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Morag MacDonald, Robert Greifinger, David Kane

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The *IJPH* is a refereed journal which welcomes original articles from all parts of the world, and will address an international audience spanning many disciplines and arenas of professional practice in the prison environment. The journal is intended primarily to facilitate an exchange of information among experts in the field of healthcare of prisoners, from a range of different cultural interpretations and perspectives of health.

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A New and Exciting Partnership

Morag MacDonald, Robert Greifinger, David Kane

This issue of the *International Journal of Prisoner Health (IJPH)* is the start of a new and exciting partnership. It is the first issue with our new publisher, the Humanitas Foundation. We expect this change to help the journal to grow, with wider coverage across the world.

The *IJPH* has had a rich history over the past five years. Authors from across the world have raised issues of equity, abuses against human rights, and many other areas where the provision of health care for this very vulnerable group of people is still not meeting international standards. The *IJPH* has featured articles on human rights and ethics regarding prisoner health care including a consideration of the Dublin Declaration (Lines et al, 2004) that sought to provide a framework for mounting an effective response to HIV/AIDS in the prisons of Europe and Central Asia. The Principles and Articles outlined in the Dublin Declaration are based upon recognized international best practices, scientific evidence, and the fundamental human rights of people in prison and the obligations of States to fulfill those rights.

The challenges of HIV and AIDS have been substantially addressed in the *IJPH* during the past five years and continue to be a primary focus for many prison systems of the world. Jörg Pont's article on *Medical Ethics in Prisons: Rules, Standards, and Challenges (IJPH, 2006)* was another key article that discussed ethical care for prisoners guided by international standards highlighting the challenges and peculiarities that prison healthcare practitioners face in providing high standards of health care.

Prison healthcare services often struggle to cope with major challenges such as HIV infection, hepatitis C virus (HCV) infection, and drug-injecting prisoners. Along with drug use, the prevalence of HIV, hepatitis B virus (HBV), and HCV infection are major challenges facing prisons in many countries. A useful information source was Ralf Jürgen's (*IJPH, 2006*) selected annotated bibliography (published in three parts) of HIV and HCV in prisons. This series championed the implementation of HIV interventions noting that many countries have

introduced HIV and, to a lesser extent, HCV prevention programmes since the early 1990s. It pointed out, however, that many of these programmes "are small in scale and restricted to a few prisons." The bibliography provides an invaluable resource for practitioners and academics alike.

Drug use in prison, particularly injecting drug use, risk behavior and the associated issue of providing harm reduction tools has attracted a tremendous amount of attention from authors who have contributed to the *IJPH*. A study of substitution treatment in prisons in 18 European countries (Stöver et al, 2006) reported that provision in terms of access and continuity still lags behind the standards of treatment available in the community. The authors conclude that although the scope of substitution treatment has extended considerably across Europe, additional psychosocial care is required to support the medical therapy along with recognition that continuity of treatment upon release is imperative. Another key issue reported in the journal is the mortality rate of drug users after release from prison. A study of Danish prisons (Christenson et al, 2006) argued that drug users released from prison are potentially at high risk of death due to overdose and suggested that methadone treatment should be evaluated as a way to decrease mortality after release.

Risk behavior in prison has been addressed by Sifunda et al (*IJPH, 2007*) who examine the possible relationship between substance misuse and risky sexual behaviour among a cross-section of prisoners in four South African prisons involved in pre-release intervention programs for parolees. They conclude that prisoners demonstrate high levels of substance use and engagement in risky sexual behaviours and view "targeted pre-release substance abuse interventions as essential to reduce the burden of disease amongst offenders." Weilandt et al (*IJPH, 2007*) examined the risk behaviour of a sample of Armenian male adult prisoners and staff and assessed their knowledge, attitude, and behaviour toward blood-borne viral infections. Their results indicated that both prisoners and staff have poor knowledge relating to the transmission and prevention of infec-



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tious diseases and that the development of a rapid education and information programme is required.

The use of amphetamine type stimulants in prison was described in a study by Tom Decorte (*IJPH*, 2007) and concluded that “both security and health care staff in prison often feel ill-equipped to deal with stimulant-related problems.”

Heike Zurhold and Christian Haasen (*IJPH*, 2005) explored the responses of European prison systems to women with problematic drug use. They looked particularly at the availability of treatment and healthcare services for this group. They conclude that there is both poor availability and quality of data relating to the extent of problematic drug use in women’s prisons. Where it is available, data do not give a realistic picture of the scale of female problematic drug users in prisons.

Women, young prisoners and ethnic minority prisoners have been the subject of articles submitted to the journal. Women in prison, while still a minority, are the fastest growing group within the prison population. Additionally, they have special requirements, which are frequently not being met by prison authorities. While issues such as overcrowding, hygiene, and visitation rights are relevant to prisoners of either gender, there are concerns which are specific to female prisoners, or which affect female prisoners differently or in a particularly harsh way when compared to their male counterparts. Donatella Zoia (*IJPH*, 2005) focused on the particular healthcare needs of women in Italian prisons, which were often undetected and underestimated. She highlighted the lack of availability of a preventive health care service to meet the particular needs of women prisoners and noted that the organization of prison health deals predominantly with emergency cases. In his article on a women’s prison in Sweden, Odd Lindberg (*IJPH*, 2005) argues that staff and prisoner cultures work, in some cases, against women drug users being able to access treatment even when it is available. Lindberg highlights the importance of including prisoners in the design and implementation of treatment programmes and underlines the complexity of “life in prison” for both staff and prisoners.

Barling, Halpin & Levy (*IJPH*, 2005) continued the discussion of the importance of patient satisfaction related to prisoner health services in a description of their study of Australian prisoners’ assessment of prison health services using the World Health Organization (WHO) Rapid Cluster Sample Survey methodology. The research found that confidentiality of their medical records was a key concern raised by the prisoners and this reflects a common problem in many prison systems worldwide. The lack of confidentiality in prisoner health care was also the subject of Morag MacDonald’s (*IJPH*, 2006) article, which argued that institutional factors unique to prisons, such as security or health and safety concerns, may impact on healthcare staffs’ ability to maintain prisoners’ confidentiality.

The wellbeing and health of young prisoners has also been addressed by authors during the last five years. Juvenile prisoners are particularly vulnerable to abuse of all sorts. Heather Welfare and Jonathan Mitchell (*IJPH*, 2005) evaluated an Access Course, operating in a young offenders’ institution in the UK that sought to build confidence and increase coping skills in this group. The evaluation suggests that programmes such as this might provide a promising addition to strategies for dealing with problems of bullying and self-injury in juvenile prisoners. Douglas & Plugge (*IJPH*, 2008) argued that little is known about the health needs of detained juvenile females, yet there is emerging concern regarding substance misuse, mental health problems, poor sexual health, and poorer general physical health on a range of indicators. Their study sought to identify the health needs from the perspective of imprisoned young women and key professionals working with them. The study raised concerns regarding substance misuse, mental health problems, self harm and poor sexual health, and the need for priority interventions to redress health inequalities experienced by these young women.

Another health concern of fundamental importance in prison populations is tuberculosis (TB). Hernán Reyes (*IJPH*, 2007) offered a personal view on the complex problem regarding the many pitfalls in the management of TB in prisons. The paper noted that in some instances, TB specialists are under the impression that dealing with the disease in a custodial setting is somehow “easier” than outside. It is this erroneous impression that the author sets out to correct, basing his arguments on field experience in different prisons on several continents, where the International Committee of the Red Cross manages or oversees the work being done to deal with the problem. Gesa Walcher (*IJPH*, 2005) looked at the spread of HIV/AIDS and TB in the Central Asian republics and analyzed the role prisons play as one of the main multipliers. The Central Asian republics are among the countries which currently experience the world’s fastest growing HIV/AIDS epidemic. At the same time, they are threatened by the re-emergence of TB, with the highest rates of new TB cases among the Former Soviet Republics.

The *IJPH* has had two special issues devoted to the topic of mental health, which indicates the importance of this area in prisoner health. This is a crucial area of concern for prison health care providers and affects all groups in the prison population. Juliet Lyon (Prison Reform Trust) and Mary Murphy (Penal Reform International) argued in the editorial of their special *IJPH* issue in 2009 that, “Across the world prisons are used as places to warehouse people who are mentally ill and those with learning disabilities. This special issue of the *IJPH* raises penetrating questions about why so many countries and states elect to lock up their most vulnerable citizens in their most bleak institutions as well as opening up debate on the

scope to improve treatment and conditions – in prison and in the wider community.” The impact of incarceration on prisoners’ mental health was also a theme explored in this special issue. Concerns were raised about offenders with learning disabilities or difficulties that interfere with their ability to cope within the criminal justice system. Important questions were raised: How did such vulnerable people get caught up in the criminal justice system in the first place? Could those responsible for special education, social care, and family support have done more to prevent this happening?

Many other key issues of prisoner health have been raised by authors many of which are rarely discussed in the context of prisoner health. These include influenza, training needs of physicians working in prisons, prisoner perspectives on managing long-term conditions, the healthcare of older inmates in the correctional setting, child sexual abuse, coping strategies and lifetime post traumatic stress disorder among female prisoners, diabetes among sexual and violent offenders, alcohol, telemedicine, and the use of Tasers in correctional facilities.

We hope with our new publisher to widen the *IJPH*'s scope and attract a greater number of papers from many more countries both highlighting concerns and also best practice in their prison systems.

This issue of *IJPH* includes articles that explore estimates of HBV seroprevalence, personality disorder traits among adult male prisoners, drug-related deaths among recently released prisoners in Ireland, the issue of psychological health and bullying among adult male offenders, and patterns of visual impairment and blindness in a Nigerian prison.

Harzke, Goodman, Mullen & Baillargeon conduct a systematic review of studies from the period 1975–2005 that meet pre-specified criteria and report HBV seroprevalence estimates from US adult incarcerated populations. Using meta-regression techniques, the authors investigated a number of variables as potential study-level sources of heterogeneity in prevalence estimates for common HBV seromarkers. From the results of bivariable meta-regression analyses, the authors conclude that the higher mean age of the study sample (≥ 31 years) was strongly associated with increased HBsAg prevalence and earlier serum collection year (before 1991) was strongly associated with increased prevalence of any positive marker.

In her paper, Jane Ireland considers the structure of personality disorder traits among adult male prisoners using confirmatory and exploratory analyses with two independent samples. The author reports that the results highlight the lack of validity for the DSM-IV-TR and the Four A's published clusters and, therefore, argues “for a more parsimonious cluster model for prison samples.” The importance of validating personality clusters across samples is also discussed and the implications highlighted.

Lyons, Walsh, Lynn & Long investigate deaths following release from prison among individuals recorded on the National Drug-Related Deaths Index (NDRDI) in Ireland during the period 1998-2005. The authors report that almost all of the recorded cases had a history of drug use or drug dependence, over 60% had a history of injecting drug use, and 34% were reported to be injecting at the time of their death. The authors conclude that there is a “need for more intensive prevention measures in the period immediately following release from Irish prisons, including the development of a national overdose prevention strategy.”

Gayle Brewer reports on an investigation into the psychological health and bullying behavior among adult male offenders at two medium risk institutions in the United Kingdom. The author reports that “bully/victims reported more psychological problems than other offenders, followed by pure victims, suggesting that within a prison population, bully/victims should be regarded as a category of “victim” rather than a category of “bully,” and that the number of indirect bullying behaviors exhibited was more closely related to poor psychological health than the number of direct bullying behaviors displayed.

Finally, Ajite et al report on the results of a cross-sectional survey of the ocular health status of prisoners in a Nigerian medium security prison. The authors note that almost 10% of the sample had a visual impairment. Additionally, it is reported that the leading causes of blindness and visual impairment among prisoners can be avoided through the provision of screening and spectacles, improved access to ophthalmic care, and the discouragement of violence.

