an effective approach to achieving HCV control[73]. Given that prisoners are disproportionately affected by HCV, addressing this population's unique needs is essential to reducing the global disease burden[74,75].

Innovative tools such as the Let's End HepC (LEHC) project have proven instrumental in guiding public health decision-making. By simulating the

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outcomes of 24 distinct public health policies across the HCV Cascade of Care, LEHC offers predictive insights into the impact of policy implementation in key populations, including prisoners[76–80]. Model projections indicate that fully implementing comprehensive public health policies could reduce HCV prevalence among incarcerated populations by over 90%, aligning with the WHO elimination target. Critical areas for investment include national plans, awareness campaigns, prevention initiatives, and enhanced linkage-to-care, treatment, and diagnostics.

Despite growing evidence to support evidence-based interventions, significant gaps persist in implementing public health programs in prisons. These challenges often stem from structural issues, including the segregation of prison healthcare systems under Ministries of Justice rather than Ministries of Health. High reinfection rates following DAA treatments, estimated at 12.5% in prison settings, further highlight the necessity of integrating treatment with harm-reduction strategies, such as high-coverage opioid substitution therapy (OST) and needle syringe programs (NSPs)[81].

Correctional facilities offer a controlled environment conducive to comprehensive HCV interventions. Integrating HCV care into basic primary healthcare services within prisons ensures timely diagnosis, treatment for all stages of liver disease, and prevention of transmission[8,56,82].

Such integration reduces logistical challenges, including costs associated with transporting inmates to external healthcare facilities. Additionally, it facilitates the adoption of micro-elimination strategies that address the entire HCV Cascade of Care, from diagnosis to reintegration post-release[83].

Institutional professionals within prisons play a pivotal role in the success of these interventions. Adequate training in infection control, disease knowledge, stigma reduction, and related dimensions is critical to improving prisoners' access to care[18,80]. Point-of-care services, including screening, treatment, consultations, and fibrosis assessments, should be prioritized to minimize barriers. Importantly, recognizing prisoners' health rights as outlined in the United Nations Basic Principles for the Treatment of Prisoners is vital for achieving equitable care[84]. Collaboration between criminal justice systems and public health entities in policy development, funding allocation, and workforce management is indispensable for sustainable success[85].

The PIONEER framework provides a structured, systematic approach to addressing the challenges of HCV management in correctional settings and during post-release reintegration. By focusing on problem identification, solution formulation, output evaluation, and outcome assessment (Figure 2), the framework ensures a dynamic and adaptive response to evolving needs. This iterative process fosters continuous improvement in public health interventions, tailored to the legal, economic, and social contexts of individual countries.

While the PIONEER framework is designed for comprehensive implementation, resource-limited settings may require selective prioritization of its components. Nonetheless, its emphasis on proactive engagement, meticulous documentation, and transparency ensures sustained progress across correctional healthcare systems.

Implications and future directions

Correctional facilities serve as both amplifiers of infectious diseases and critical intervention points for public health. By targeting incarcerated populations with systematic HCV interventions, the PIONEER framework offers a pathway to achieving the WHO elimination goal by 2030. Its alignment with micro-elimination strategies ensures that efforts are not only scalable but also effective in reducing HCV prevalence and mitigating transmission risks post-release.

Key to the framework's success is collaboration among diverse stakeholders, including prison authorities, healthcare providers, educators, community organizations, and public health institutions. Aligning these efforts within a synergistic matrix framework enables the formulation of policies that uphold prisoners' human rights while addressing the broader public health implications of HCV.

Further empirical studies are necessary to evaluate the PIONEER framework's impact across different cultural and legislative contexts. Such research will inform best practices, establish performance indicators, and optimize interventions for both incarcerated individuals and the broader community. By bridging gaps in care and fostering equity in healthcare delivery, the PIONEER framework stands as a pivotal tool in the global fight against hepatitis C.