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Heterogeneity in Hepatitis B Virus (HBV) Seroprevalence Estimates from US Adult Incarcerated Populations: A Systematic Review and Meta-Regression Analysis

Amy J. Harzke¹, Karen J. Goodman², Patricia Dolan Mullen³, Jacques Baillargeon¹

Keywords: hepatitis, prison, prisoner health, correctional healthcare, meta-regression analysis

ABSTRACT

Hepatitis B virus (HBV) seroprevalence estimates from US incarcerated populations are relatively high. However, the usefulness of these estimates for guiding HBV-related correctional healthcare policy is limited by wide variation in estimates across studies and little understanding of the sources of this variation. The authors systematically reviewed studies indexed from 1975-2005, meeting pre-specified criteria and reporting HBV seroprevalence estimates from US adult incarcerated populations. Using meta-regression techniques, the authors investigated report type, geographical region, serum collection year, facility type, serum source, sampling procedures, sample characteristics, and measurement procedures as potential study-level sources of heterogeneity in prevalence estimates for common HBV seromarkers. In bivariable meta-regression analyses, mean age ≥ 31 years was strongly associated with increased HBsAg prevalence (POR = 2.6), and serum collection year before 1991 was strongly associated with increased prevalence of any positive marker (POR = 2.0). Other moderate-to-strong associations were observed, but these were considered less certain because of small numbers of observations, influence of single studies, or potential confounding. Potential sources of heterogeneity should be considered when comparing HBV seroprevalence estimates in adult US incarcerated populations and when developing HBV screening and vaccination protocols in correctional settings.

INTRODUCTION

Although US incidence rates for hepatitis B virus (HBV) have declined substantially over the past two decades, HBV infection and its sequelae – chronic liver disease/cirrhosis and primary liver cancer – continue to present a significant public health problem. An estimated 800 000 to 1.4 million persons in the US are chronically infected with HBV (CDC, 2008), and these persons have a 15% to 25% lifetime risk of death from chronic liver disease or primary liver cancer (CDC, 1990). Conservative estimates suggest as many as 2000 to 4000 deaths annually are due to HBV-related liver disease and cancer (CDC, 2003; CDC, 2008). Incidence of HBV infection among those 25 years of age and older has remained steady since 1999 (CDC, 2005a; CDC, 2005b). As infected persons age and begin to experience HBV-related morbidity and mortality over the next 10 to 20 years, hospitalizations and deaths due to HBV-related conditions are anticipated to remain steady as well (CDC 2005a; CDC 2005b).

Chronic HBV infection and related conditions may have a particularly strong impact on correctional healthcare systems in the

United States. Studies have consistently reported high prevalence of serologic markers of HBV infection in prison populations compared to the general US population (Koplan et al, 1978; Decker et al, 1984; Ruiz & Mikanda, 1996; Macalino et al, 2004). Typically tested seromarkers include HBV antigen (HBsAg) and HBV core antibody (anti-HBc); presence of HBV antigen indicates current infection, and presence of HBV core antibody indicates immune response and may reflect current or past infection. Studies suggest that the prevalence of current or past HBV infection in prison pop-

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ulations is about four to five times greater than national estimates (Harzke et al, 2009). Moreover, the prison population is a growing and aging one. The US prison population has more than quadrupled since 1980, exceeding 1.5 million in 2002 (Harrison & Beck, 2003), and inmates over 45 years of age comprised 21.3% of all inmates in 2007, up from 13.6% in 1997 (Beck & Mumola, 1999; West & Sabol, 2008). Thus, the high prevalence of HBV seromarkers portends a high burden of chronic HBV infection and related conditions in incarcerated populations over the coming decades, assuming the prison population does not decline and HBV-infected inmates continue to age (Hammett et al, 2002; Mitka, 2004).

HBV seroprevalence estimates to date provide useful data for correctional healthcare planners and policy makers in the particular systems or facilities studied, but the usefulness of these estimates beyond the particular study contexts may be limited. HBV seroprevalence estimates vary widely across studies, and the sources of this variation have received little attention in the literature (Harzke et al, 2009). Reported prevalence estimates in US prisons have ranged from 0.9% to 8.0% for HBsAg (Decker et al, 1984; Koplan et al, 1978) and from 6.5% to 42.6% for anti-HBc (Decker et al, 1984; Barry et al, 1990). A majority of reported studies have examined *within* study variation in HBV seroprevalence estimates across demographic or risk factor strata; only a few reported studies, however, have discussed or otherwise addressed whether and how study-specific estimates differ from previous estimates or the degree to which the distribution of demographic characteristics and risk factors affect the comparability of seroprevalence estimates *across* studies (Ruiz & Mikanda, 1996; Ruiz et al, 2001). Furthermore, only a small number of reports have addressed the potential role of broader epidemiologic factors (e.g., geographic and temporal variation in background prevalence) and methodologic factors (e.g., sampling or measurement procedures) in producing variation in seroprevalence estimates across studies (Decker et al, 1984; Anda et al, 1985; Hammett et al, 2002). Several authors have claimed their seroprevalence estimates were comparable to previous estimates, implicitly assuming homogeneity of HBV seroprevalence and risk factors in different prison populations as well as assuming homogeneity of methods across seroprevalence studies (Harzke et al, 2009).

The objectives of this study were to systematically identify and review studies reporting HBV seroprevalence estimates from US adult incarcerated populations and to investigate a range of study-level factors as potential sources of variation in these estimates. Investigating and identifying study-level sources of variation in HBV seroprevalence estimates may aid researchers and policymakers in interpreting and comparing existing studies and in designing and reporting future studies. Understanding study-level sources of variation may help guide correctional healthcare leaders in using existing data to assess the burden of HBV infection in correctional facilities not previously studied.

METHODS

Data Sources and Search

The following databases were searched for reports of HBV seroprevalence estimates in incarcerated adults indexed from January 1, 1975, through August 31, 2005, using the keywords "hepatitis" and "prison": Medline *via* Ovid; Web of Science-Science Citation Index and Social Sciences Citation Index; National Criminal Justice Reference Service Abstracts Database; and UMI Proquest Digital Dissertations. Bibliographies from initially eligible studies, review articles, and commonly cited reports (e.g., CDC, 2003) were also searched.

Study Selection

The following eligibility criteria were pre-specified and applied hierarchically in the order noted: (1) indexed or available from the author in the time period noted above (reliable serologic testing for HBV was not available until 1975); (2) conducted in the United States; (3) primary study; (4) reporting prevalence estimates of HBV infection; (5) study population sampled from prisons, jails, or other correctional facilities; (6) disease ascertainment methods included measurement of one or more standard serologic markers for HBV (HBsAg, Total anti-HBc, IgM anti-HBc, anti-HBs); (7) HBV seroprevalence estimates based on direct methods (i.e., not based on mathematical models or surveys of medical directors); (8) sample drawn exclusively from correctional system or facility housing primarily adults; (9) sample not drawn from a facility housing primarily non-US residents; and (10) sample not restricted to those with another illness. HBV seroprevalence in samples primarily comprised of juvenile detainees, non-US residents, or adult detainees with a specified co-morbidity may not be comparable to adult correctional populations (McQuillan et al, 1999; Ruiz & Mikanda, 1996; Ruiz et al, 1999). No restrictions were imposed with respect to publication type (e.g., full articles, abstracts, government reports, etc.). When unique citations reflected duplicate reports of the same data, HBV seroprevalence estimates and sample characteristics were drawn from the more complete report, and both reports were considered for ascertaining study methods.

Data Extraction

Study characteristics for extraction were pre-selected based on hypothesized potential sources of variation, using guidance from Loney et al (1998) and Stroup et al (2000). Study characteristics extracted included: publication type; geographic region; serum collection year; facility type; sampling procedures; sample size; sample demographics; sample distribution of behavioral risk factors; data source; timing of serum collection *vis-à-vis* incarceration; and generation of immunoassay. Geographic regions were those used by the US Centers for

Disease Control and Prevention (CDC) for hepatitis surveillance (CDC, 2005b). Region and serum collection year were considered proxies for background disease prevalence in the local non-incarcerated population. Although data were extracted on all reported behavioral risk factors, only history of injection drug use (IDU) and history of male sex with males (men who have sex with men [MSM]) were considered further in analyses because IDU and MSM histories were commonly reported and consistently operationalized. Generation of immunoassays was considered a potential source of variation because first generation tests demonstrated levels of sensitivity and specificity which were considerably lower than second generation tests. Immunoassays were not examined by manufacturer and version (e.g., Abbott Laboratories, Auszyme Monoclonal EIA) because specific tests exhibited similar levels of sensitivity and specificity within generation.

Data were extracted from eligible studies independently by two authors. The correlation coefficient and the percentage agreement were calculated for independent reviewers' responses to close-ended items on the data extraction form (total $n = 1208$, ~ 80 items per study) [$r = 94.4$; 89.4% (87.5%, 91.1%)]. Discrepancies were identified and resolved (A.J.H., K.J.G.).

Analysis

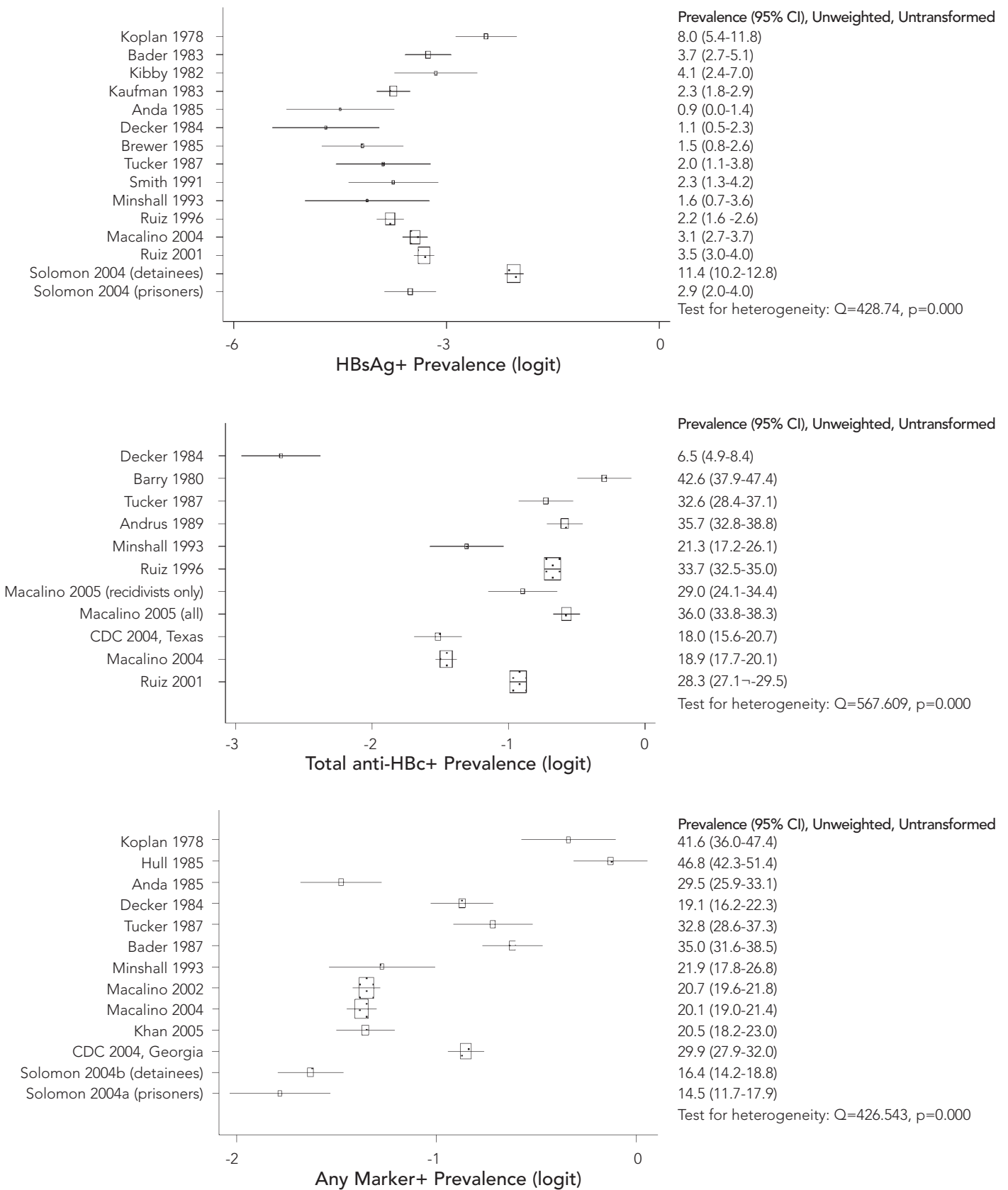
Data were analyzed using Stata 8.2 (College Station, TX: StataCorp LP). Outcomes of interest were prevalence estimates for the most commonly reported seromarkers: HBsAg, total anti-HBc, and any positive HBV marker (i.e., one or more seromarkers positive when more than one seromarker was tested). For each outcome, prevalence estimates with 95% Wilson confidence intervals (CIs) were calculated to display prevalence estimates using a common metric for precision. Wilson CIs were selected because of their overall statistical properties across sample sizes (Brown et al, 2001).

Meta-regression analysis was used to identify potential study-level sources of variation (Greenland, 1998; Thompson, 2001). Harzke et al (2009) previously demonstrated that adult incarcerated populations in the United States are heterogeneous with respect to prevalence estimates of the three commonly reported HBV seromarker outcomes; that is, the dispersion of these HBV seroprevalence estimates around their mean was far greater than would be expected from within-study sampling error alone. Heterogeneity persisted when analyses excluded identified statistical outliers, when analyses were limited to within study sub-groups (e.g., all males, all females, all IDUs), and when analyses were limited to within study-level strata, with one exception (all studies with samples that had $\leq 30\%$ IDUs) (Harzke et al, 2009). Prior to performing meta-regression analyses, prevalence estimates and corresponding standard errors were transformed into *logits* (natural log of the division

of the proportion by 1 minus the proportion) and weighted using the inverse variance method (*meta* command) (Lipsey & Wilson, 2001; Deeks et al, 2001). Logit transformation of proportions has been recommended for meta-analysis because untransformed proportions may overestimate heterogeneity and because logits afford the advantages of a normal distribution and stable variance analysis (Lipsey & Wilson, 2001; Benjamin et al, 2003). Meta-regression analyses were conducted using a random effects model, which more accurately reflects uncertainty about sources of variation than a fixed model (Greenland, 1998). Because of small samples sizes overall and by strata, weighted logit prevalence estimates for each HBV seromarker prevalence outcome were regressed on each individual study characteristic (*metareg* command). Resulting coefficients were exponentiated to produce prevalence odds ratios (PORs) (Greenland, 1998; Benjamin et al, 2003). Sample demographic variables were dichotomized to capture non-linear relationships and/or to reflect important epidemiologic cut-points (e.g., mean age ≥ 31 years, because incidence of HBV infection increases sharply at ~ 30 years of age; CDC, 2005b) or heuristic cut-points [(e.g., $>15\%$ females would be considered high and operationally important in a correctional setting; $>40\%$ Caucasian or African American generally exceeds distributions for state prison populations (Harrison & Beck, 2003; West & Sabol, 2008)]. Study methods variables with three or more categories were initially modeled as multi-categorical variables, but were later dichotomized to improve precision.

Statistical outliers among weighted logit prevalence estimates were identified using the method proposed by Hamilton (2003) (*iqr* command). To examine the influence of particular study-specific prevalence estimates on meta-regression analyses, analyses were repeated excluding identified outliers. Given sparse data for several potential confounders, the following steps were taken to identify potential confounding: we identified study characteristics that showed at least moderate crude associations with HBV seroprevalence outcomes (POR ≥ 1.5 for categorical contrasts); we determined which of these study characteristic variables had sufficient numbers of observations to produce PORs by strata (i.e., no zero cells in cross-tabulations of study characteristic variables, and three or more observations in each stratum of a variable, a requirement for meta-regression in Stata 8.2); for study characteristic variables with sufficient observations to do so, we produced and examined PORs for each study characteristic across strata of each of the other study characteristics; finally, when there appeared to be evidence of moderate or strong confounding (i.e., substantial differences between crude and stratified PORs), the variable of interest and the potential confounder variable were entered together into a meta-regression model to examine the influence of the adjustment on the POR for each variable.

FIGURE 1 | HBV seromarker prevalence estimates with 95% CIs and heterogeneity statistics



RESULTS

Search and Study Selection

A total of 579 unique citations were screened. From these, 23 unique studies meeting eligibility criteria were identified. Two eligible studies estimated HBV seroprevalence for two distinct populations, so we treated them as separate estimates. In Solomon et al (2004), one sample was comprised entirely of sentenced state inmates, and the other was comprised of county inmates and detainees along with state detainees awaiting sentencing or transport [hereafter referred to as Solomon et al, 2004a and 2004b, respectively]. In Macalino et al (2005), one sample included only recidivist women (i.e., those with more than one incarceration during the study period), and the other included all women incarcerated during the study period [hereafter referred to as Macalino et al, 2005a and 2005b, respectively]. Thus, our analyses included reported HBV seroprevalence estimates from 25 distinct US incarcerated samples, with 15 estimates of HBsAg prevalence, 11 of anti-HBc, and 13 of any positive HBV marker.

Seroprevalence Estimates and Study Characteristics

Point estimates ranged from 0.9% to 11.4% for HBsAg prevalence, 6.5% to 42.6% for anti-HBc prevalence, and 16.4% to 46.8% for any positive HBV marker prevalence (Figure 1; Table 1). A majority ($n = 15$) of study populations were composed entirely or predominately ($>85\%$) of male inmates. Nearly all studies ($n = 20$) were conducted in state prison systems or units, and more than one-third of the studies were conducted in the Southern region of the United States ($n = 9$). Serum for HBV screening was collected at a single time point during incarceration in five studies and sequentially upon inmate admission in all other studies.

Less than half ($n = 10$) of the studies reported prevalence estimates for markers providing indications of both current infection (HBsAg) and past infection (anti-HBc or any marker positive). Two recent studies reported their findings in terms of disease states that either were not explicitly defined in terms of seromarkers (CDC, 2004b) or were defined by combinations of seromarkers inconsistent with previous studies (Khan et al, 2005). Findings from these studies were excluded from analyses of the HBsAg and anti-HBc outcomes but were included in analyses for the any positive HBV marker outcome.

Hispanic ethnicity was reported for less than half ($n = 12$) of the study populations, and when reported, was defined inconsistently across studies. Slightly more than half of the eligible studies reported any behavioral risk factor data, with only 14 studies reporting on history of IDU and only nine studies reporting on MSM history. A majority of HBV seroprevalence estimates ($n = 13$) were reported in short reports or abstracts rather than in full study reports.

Meta-Regression

In bivariable meta-regression analyses (Table 2), the following study characteristics showed strong positive crude associations ($\text{POR} \geq 2.0$) with increased HBsAg prevalence: mean age ≥ 31 , $<85\%$ male, $<40\%$ Caucasian, $<4\%$ MSM, and non-probability sampling (vs. census or probability). Study characteristics showing moderate associations ($\text{POR} \geq 1.5$ and <2.0) with increased HBsAg prevalence included use of discarded/stored serum (vs. study-specific screening), serum collection year prior to 1991, and non-state prison facility type. Study characteristics showing strong crude associations with increased anti-HBc prevalence included $<40\%$ African American, $<4\%$ MSM, and second generation test (vs. first generation). Study characteristics showing moderate crude associations with increased anti-HBc prevalence were $<85\%$ male, $<40\%$ Caucasian, $\geq 30\%$ IDU, short report/abstract (vs. full report), and serum collection during incarceration (vs. at admission). Study characteristics showing strong crude associations with increased prevalence of any positive marker included: $\geq 20\%$ Hispanic/Latino, $\geq 30\%$ IDU, $<4\%$ MSM, serum collection year before 1991, and serum collection during incarceration (vs. at admission). Study characteristics showing moderate associations with increased prevalence of any positive marker included $<85\%$ male and West/Midwest region (vs. South/Northeast region).

In general, CIs for crude associations with HBsAg and anti-HBc prevalence estimates were fairly wide, indicating poor precision. Confidence intervals for crude associations with prevalence estimates based on any positive HBV marker were fairly narrow, indicating reasonably good precision. However, for all three markers, nearly all POR estimates ≥ 2.0 had CIs that excluded values <1.0 , and all POR estimates >1.5 had CIs with values overwhelmingly in the positive direction.

Some crude associations were based on a small number of observations overall (e.g., <10 observations) and/or the small number of observations in one of the categories being contrasted (e.g., <3 observations). These associations included: associations of $<85\%$ male and $<4\%$ MSM with increased HBsAg prevalence; all associations with increased anti-HBc prevalence; and associations of $<85\%$ male, $\geq 20\%$ Hispanic/Latino, $\geq 30\%$ IDU, and $<4\%$ MSM with increased prevalence of any positive HBV marker.

Some crude associations appeared to be strongly influenced by particular studies. The associations of $<40\%$ Caucasian and non-state facility type with increased HBsAg prevalence were influenced largely by a single study (Solomon et al, 2004b). These associations were reduced from $\text{POR} = 2.3$ to $\text{POR} = 1.5$ and from $\text{POR} = 1.9$ to $\text{POR} = 1.3$, respectively, when excluding the influential study. Excluding Solomon et al, 2004b, the strength of the association of serum collection year before 1991 with decreased HBsAg prevalence was also reduced to near null

TABLE 1 | Study characteristics and reported prevalence estimates of HBV serologic markers in US incarcerated populations, ordered by year of serum collection

Citation Author, Pub Yr (Serum collection yr) Report type	Setting State Region ^a Type	Serum source/ Sampling ^b	Sample characteristics ^c								Prevalence estimate(s), 95% Wilson confidence interval(s)			
			N	Mean Age ^d	Male %	White %	Black %	Hispanic %	IDU %	MSM %	HBsAg+ %	Anti-HBc+ %	Any + marker %	
Koplan, 1978 ^e (1974) Short report/brief	Kansas Midwest State unit	1c	286									8.0 (5.4, 11.8)		41.6 (36.0, 47.4)
Bader, 1983 (1980) Letter	Wisconsin Midwest Federal (5 sites)		1045									3.7 (2.7, 5.1)		
Kibby, 1982 (1981) Letter	North Carolina South Federal	1a	293		100							4.1 (2.4, 7.0)		
Hull, 1985 ^e (1982) Short report/brief	New Mexico West State system	1a	455	30.3	100	25.1	7.9	59.1 ^f	41.3	3.6				46.8 (42.3, 51.4)
Kaufman, 1983 (1982) Letter	Michigan Midwest State system	4a	3092		100							2.3 (1.8, 2.9)		
Decker, 1984 ^e (1983) Full	Tennessee South State system	1b	759	30.5	100	42	57		47	22		0.9 (0.0, 1.4)	6.5 (4.9, 8.4)	29.5 (25.9, 33.1)
Anda, 1985 (1983) Short report/brief	Wisconsin Midwest State system	1c	619	25.1	100	58	32	4	28.6	4		1.1 (0.5, 2.3)		19.1 (16.2, 22.3)
Brewer, 1985 (1985) Short report/brief	Maryland South State system	1a	797						28 ^g			1.5 (0.8, 2.6)		
Barry, 1990 ^e (1985) Short report/brief	Massachusetts Northeast County facility	1a	406	27.8					33.5	3.0			42.6 (37.9, 47.4)	
Tucker, 1987 (1985) Full	Virginia South State system	1a	445	33.4	100	42			30	8		2.0 (1.1, 3.8)	32.6 (28.4, 37.1)	32.8 (28.6, 37.3)
Andrus, 1989 (1987) Short report/brief	Oregon West State system	2b	977	30.0	91.4	73.9	16.5	6.2	53.1	3.07			35.7 (32.8, 38.8)	
Bader, 1987 (1987) Abstract	Multiple states Federal (6 sites)		741		77.5									35.0 (31.6, 38.5)
Smith, 1991 (1988) Full	New York Northeast State system	4a	430	29.4	0	17.7	44.8	37.5	28.6	N/A		2.3 (1.3, 4.2)		
Minshall, 1993 (1991) Full	Indiana Midwest County facility	1a	319	30.8	86.2	44.5	44.8	10.0	19.4			1.6 (0.7, 3.6)	21.3 (17.2, 26.1)	21.9 (17.8, 26.8)
Ruiz, 1996 ^f (1994) Govt. agency report	California West State system	1b	5144	33.1	87.8	28.4	29.4	30.6	97.1	0.3%		2.2 (1.6, 2.6)	33.7 (32.5, 35.0)	