Author Contributions

Conceptualization, R.B.L. and H.L.; methodology R.B.L. and H.L.; validation, R.B.L., H.L. and H.B.; formal analysis, R.B.L. and H.L.; investigation, H.L. and D.F.; data curation, H.L. and D.F.; writing—original draft preparation, H.L. and D.F.; writing—review and editing, R.B.L., H.L., D.F. and H.B.; supervision, R.B.L. and H.L.; project administration,

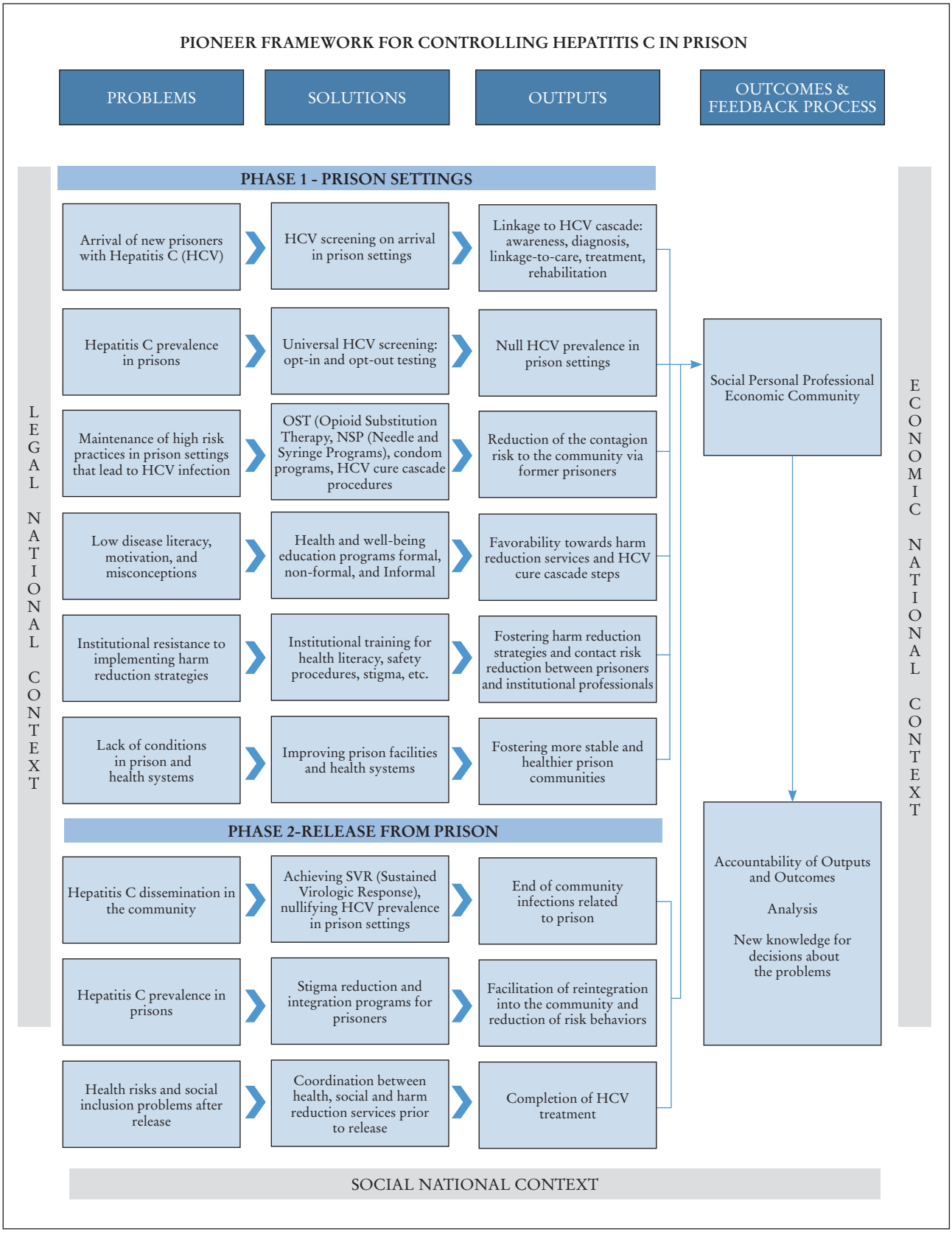

Figure 2. Framework proposal to fight hepatitis C in prison and upon release from prison – PIONEER.

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Conflicts of interest

The authors declare no conflicts of interest.

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