TABLE 1 | Study characteristics and reported prevalence estimates of HBV serologic markers in US (cont.) | incarcerated populations, ordered by year of serum collection

Citation Author, Pub Yr (Serum collection yr) Report type	Setting State Region ^a Type	Serum source/ Sampling ^b	Sample characteristics ^c								Prevalence estimate(s), 95% Wilson confidence interval(s)		
			N	Mean Age ^d	Male %	White %	Black %	Hispanic %	IDU %	MSM %	HBsAg+ %	Anti-HBc+ %	Any + marker %
Macalino, 2005-a ^g (1996) Full	Rhode Island Northeast State system	2c	297	30.9	0	65.0	25.6	9.4	40.4			29.0 (24.1, 34.4)	
Macalino, 2005-b ^h (1996) Sub-study	Rhode Island Northeast State system	2a	1805	32	0	71	21	6				36.0 (33.8, 38.3)	
CDC, 2004 ⁱ (1999) Govt. agency report	Texas South State system	3b	889									18.0 (15.6, 20.7)	
Macalino, 2002 (1999) Abstract	Rhode Island Northeast State system	2a	5053			87.5	59.0	24.9	16.2			20.7 (19.6, 21.8)	
Macalino, 2004 (1999) Full	Rhode Island Northeast State system	2a	4269	31.8	100	57.4	25.6	16.2	10.6		3.1 (2.7, 3.7)	18.9 (17.7, 20.1)	20.1 (19.0, 21.4)
Ruiz, 2001 ^j (1999) Govt. agency report	California West State system	1b	5595	34.8	87.1	24.1	28.4	33.1	36.3	1.2	3.5 (3.0, 4.0)	28.3 (27.1, 29.5)	
Khan, 2005 (2000) Full	Georgia South State unit	1a	1124	32.5	100	24.3	66.3	6.7	11.6	5.6			20.5 (18.2, 23.0)
Solomon, 2004-a ^k (2002) Full	Maryland South State system	2c	1081	33.1	90.3	31.8	68.0				2.9 (2.0, 4.0)		16.4 (14.2, 18.8)
Solomon, 2004-b ^l (2002) Full	Maryland South County facility	2c	2236	33.9	83.6	13.9	85.2				11.4 (10.2, 12.8)		29.9 (27.9, 32.0)
CDC, 2004 ^m (2003) Govt. agency report	Georgia South State unit	1d	489										14.5 (11.7, 17.9)

a Regions used by the US Centers for Disease Control and Prevention (CDC) for hepatitis surveillance in the United States (CDC, 2005).
 b Serum Source/Sampling: 1=Screening specifically for prevalence study, a=census, b=probability, c=non-probability, d=not reported; 2=Discarded or stored serum from correctional health routine/mandatory serum collection (e.g., as for syphilis or HIV testing), a-d as previously noted; 3=Discarded/stored serum from previous study, a-d as previously noted; 4=Correctional health HBV screening, a=mandatory/routine, b=targeted.
 c Percentages were re-calculated by reviewing authors and reported to first decimal place unless raw data were not provided.
 d When age categories were reported without a value for mean age, mean age was calculated by assuming that the mid-point of each age category was the mean of the category.
 e Unless reported otherwise, first generation assays were assumed to be used in studies testing serum before 1985.
 f Six (of 10) reception/intake centers (four male, two female). Behavioral risk factor data were based on 899 inmates. Only anti-HBc positives were tested for HBsAg.
 g Single intake facility serves as both jail & prison. Sampling frame restricted to women recidivists (i.e., more than one incarceration at the site during the study period).

h Baseline estimate from Macalino et al (2005-a) for all female admits (both non-recidivists & recidivists). Sample size value estimated from data provided. Baseline estimate treated as a short report/brief in analyses
 i Texas system includes state jails (for those with less than two-year sentence).
 j Six (of 10) reception/intake centers (four male, two female). Behavioral risk factor data drawn from Table 13 in Ruiz et al (2001), with 4318 reporting for IDU question and 1148 reporting for MSM question.
 k Intake facility for the Maryland Department of Corrections for sentenced inmates. Sample included inmates not tested at Baltimore Municipal Detention Center while awaiting sentencing. Hierarchical sampling scheme using excess serum (screening for HIV, followed by HCV, HBsAg, and core and surface HBV antibodies). Denominator for HBsAg prevalence=1050. For core and surface antibodies (aggregate) prevalence, denominator=1018
 l Intake facility and detention center for the county of Baltimore. Denominator for HBsAg=2236 and for core and surface antibodies=1892.
 m Includes four (of five) intake facilities.

(POR = 0.91, from POR = 0.69). The strength of the associations of discarded serum (vs. study-specific screening) and non-probability sampling procedures with increased HBsAg prevalence were also diminished when the Solomon et al 2004b study was excluded, from POR = 1.8 to POR = 1.3 and from and POR = 2.0 to POR = 1.5, respectively. The association of <40% African American with increased anti-HBc prevalence were largely influenced by Decker et al, (1984) (from POR = 3.1 to POR = 1.6 excluding this study).

Although assessment of potential confounding was limited by the small number of studies and reported strata, evidence suggestive of confounding was apparent for some associations with HBsAg and any positive HBV marker prevalence estimates. After adjusting for mean age and excluding Solomon et al (2004b) (due to results of influence analysis), the association of <40% Caucasian with increased HBsAg prevalence reversed its direction to a modest degree (adjusted POR = 0.83). Similarly, the association of non-probability sampling procedures with increased HBsAg prevalence approached null when excluding Solomon (2004-b) and adjusting for percent Caucasian, percent African American, or serum source. Serum collection year appeared to confound several associations with any positive HBV marker. Notably, adjusted for serum collection year, PORs were 0.61 for serum collection during incarceration and (crude POR = 2.2) and 1.1 for West/Midwest region (crude POR = 1.6). So, after adjustment for each of the other potential sources of variation, mean age ≥ 31 remained strongly associated with increased HBsAg prevalence, and serum collection year <1991 remained strongly associated with increased prevalence of any positive HBV marker. It may also be noted, although based on a fairly small number of observations ($n = 7$), the association of $\geq 30\%$ IDU with increased prevalence of any positive HBV marker also remained strong after adjustment for each of the other potential sources of variation.

DISCUSSION

Because HBV seroprevalence estimates from US incarcerated population vary widely, the purpose of this study was to investigate a range of study-level factors as potential sources of variation in prevalence estimates of HBV serologic markers from adult incarcerated populations in the United States. Results of bivariable meta-regression analyses indicated that higher mean age of the study sample (≥ 31 years) was strongly associated with increased HBsAg prevalence (POR = 2.5), and earlier serum collection year (before 1991) was strongly associated with increased prevalence of any positive marker (POR = 2.0). These associations were fairly precise and were not influenced by particular studies or apparent confounding. Other study-level characteristics, including the distribution of race/ethnicity and

behavioral risk factors (IDU and MSM) and specific sampling and measurement procedures, showed moderate-to-strong associations with HBV seroprevalence estimates, but were considered less certain because of small numbers of observations, influence of single studies, or potential confounding. However, these epidemiologic and methodologic factors cannot be ruled out by the available data as potential sources of heterogeneity in HBV seroprevalence estimates.

The association of older mean age with increased HBsAg prevalence suggests that the age distribution of an incarcerated population may be an important consideration for determining HBV-related policy in correctional settings. The associations of behavioral risk factors (e.g., IDU history) with HBV seroprevalence have often been assessed in previous studies with the explicit aim of informing decisions about targeted HBV vaccination programming in incarcerated populations. In contrast, although age has been consistently and often strongly associated with HBV seroprevalence (for all markers) within study samples, the age distribution of a study sample or prison population has seldom been discussed as an important consideration in policy-making. The association of older mean age with prevalence of HBsAg, which indicates active HBV infections, suggests that incarcerated populations with older mean ages may have a greater burden of active, infectious cases of HBV. This knowledge may inform HBV screening and vaccination protocols in incarcerated populations, particularly given evidence of continued HBV transmission in these populations (CDC, 2004b; Macalino et al, 2004; Khan et al, 2005). Additionally, the distributions of race/ethnicity and behavioral risk factors – particularly Hispanic/Latino ethnicity and IDU – cannot be ruled out as sources of heterogeneity in HBV seroprevalence in incarcerated populations, because small numbers of studies reporting complete risk factor data prevented us from obtaining valid and precise estimates of these associations.

The association of earlier serum collection year (before 1991) with increased prevalence of any positive marker suggests that temporal variation in background prevalence may be partially responsible for heterogeneity of these estimates in incarcerated populations. In previous studies, HBV seroprevalence estimates have been assumed to be homogeneous over time and space and have been compared only with national average HBV seroprevalence estimates (e.g., Anda et al, 1985; Tucker et al, 1987; Macalino et al, 2004; Solomon et al, 2004). With a few previously noted exceptions, HBV seroprevalence estimates in incarcerated populations have not been contrasted with other incarcerated populations or with background prevalence across time and space. Consideration of existing background prevalence data may be useful in interpreting comparisons of overall burden of HBV seroprevalence estimates across incarcerated populations. Considering existing background prevalence data may

TABLE 2 | Results of bivariable meta-regression analyses relating sample characteristics and study methods to HBV seromarker prevalence estimates^a

Characteristic	Category	HBsAg			Anti-HBc			Any positive HBV marker				
		n	POR	95% CI	n	POR	95% CI	n	POR	95% CI		
Mean Age	<31 yrs (ref)	4			5			4				
	≥31 yrs	6	2.6	1.1	6.0	5	1.3	0.55	3.1	5	0.78	0.41
% Male	≥85% (ref)	10			7			9				
	<85%	2	2.7	1.1	6.3	2	1.6	0.55	4.5	2	1.5	0.75
% White	≥40% (ref)	5			7			6				
	<40%	5	2.3	0.87	5.3	2	1.5	0.50	4.2	4	1.2	0.67
% Black	≥40% (ref)	5			2			5				
	<40%	4	0.84	0.28	2.5	6	3.1	1.4	6.7	4	1.1	0.59
% Hispanic	<20% (ref)	4			4			6				
	≥20%	3	0.84	0.24	3.0	2	1.2	0.59	2.4	1	3.2	1.9
% IDU	<30% (ref)	4			2			4				
	≥30%	4	1.0	0.51	2.1	7	1.5	0.50	4.6	3	2.2	1.5
% MSM	≥4% (ref)	3			2			4				
	<4%	2	2.2	1.1	4.4	4	2.9	0.85	10.0	1	2.6	1.2
Report type	Full study (ref)	7			5			7				
	Short report/abstract/other	8	1.1	0.52	2.3	6	1.9	0.94	3.9	6	1.2	0.70
Serum collection year	1991 or later (ref)	6			7			7				
	Before 1991	9	0.69	0.34	1.4	4	0.99	0.43	2.3	6	2.0	1.3
Region	South/Northeast (ref)	8			7			8				
	West/Mid-west	7	0.98	0.47	2.0	4	1.3	0.58	3.0	4	1.6	0.86
Facility type	State prison (ref)	11			9			10				
	Other	4	1.9	0.92	4.1	2	1.4	0.49	3.8	3	1.2	0.62
Serum source	Study-specific screen (ref)	7			4			8				
	Discarded serum	5	1.8	0.76	4.3	7	1.3	0.59	3.1	4	0.73	0.40
Sampling protocol	Census/Probability (ref)	10			10			7				
	Non-probability	5	2.0	1.0	3.9	1	1.2	0.29	4.9	6	0.90	0.51
Serum collection timing	At admission (ref)	13			9			10				
	During incarceration	2	1.1	0.40	3.3	2	0.60	0.22	1.6	3	2.2	1.3
Test generation	First (ref)	6			2			--				
	Second	9	0.99	0.47	2.1	9	2.4	0.99	5.8	--	--	--

a Meta-regression analyses assumed a random effects model and used logit transformations of HBV seroprevalence estimates as the dependent variable.

also be useful for estimating HBV seroprevalence or projecting future disease burden in incarcerated populations, particularly when site- or system-specific correctional data are limited.

Our analysis was limited to studies indexed prior to August 31, 2005; however, only one subsequently published study has reported HBV seroprevalence estimates from an adult incarcerated population (jail detainees, specifically) (Hennessey et al, 2009). Estimates reported from this study would likely have been excluded from our analysis because these estimates reflected complex weighting methods which would not have been comparable to the estimates included in our analysis. The any positive HBV marker outcome may be viewed as inherently heterogeneous because it reflects the use of different seromarkers

across studies. However, this heterogeneity may actually be limited, because in all identified studies, the any positive marker prevalence outcome reflected the combination of a marker indicating current infection (e.g., HBsAg or IgM anti-HBc) with a marker indicating past infection (e.g., IgG anti-HBc, total anti-HBc, or anti-HBs in the pre-vaccination era). Our analysis included prevalence estimates from several different types of correctional samples, including federal, state, and county inmates as well as county and state detainees. It may be suggested, on the basis of the relatively high HBsAg prevalence estimate from the sample comprised primarily of county and state detainees (Solomon et al, 2004b) and the strong influence of this estimate on meta-regression analyses, that estimates

from detainee samples could have been initially excluded from analysis. However, only a few studies have reported HBV seroprevalence estimates from detainee populations (Solomon et al, 2004b; Hennessey et al, 2009), and it is unclear from these studies how prevalence estimates of HBsAg or other HBV seromarkers from jail populations compare to estimates from prison populations.

The small number of studies reporting data relevant for meta-regression analyses affected the precision of our estimated associations and limited multivariable analyses, which impaired our assessment of interaction and confounding. Thus, our systematic review and meta-regression analyses highlight the limitations of the literature and point toward recommendations for designing and reporting future HBV seroprevalence studies. First, at a minimum, HBV seroprevalence studies should measure and report both HBsAg and anti-HBc for all members of the study sample. This would optimize comparability with other studies and support further investigations of across-study variation. Ideally, future studies would also test for anti-HBs, the seromarker which indicates immunity due to vaccination. Measuring all three of these HBV seromarkers would make it possible to report HBV seroprevalence in a manner that distinguishes infection and immune states: susceptible (HBsAg⁻, anti-HBc⁻, anti-HBs⁻); acute infection (HBsAg⁺, anti-HBc⁻, anti-HBs⁻); chronic infection (HBsAg⁺, anti-HBc⁺, anti-HBs⁺);* past infection with immunity (HBsAg⁻, anti-HBc⁺, anti-HBs⁺); and immune due to vaccination (anti-HBsAg⁻, anti-HBc⁻, anti-HBs⁺). Describing the distribution of infection and immune states would provide guidance to correctional healthcare planners and administrators in projecting the burden of HBV disease in prison populations and in targeting prevention efforts.

Second, it is important that study samples are described in detail and HBV seroprevalence estimates are reported across strata of race/ethnicity and behavioral risk factors. To reiterate, Hispanic/Latino ethnicity was reported for less than half ($n = 12$) of the study populations, and when reported, was defined inconsistently across studies. It is particularly critical that Hispanic/Latino ethnicity be considered in future studies. Hispanic/Latino persons represent a growing portion of the US population and the US prison population. In the non-incarcerated US population, estimates of HBV seroprevalence historically have been considerably higher among African Americans compared to other race/ethnic groups; however, studies have shown that HBV seroprevalence among Hispanic/Latino prisoners approaches or surpasses that among African-American prisoners (Ruiz & Mikanda, 1996; Ruiz et al, 2001; Macalino et al, 2004; Hennessey et al, 2009).

With respect to behavioral risk factors, a history of IDU and a history of multiple sex partners (particularly among MSM) are the most common risk factors for incident HBV infection (CDC, 2009), but only 14 studies included in our review reported on history of IDU and only nine reported on history of MSM. Indeed, in our analysis, estimated associations of the history of IDU with the prevalence of any given HBV seromarker outcome were based on <10 studies, and associations of the history of MSM with the prevalence of any given HBV seromarker outcome were based on less than six studies. So, although the associations of histories of IDU or MSM with prevalence of HBV seromarkers were moderate-to-strong, these associations were considered less certain because they were based on small numbers of observations. However, given the evidence from the general population and the evidence available from incarcerated populations to date, it is reasonable to think that the distributions of these risk factors are sources of variation in HBV seroprevalence across studies of incarcerated samples. Where possible, the distributions of these behavioral risk factors and stratum-specific prevalence estimates should be included in studies reporting HBV seroprevalence estimates from incarcerated populations. Behavioral risk factor information is often readily available to investigators, because information regarding IDU and sexual history are routinely included in the medical intake process in prison healthcare settings to assess risk of HIV and viral hepatitis infections and to recommend further screening.

Despite its limitations, our study contributes to the prison healthcare literature in several ways. It provides detailed descriptive information about all reports of HBV seroprevalence estimates (meeting pre-specified criteria) from US adult incarcerated populations. On that basis, our study supports specific recommendations for the design and reporting of future studies – namely, to measure and report a standard set of HBV seromarkers and to improve reporting of race/ethnicity categories and behavioral risk factors. Furthermore, our study suggests several potential sources of across-study heterogeneity in HBV seroprevalence estimates from US incarcerated populations. Specifically, in meta-regression analyses, it appeared that mean age was a source of heterogeneity in HBsAg prevalence and serum collection year was a source of heterogeneity in the prevalence of any positive HBV marker. However, other potential sources of variation could not be ruled out by the available data. Heterogeneity in HBV seroprevalence estimates may potentially be influenced by a range of factors including the distribution of other demographic characteristics (e.g., race/ethnicity) and behavioral risk factors (IDU and MSM) in study samples as well as geographic and temporal variation in background prevalence and study methods (sampling procedures, serum source, and serum collection timing). These factors

* A small proportion of persons who test HBsAg⁺ and anti-HBc⁺ may be in the process of developing immunity and resolving their infection.

should be considered when comparing HBV seroprevalence estimates from incarcerated populations across studies and when developing HBV screening and vaccination protocols in correctional settings.

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DECLARATION OF CONFLICTING INTERESTS

The authors declared no conflicts of interest with respect to the authorship and/or publication of this manuscript.

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Validity of the DSM-IV and the Four A's Personality Disorder Clusters Among an Adult Male Prisoner Sample

Jane L. Ireland¹

Keywords: DSM-IV clusters; Four A's; IPDE-SQ; prisoners; personality disorder traits

ABSTRACT

The structure of personality disorder traits among adult male prisoners is considered using confirmatory and exploratory analyses with two independent samples ($n = 280$ and 339). All completed the International Personality Disorder Examination Screening Questionnaire (IPDE-SQ). It was predicted that: 1) personality disorder traits would be represented via a multidimensional structure; 2) the DSM-IV-TR independent three-cluster structure of personality disorder would not be replicated; and 3) there would be some convergence for the Four A's published factor model of personality disorder. Evidence of clusters were found but these did not support a straightforward replication of the DSM-IV-TR cluster model or support the Four A's model. A two-cluster model with narcissistic and paranoid traits removed and a DSM-IV-TR three-factor model with correlating factors fitted the data to an acceptable level. The only good model fit though was for an adapted DSM-IV-TR three-factor model with correlating factors, where the "dramatic" cluster B was characterised by the removal of narcissistic and antisocial. The results highlight the lack of validity for the DSM-IV-TR and the Four A's published clusters, arguing for a more parsimonious cluster model for prison samples. The importance of validating personality clusters across samples is discussed and the implications highlighted.

INTRODUCTION

Personality disturbances are not uncommon in prison samples (Hart, 2001; McMurrin, 2003), making this a topic worthy of empirical enquiry (Ireland, Brown & Ballarini, 2006). Indeed, personality disorder and its associated traits are considered of particular importance within prison and psychiatric samples, where their incidence is arguably higher than in community samples. Alwin et al (2006) report, for example, that 10% of community samples would meet the criteria for personality disorder, compared to 80% for psychiatric patients and 50% to 78% for adult prisoners, in some studies. Aside from issues concerning prevalence, further areas of debated interest within this field have focused on the methods and approaches to "diagnosis," including that on the use of a dimensional versus a categorical system (Blackburn, 2007; Bernstein, Iscan & Maser, 2007), the appropriate use of diagnosis across all samples (Alwin et al, 2006), the validity of the DSM-IV criteria for personality disorder (Livesley, 1995), and the problems in applying DSM-IV criteria to forensic samples in the absence of well conducted field studies with this population

(e.g., Hare, 1996). An area that has received limited attention within prisoner samples has been the actual structure of personality disorder traits, most notably with regard to the DSM-IV-TR (APA, 2000) three-cluster model where the full range of personality disorders are grouped into: Cluster A "odd-eccentric"; Cluster B "dramatic"; and Cluster C "anxious" – with DSM-IV suggesting that this cluster system has potential for offering a dimensional re-conceptualisation of the Axis II disorders (APA, 1994).

These clusters have been applied to research exploring a range of variables such as violence and co-morbidity among prisoners, with conclusions drawn, but this has been based on an assumption that the three-cluster model outlined in

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DSM-IV-TR, a) correctly represents how the disorders cluster together, and b) has reliability and validity across samples. The three-factor structure, however, was a result of a themed and theoretical analysis and not a product of careful statistical enquiry using exploratory and confirmatory models, with its validity and reliability across samples not routinely tested (Ireland et al, 2006) and even questioned by the original authors (APA, 1994). This issue has been explored within non-forensic psychiatric and clinical samples (e.g., Yang et al, 2002; Fossati et al, 2006), general samples (e.g., Moldin, Rice, Erlenmeyer-Kimling & Squires-Wheeler, 1994) and among student samples (Chabrol et al, 2007), although the focus in a number of papers has been on the DSM-III or DSM-III-R classification as opposed to DSM-IV. Only a single study to date has explored the validity of these clusters with a prison sample (Ireland et al, 2006).

Research conducted in non-forensic samples, has questioned the validity of the DSM-IV clusters, indicating that examinations of the three-cluster conceptualizations has produced mixed results, with some studies reporting support for the DSM-IV three-cluster model (e.g., Bagby et al, 1993), some reporting three factors but not comprised of the same personality disorders (Moldin et al, 1994), some reporting five factors (Nestadt et al, 1994), and some preferring a four-factor structure (Chabrol et al, 2007; Mulder & Joyce, 1997). Indeed, the four-factor structure has been supported by a number of studies, and has been referred to as the Four A's (i.e., 'Antisocial' - antisocial, borderline, histrionic and narcissistic; 'Asocial' - schizoid; 'Asthenic' - avoidant and dependent and; 'Anankastic' - obsessive-compulsive; Mulder & Joyce, 1997; Austin & Deary, 2000). Further research exploring the existence of the DSM-IV three-factor model has questioned its applicability if self-report measures are employed, finding more evidence of convergence with clinician rated diagnoses, but only if the factors were allowed to correlate (e.g., Yang et al, 2002).

In a study examining adult male prisoners, the structure of personality disorder traits was not found to correspond to the DSM-IV-TR model, with some convergence with the Four A's model (Ireland et al, 2006). In this study, three factors were extracted using the International Personality Disorder Examination Screening Questionnaire. Factor 1 (termed 'Asocial') and Factor 2 (termed 'Antisocial') corresponded broadly to the Antisocial and Asocial factors referred to as part of the Four A's model, with the third factor termed 'Anxious-Dramatic' appearing to be a combination of the DSM-IV-TR Cluster B ('dramatic') and Cluster C ('anxious'), further corresponding in part to the Asthenic and Anankastic factors of the Four A's (Mulder & Joyce, 1997). This study overall suggested some validity for the Asocial and Antisocial factors described as part of the Four A's (Mulder & Joyce, 1997), as opposed to the DSM-IV-TR cluster structure.

The current study aimed to explore the structure of personality disorder traits using two adult male prisoner samples, and to advance the research field by examining both the existence of factors and the nature of how these are represented. The study employed two independent samples, with the first used to attempt to explore and confirm published structures of personality disorder traits, and the second to confirm a revised structure. All participants completed the International Personality Disorder Examination Screening Questionnaire (IPDE-SQ). There were three predictions, as follows: 1) in keeping with previous research indicating clusters across personality disorders and their traits (e.g., Mulder & Joyce, 1997; Ireland et al, 2006; Austin & Deary, 2000), it is predicted that the IPDE-SQ would be represented best by a multidimensional (i.e., clustered) than a one-dimensional solution; 2) the DSM-IV-TR three-cluster structure would not be replicated with the current sample, accounting for previous research with non-forensic (e.g., Mulder & Joyce, 1997; Nestadt et al, 1994) and forensic samples (Ireland et al, 2006) which has questioned the reliability of these clusters; and 3) that the Four A's cluster model of Mulder & Joyce (1997) would fit the data to a greater extent than the DSM-IV-TR model, based on previous research with prisoners (Ireland et al, 2006).

METHOD

Two independent samples were employed as follows:

- *Study 1:* Participants were taken from two adult male prisons, both of which were medium-to-high security establishments. A total of 371 prisoners were provided with questionnaires of which 280 were returned fully completed, producing a 75% response rate. [AUTHORS' NOTE: It was not possible to collect information on the 25% who declined; no information was obtained due to ethical constraints which requested total anonymity.] The mean age of the sample was 33 years (SD = 10.4). Eighty-eight percent were of White ethnic origin, 4% Asian, 4% Black British, 3% Mixed, and 1% "other." The average sentence length was 46.0 months (SD 42.9) and the average total length of time served in penal institutions throughout their lives 48.9 months (SD 48.2). Thirty-six percent were serving for violent offenses, 20% for acquisitive offences, 20% for other indictable offenses, 15% for drug possession/sale offenses, and 9% for sex offenses.
- *Study 2:* Participants were taken from two adult male prisons, again, two medium-to-high risk establishments. A total of 413 prisoners were provided with questionnaires of which 339 were returned fully completed, pro-

ducing an 82% response rate. The mean age of the sample was 30 years (SD = 9.1). Eighty-four percent were of White ethnic origin, 6% Asian, 6% Black British, 3% Mixed, and 1% "other." The average sentence length was 39.2 months (SD 26.4) and the average total length of time served in penal institutions, throughout their lives 59.5 months (SD 58.9). Forty-two percent were serving for violent offenses, 30% for acquisitive offenses, 10% for other indictable offences, 16% for drug possession/sale offenses, and 2% for sex offences.

Measures

All completed the International Personality Disorder Examination Screening Questionnaire (IPDE-SQ; Loranger, Janca, Sartorius, 1997). The IPDE-SQ is a 77-item self-report screening measure with the purpose of detecting maladaptive personality traits evidenced over the last five years. It is used to screen for all 10 DSM-IV-defined personality disorders. Participants were asked to answer either true or false to each item (12 items reversed). Examples of items included, "I discover hidden threats in what some people tell me," and "I daydream about being famous." Internal consistency reliability statistics for the IPDE-SQ for prison samples has ranged from reduced to

good, although this is a likely function of its dichotomous nature and small number of items, which limits reliability methods to a use of Kuder-Richardson-20. In Ireland et al (2006), Kuder-Richardson averaged at .55, with compulsive producing the lowest (.40) and anti-social the highest (.75). The current study will examine this more thoroughly, and appropriately, as part of the confirmatory models.

Procedure

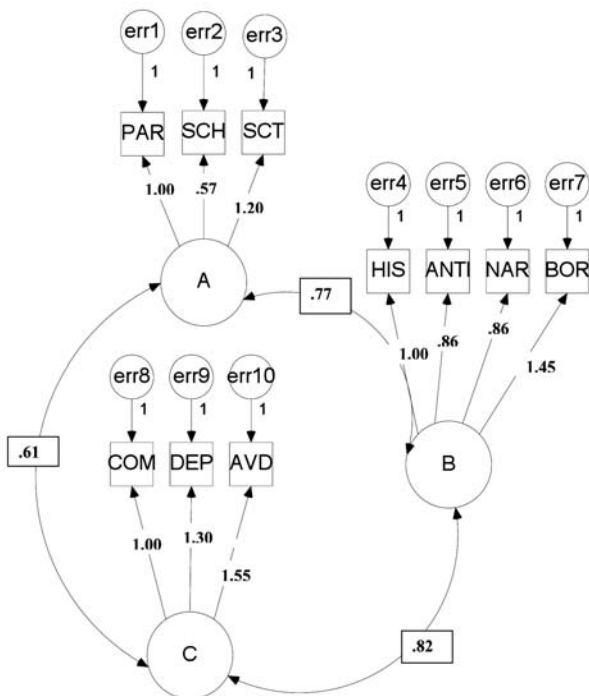
Ethical approval for the study was obtained from the University Ethics Committee and from each prison. All questionnaires were administered during a lunchtime period when prisoners were in their cells on their own. They were given to each prisoner personally. There were no differences in the sampling methods utilized across establishments. All participants were informed of the nature, purpose and anonymity of the study. Analysis was conducted using SPSS.

RESULTS

Initially the structure of the IPDE-SQ was examined with regard to its unidimensional structure, followed by an attempt to confirm the published three factor personality disorder

FIGURE 1

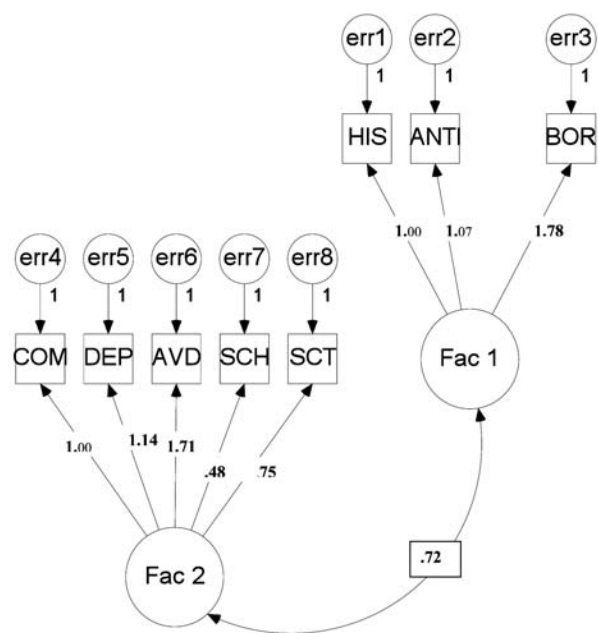
Confirming the DSM-IV-TR three-factor personality structure using the IPDE-SQ with an adult male prisoner sample (n = 280). RMSEA = .07; GFI = .94. Regression estimates are illustrated*.



*A: 'odd-eccentric' cluster; B: 'dramatic' cluster; C: 'anxious' cluster.

FIGURE 2

Confirming the revised two-factor personality structure using the IPDE-SQ with an adult male prisoner sample (n = 339). RMSEA = .08; GFI = .96. Regression estimates are illustrated.



structure according to DSM-IV-TR and also the Four A's structure (Mulder & Joyce, 1997). Following this are exploratory and confirmatory stages examining a proposed revised factor structure for the IPDE-SQ. All confirmation models were recursive, identified and standardized with variances set to 1.00 and employing Maximum Likelihood estimation.

STEP 1: Overall Structure of the IPDE-SQ. Is It unidimensional? The unidimensional nature of the data was explored with the Study 1 sample (n = 280). Although the GFI was over .90, the RMSEA was above .08 and the χ^2/df ratio higher than 2.00 ($X^2 = 3.43$), suggesting a less than adequate model fit (Hu, Bentler, 1999) ($\chi^2 (35) = 120.3 [P = .00]$; RMSEA = .09 [.07 to .11]; GFI = .92; ECVI = .57 [.47 to .71]). This indicated a multidimensional structure to the data. The nature of this structure was thus explored, first with regards to the three cluster structure indicated by DSM-IV-TR, and then by the suggested Four A's model structure.

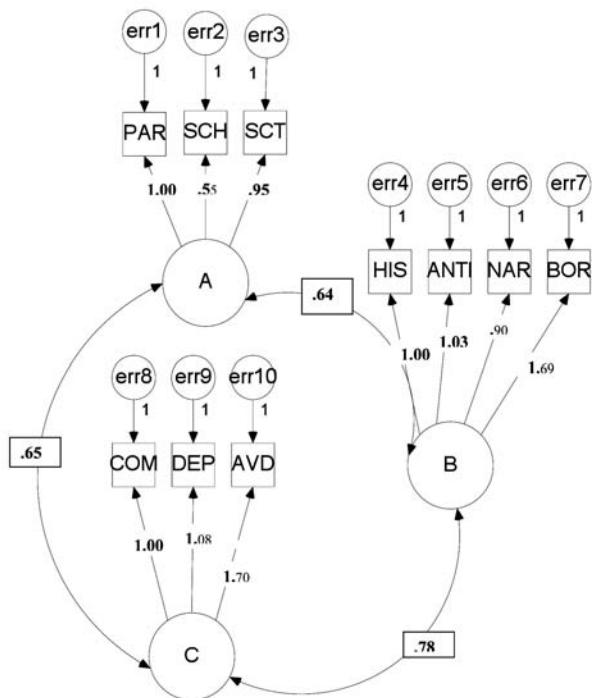
STEP 2: Confirming the DSM-IV or Four A's Multidimensional Structure of Personality Disorder Traits. Following demonstration of a non-unidimensional structure, the next step was to attempt to confirm the structure proposed by DSM-IV-TR for

maladaptive personality (Axis II), namely [A] 'odd-eccentric' (paranoid, schizoid and schizotypal); [B] 'dramatic' (antisocial, borderline, histrionic and narcissistic); and [C] 'anxious' (obsessive-compulsive, avoidant and dependent). Confirmation was attempted using the Study 1 sample, commencing with an uncorrelated model. The model fitted the data poorly ($\chi^2 (35) = 335.8 [P = .00]$; χ^2/df ratio = 9.59; RMSEA = .18 [.16 to .19]; GFI = .81; ECVI = .135 [1.15 to 1.57]). Correlating the factors greatly improved model fit, bringing it to an acceptable level with regards to RMSEA and GFI ($\chi^2 (32) = 85.2 [P = .00]$; RMSEA = .07 [.06 to .09]; GFI = .94; ECVI = .47 [.39 to .58]), with the χ^2/df ratio = 2.66, suggesting an acceptable fit. A model with correlated factors was clearly greatly improving model fit. The model is presented in Figure 1.

The Four A's cluster model was also examined with the data; *Antisocial* - antisocial, borderline, histrionic and narcissistic; *Asocial* - schizoid; *Asthenic* - avoidant and dependent; and *Anankastic* - obsessive-compulsive (Mulder, Joyce, 1997; Austin, Deary, 2000). Confirmation was attempted using the Study 1 sample. The model fitted the data poorly (RMSEA = .27 [.25 to .29]; GFI = .52; ECVI = .25 [.25 to .26]), with correlation of factors failing to improve model fit (RMSEA = .28 [.26 to .30]; GFI = .52; ECVI = .26 [.25 to .26]).

FIGURE 3

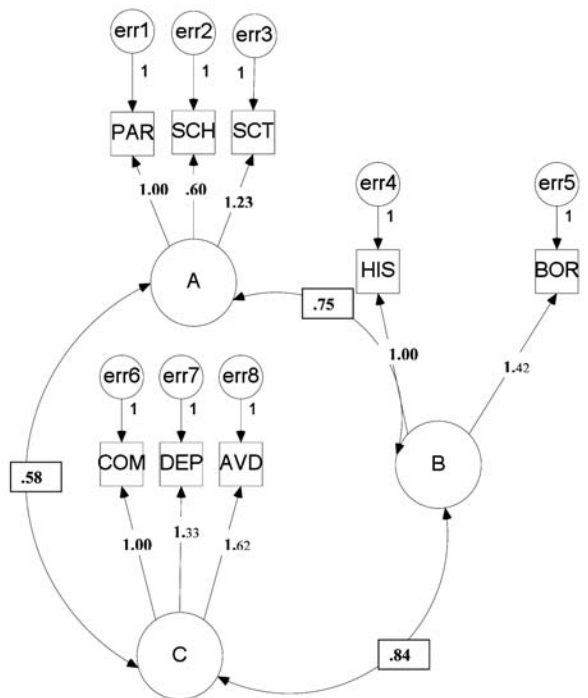
Confirming the three-factor DSM-IV-TR structure using the IPDE-SQ with Study 2 (adult male prisoners, n = 339). RMSEA = .07; GFI = .94. Regression estimates are illustrated*.



*A: 'odd-eccentric' cluster; B: 'dramatic' cluster; C: 'anxious' cluster.

FIGURE 4

Confirming the adapted DSM-IV-TR three-factor personality structure using the IPDE-SQ with Study 2 (adult male prisoners, n = 339). RMSEA = .04; GFI = .98. Regression estimates are illustrated*.



*A: 'odd-eccentric' cluster; B: 'dramatic' cluster; C: 'anxious' cluster.

STEP 3: Exploring the Factor Structure of the Personality Disorder Traits. Following demonstration of a multidimensional structure for the IPDE-SQ but difficulties in producing a model with good fit to the data when applied to pre-existing clusters (i.e., DSM-IV-TR and the Four A's model), the next step focused on exploring the structure of personality disorder traits. This was completed using Study 1. In order to more strictly identify the number of factors evident, Parallel Analysis (PA), was employed since this is recommended as the best method to assess the true number of factors (Velicer, Eaton & Fava, 2000; Lance, Butts & Michels, 2006). This indicated two factors and was also confirmed via a scree plot. The factor analysis therefore proceeded, restricting analysis to two factors using Principle Components Analysis with Varimax Rotation. Results are indicated in Table 1. A cut-off of .40 is used to display all factor loadings. The model produced explained 52% of the variance. Factor 1 explained 27.3% of the variance and appeared to correspond largely to the original DSM-IV-TR 'dramatic' cluster; with Factor 2 explaining 25.2% of the variance and best described as a mixture of the 'avoidant-odd-eccentric' clusters (A and C of DSM-IV-TR).

STEP 4: Confirming This Revised Structure on an Independent Sample. The next stage was to attempt to confirm this two-factor structure with an independent sample, specifically Study 2, comprising of 339 adult male prisoners. The first model indicated a very poor fit to the data (χ^2 (35) = 311.5 [p = .001]; χ^2 /df ratio = 8.9; RMSEA = .15 [.13 to .16]; GFI = .86; ECVI = 1.04 [.88 to 1.22]). When factors were allowed to correlate there was an improved fit but not a good fit when accounting for RMSEA and the χ^2 /df ratio (χ^2 (34) = 160.8 [p = .001]; χ^2 /df

ratio = 4.73; RMSEA = .10 [.08 to .12]; GFI = .91; ECVI = .60 [.49 to .72]). The model was then recalculated, removing the two factors which had cross-loaded on both factors, namely narcissistic and paranoid (see Table 1), with covariances retained. Their removal greatly improved model fit, bringing this to an acceptable level with regards to RMSEA and GFI (χ^2 (19) = 61.6 [p = .001]; χ^2 /df ratio = 3.24; RMSEA = .08 [.05 to .10]; GFI = .96; ECVI = .28 [.22 to .37]).

To assess whether the original DSM-IV-TR three-factor solution produced a better fit with this independent sample, a further confirmatory factor analysis was conducted. The model fit was not good with the RMSEA close to .10, and the χ^2 /df ratio well above 2.00 (χ^2 (32) = 125.5 [p = .001]; χ^2 /df ratio = 3.92; RMSEA = .09 [.07 to .11]; GFI = .93; ECVI = .51 [.42 to .62]). However, the model fit was greatly improved by allowing factors to correlate, bringing it to an acceptable level (χ^2 (32) = 85.2 [p = .001]; χ^2 /df ratio = 2.66 RMSEA = .07 [.05 to .10]; GFI = .94; ECVI = .47 [.38 to .58])

STEP 5: Identifying the Best Fitting Model. Thus, there appeared two "best" fitting models, a three- and adapted two-factor model with factors that were not independent of one another (i.e., were allowed to correlate – the models are illustrated in Figures 2 and 3). However, due to the failure to find a model which fitted the data well, it was explored if the three-factor DSM-IV-TR model could be improved further by the removal of the factors with elevated Modification Indexes (MIs). Elevated MIs were noted for narcissistic (10.98) and antisocial (7.68) indicating that their presence was not assisting with producing a cohesive factor. Removal of these factors greatly improved model fit, indicating a very good fit to the data (χ^2 (17) = 24.7 [p = .10];

TABLE 1 | Exploratory factor structure of the IPDE-SQ using adult male prisoners (n = 280)

IPDE-SQ personality disorder	Factor 1 27.3% variance Loading	Factor 2 25.2% variance Loading	Original DSM-IV-TR cluster	Original Four A's cluster
Antisocial	.84	-	B/DRAMATIC	ANTISOCIAL
Borderline	.77	-	B/DRAMATIC	ANTISOCIAL
Histrionic	.68	-	B/DRAMATIC	ANTISOCIAL
Paranoid*	.50	-	A/ODD-ECCENTRIC	-
Narcissistic*	.46	-	B/DRAMATIC	ANTISOCIAL
Schizoid	-	.73	A/ODD-ECCENTRIC	-
Compulsive	-	.63	C/ANXIOUS	ANANKASTIC
Avoidant	-	.61	C/ANXIOUS	ASTHENIC
Schizotypal	-	.60	A/ODD-ECCENTRIC	ASOCIAL
Dependent	-	.52	C/ANXIOUS	ASTHENIC

*NB: These factors loaded above .40 onto Factor 2 also although the higher loading was on Factor 1.

χ^2/df ratio = 1.45; RMSEA = .04 [.001 to .07]; GFI = .98; ECVI = .47 [.38 to .58]). The model is shown in Figure 4. When the model confirmed with the previous sample (Study 1) it also produced a good fit to the data ($\chi^2(17) = 38.9$ [$p = .002$]; χ^2/df ratio = 2.28; RMSEA = .06 [.04 to .08]; GFI = .97; ECVI = .23 [.19 to .29]). There was no attempt made to improve the model fit for the Four A's model owing to its overall very poor fit, even with covariances added (i.e., RMSEA = .25 and .26).

DISCUSSION

The current study supported the existence of clusters within personality disorder trait structures, and in doing so supported the prediction made that clusters would be evident. This was consistent with previous research indicating personality disorder and its traits are best represented via a number of factors (e.g., Austin & Dreary, 2000; Mulder & Joyce, 1997). Neither the DSM-IV-TR three-factor structure nor the Four A's factor structure were replicated. This supported the prediction that there would not be a straightforward application of the three-factor structure to a prison sample (Ireland et al, 2006), but did not support the prediction that the Four A's model would fit prisoner data better than the DSM-IV-TR clusters. This latter finding is inconsistent with previous research that has reported more convergence in prisoner samples for the Four A's than the DSM-IV-TR model (Ireland et al, 2006). The results highlight the difficulties in attempting to apply a factor model derived originally for non-forensic samples, to a prisoner sample.

Indeed, what the current study suggests is value in the DSM-IV-TR three-cluster model *only* if the three clusters were not independent of one another, with the best model one which removed two of the original "dramatic" cluster traits – antisocial and narcissistic. This finding is particularly interesting in that it suggests that antisocial and narcissistic do not adequately fit the dramatic cluster. This is a suggestion that has been made by previous researchers who have asserted that these two sets of traits are not well represented conceptually by the dramatic cluster (Widiger & Costa, 1994). The separation of narcissistic and antisocial from the "dramatic" cluster has also been found in adolescent samples (Durrett & Westen, 2005). The current study appears to lend support for their removal from Cluster B (dramatic).

The current study also proposed a two-factor model which also indicated the removal of traits – namely narcissistic and paranoid - with Factor 1 of this model closely resembling the original cluster B (Dramatic) of DSM-IV and the "Antisocial" cluster of the Four A's (Austin & Dreary, 2000; Mulder & Joyce, 1997), and Factor 2 representing a combination of DSM-IV-TR cluster A (odd-eccentric) and C (anxious) and the Four A's Anankastic, Asthenic and Asocial "clusters." Taken collectively, what the results suggest here is more evidence supportive of the

use of the DSM-IV-TR three-cluster model if this is adapted to allow clusters to correlate and if groups of traits are removed. The adapted three-cluster model (Figure 4) was by far fitting the data better than the other suggested models, fitting across two samples. This suggests a revision of the three-factor cluster structure and the development of a more parsimonious model with forensic samples. The finding that the model fitted best if factors were allowed to correlate is consistent with research exploring general psychiatric samples (e.g., Yang et al, 2002), and indicated the lack of independence across clusters.

The current results highlight the importance of exploring personality structures as opposed to simply assuming their validity. The futility of assuming that published structures will apply to all samples, including forensic samples, is highlighted (e.g., Ireland & Archer, 2008). Assumption of replication without considered testing can lead to clinical decisions being made on what is in fact poorly fitting data. Further significant implications of the current study are also indicated. For example, the current DSM-IV three-cluster model has been used to examine issues of co-morbidity across Axis I and Axis II disorders (see Livesley, 2001), with the current study now questioning the validity of such research and the conclusions that can be drawn from this. Furthermore, questions can be raised on the use of personality measures in prison settings, where the constraints of the environment may serve to either under or over emphasise potentially problematic traits. Thus although the current study focuses on the problems in applying personality cluster models to prisoners, it actually begins to question the whole concept of personality measurement with such populations. How, for example, can we be sure that what has been measured is stable personality as opposed to more transient, environmentally-induced, changes? Indeed, the damaging impact of incarceration on health and presentation is well argued (e.g., Dorpat, 2007; Neiland et al, 2001). Deterioration models, for example, posit that long-term incarceration causes deterioration of a prisoner's personality, emotional and mental wellbeing (e.g., John Howard Society, 1999). Although challenged by some (e.g., Zamble & Porporino, 1988), there does appear evidence for at least a transient change in prisoner functioning (John Howard Society, 1999), further questioning the validity of making a non-transient DSM-IV diagnosis (such as personality) within such a context. Furthermore, the field trials for DSM-IV in relation to Anti-Social Personality Disorder-produced criteria which have been heavily criticized for their ambiguity and inadequate specificity of the diagnostic criteria in prison settings (Hare, 1996), with the remaining field trials failing to include incarcerated populations. For this latter reason, a failure for convergent validity in the current study is thus perhaps unsurprising. Indeed, overall, there have been recurrent concerns noted about the validity of the DSM-IV criteria for per-

sonality disorder (see Livesley, 1995); with the current study suggesting that this applies equally to incarcerated populations.

There are also further questions which personality researchers should perhaps be raising, namely why are we focusing on maladaptive personality and not neutral or adaptive personality? What, for example, are the positive and adaptive traits of our forensic populations and why do we not routinely measure them? This would certainly be of great assistance when exploring therapeutic approaches and focusing on raising an individual's reliance on adaptive as opposed to maladaptive traits. There is, however, an absence of adaptive personality measures, with a focus on personality as a construct closely aligned with negative pathology. This is undoubtedly influenced by medical models (i.e., DSM) that focus on the concept of "illness" as opposed to "well-ness." Thus, a recommendation would be to use assessments of personality with caution in forensic settings, acknowledging the caveats, and seeking to combine them with assessments of neutral and adaptive personality so that assessments are well-balanced and likely to assist treatment recommendations in the future.

The current study is not, however, without its limitations. It was based on prisoner self-report and thus the extent to which this is consistent with the perception of others and/or collateral information remains unclear. Indeed, the lack of convergence with the DSM-IV-TR three-factor model could be a result of the self-report method used, with clinician's ratings known to produce clusters closer to DSM-IV-TR (e.g., Yang et al, 2002). Finally, the IPDE-SQ, although a potentially useful measure to screen for maladaptive personality, is not without its criticisms. This has included its arbitrary use of cut-offs, and its questioned use by some as a clinical tool (e.g., Rogers, 2001). However, the IPDE-SQ has been utilised in an increasing number of studies over recent years, including prison samples (e.g., Ireland et al, 2006), where the ease of administration allows for large samples to be collected which then allow confirmatory analyses to be conducted. The current study also applied the IPDE-SQ as a continuous and not categorical measure, thus avoiding problems of arbitrary cut-offs. It was also *not* being used in the current study to diagnose disorder. Rather it was being used to explore the structure of the maladaptive traits that it purports to assess. Thus, if anything, the current study forms part of a developing literature exploring the validity and reliability of this measure.

What is clear from the current study is the absence of support for *empirically* derived clusters that have been developed on non-forensic samples (i.e., the Four A's), and for the *theoretically* derived DSM-IV three-cluster system. The latter is illustrated aptly by the finding that only models which allowed for correlations between factors were improved. This lack of independence across the clusters queries the validity of the theoretical structure suggested in DSM and highlights the need to develop more

exploratory models. The current study has also illustrated how queries concerning the validity of the three-factor model extend beyond general and psychiatric samples to prison samples, lending more support to the difficulties with such models. In fact, the implications of the current research are potentially significant since they question the entire utility of currently available measures of personality for prisoner populations. The current study has essentially attempted to "fit" prisoner personality into existing factor models and noted considerable difficulty; both with regard to individual personality factors and also in trying to determine the distinct nature of clusters. Indeed, the study suggests value in the development of personality measures which capture more fully a prisoner population as opposed to simply trying to "fit" existing measures. This raises a number of additional research questions such as the true validity of personality measures to prisoners, not just the IPDE-SQ; determining if the current findings translate to clinician-rated methods of measurement; exploring the differences in personality structure between women and adolescent prisoners; exploring adaptive as well as maladaptive measures of personality; and exploring the extent to which personality is influenced by the effects of the prison environment, and thus its' stability. There does, however, need to be more acceptance of the possibility that a cluster model will not have validity across all samples. Rather, focus should be on the heterogeneity of personality clusters across samples as opposed to attempts to seek a generic homogeneous model.

DECLARATION OF CONFLICTING INTERESTS

The authors declared no conflicts of interest with respect to the authorship and/or publication of this manuscript.

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Drug-Related Deaths Among Recently Released Prisoners in Ireland, 1998 to 2005

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Keywords: prisoners, recently released, drug-related deaths, Ireland

ABSTRACT

The aim of this study was to investigate deaths following release from prison among individuals recorded on the National Drug-Related Deaths Index (NDRDI). A descriptive analysis of individuals with a history of imprisonment in the NDRDI from 1998 to 2005 was undertaken. Between 1998 and 2005, 130 (5.3%) of the recorded cases had a documented history of imprisonment, 105 of whom were not in prison at the time of their death. Of these 105, 89% were male, 62% were aged between 20 and 29 years, 84% were unemployed, and 10% were homeless. Almost two thirds (61%) had a history of injecting drug use, and 34% were reported to be injecting at the time of their death. Almost one third (28.1%) of the deaths occurred within the first week of release from prison, with a further 18% in the first month. Opiates were implicated in 89% of all poisonings in the first month after release from prison. Additionally, 62% of these poisonings involved polysubstance use. The study highlights the need for more intensive prevention measures in the period immediately following release from Irish prisons, including the development of a national overdose prevention strategy.

INTRODUCTION

Research in Australia (Karimina et al, 2007), Denmark (Christensen et al, 2006), England (Farrell & Marsden, 2007), Scotland (Bird & Hutchinson, 2003; Seaman et al, 1998; Seymour et al, 2000) and the United States (Binswanger et al, 2007), has found evidence of an increased risk of mortality among prisoners in the days and weeks immediately following their release from prison. The majority of these deaths are drug related, and frequently caused by an overdose. One reason suggested for the increased mortality in this group is that imprisonment alters an individual's tolerance of drugs, possibly because of curtailed drug use while in prison, leaving them at an increased risk of overdose on release (Jones et al, 2002; Seymour et al, 2000; Singleton et al, 2003). To date in Ireland, few studies have examined this relationship. Between 1998 and 2001, a review of 342 opiate-related deaths in Dublin coroners' records found that 13% had a history of imprisonment (Byrne, 2002). This paper investigates the time interval between date of release and date of death in deceased individuals with a documented history of imprisonment, using data from the Irish spe-

cial register for drug-related deaths, the National Drug-Related Deaths Index (NDRDI), for the years 1998 to 2005.

METHODS

The NDRDI is an epidemiological database which records all deaths by drug and/or alcohol poisoning, and deaths among drug and problem alcohol users in Ireland. To ensure completeness, data from several sources are collected: the General Mortality Register (GMR), coroners' records, acute hospital records (via the Hospital In-Patient Enquiry (HIPE) scheme) and the national methadone treatment register (the Central Treatment List [CTL]). Data collection from the community via the Family Support Network, a community organisation, is still in its pilot phase and did not contribute to this round of analy-

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sis. Data are collected retrospectively (Lyons et al, 2008), and include: demographic details; socioeconomic information (including imprisonment history); history of problem drug and alcohol use; risk behaviours (e.g., injecting drug use); and medical diagnosis, including blood-borne viral infection status; drug or alcohol treatment history; and details about the death itself. Cases are matched across the different data sources to avoid duplication; the matching criteria used were initials, date of birth, gender, place of residence, and date of death. History of imprisonment, if documented, is collected from coroners' records. Where possible, the date of release from an Irish prison or the date of death (if in prison at time of death) is verified by the Irish Prison Service.

The NDRDI includes cases that meet the criteria of a directly drug-related death (i.e., poisoning due to the toxic effects of drug or substance consumption). For the purposes of this paper, this type of death is referred to as a poisoning. The index also includes cases that have a recorded history of drug dependence or a history of non-dependent abuse of drugs. For the purposes of this paper, this type of death is referred to as a "non-poisoning" death.

Deaths due to alcohol poisoning alone or deaths among problem alcohol users who were not drug users were not included in this analysis as these cases were not recorded on the NDRDI before 2004.

The NDRDI has ethical approval from the Health Research Boards Ethics Committee and the acute hospitals participating in HIPE and in this exercise. The NDRDI has permission from the CTL, the GMR, and the Coroner Service to collect these data.

Data were entered into a secure and encrypted Microsoft Access database and when matched and exported were anonymized and analyzed using SPSS version 15. A descriptive analysis was conducted and the Pearson χ^2 test was used to compare proportions in independent groups of categorical data.

RESULTS

Profile of Individuals Released from Prison

Between 1998 and 2005, 2442 drug-related deaths were recorded on the NDRDI, of which 130 (5.3%) were of people who had a documented history of imprisonment. Of these 130 individuals, 93 (71.5%) had been released from prison, 25 (19.2%) were in prison, and 12 (9.2%) were on temporary release at the time of their death.

This analysis will focus on the 105 individuals who were not in prison at the time of their death (Table 1). The majority were male (88.6%), and most were aged between 20 and 29 years (median age 26 years). At the time of death the vast majority (83.8%) were unemployed, 20% were living in unstable accommodation, and 10% were homeless. Almost all (97.1%) had a history of drug misuse or drug dependence; 32 individuals were on the methadone

treatment register at the time of death (CTL). Almost two thirds had a documented history of injecting drug use, and one third was reported to be injecting at the time of their death. Only 11 (10.5%) had a documented history of blood-borne viral infection, of whom five were co-infected with two or more viruses and eight had a documented history of injecting drug use.

These 105 individuals were compared with the other cases on the database who had no documented history of imprisonment ($n = 2312$). There were many differences observed between the two groups for the variables examined (Table 1). Those with no documented history of imprisonment were older, had significantly lower rates of unemployment, homelessness, drug dependency/abuse, and were less likely to have a history of injecting drug use and blood-borne viral infection.

Time Between Release from Prison and Death

Date of release from prison could not be confirmed for 16 individuals. Of the 89 cases with a known date of release, nine (10.1%) died on the first or second day of release, and a further 16 (18.0%) in the first three to seven days (mode 1 day) (Figure 1). Overall, 63 deaths (70.8%) were poisonings.

Almost a third of all deaths (25, 28.1%) occurred within the first week of release, and a further 17 (19.1%) by the end of the first month. The characteristics of the deaths that occurred in the first month ($n = 42$) were further explored (Table 2).

Deaths within the first month of release

Of the 42 individuals who died in the first month, 10 (23.8%) were on temporary release from prison. These individuals comprised the vast majority of all those who were on tempo-

FIGURE 1 | Time between release from prison and death ($N = 89$)

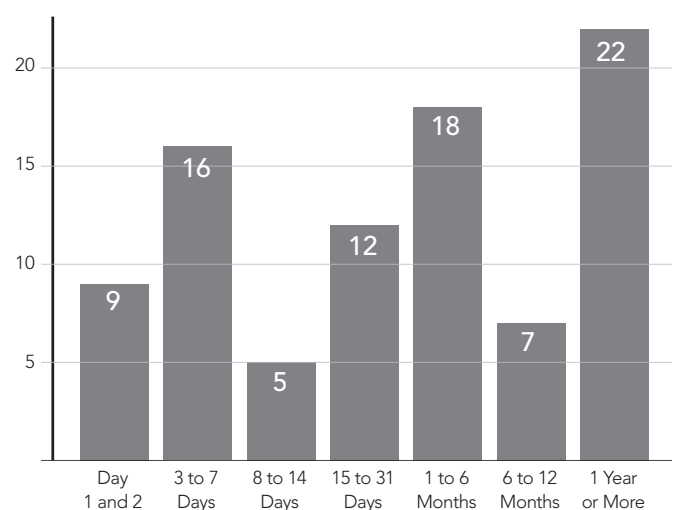


TABLE 1 | Comparison of characteristics of individuals released from prison at time of death with individuals with no documented history of imprisonment

Characteristics	Released from prison	No documented history of imprisonment	Chi square
	N = 105	N = 2312	
Male	93 (88.6)	1670 (72.2)	13.6 df 1 p >0.000
Female	12 (11.4)	642 (27.8)	
Age at time of death			
≤24 years	36 (34.3)	532 (23.0)	50.8 df 5 p = 0.0001
25–29 years	33 (31.4)	333 (14.4)	
30–34 years	20 (19.0)	324 (14.0)	
35–39 years	6 (5.7)	316 (13.7)	
40–44 years	5 (4.8)	254 (11.0)	
45+ years	5 (4.8)	552 (23.9)	
Median age	26 years	34 years	
Type of death			
Poisoning	70 (66.7)	1473 (63.7)	0.38 df 1 p = 0.5
Non-poisoning	35 (33.3)	839 (36.3)	
Employment status before death			
Unemployed	88 (83.8)	849 (36.7)	93.9 df 2 p >0.0001
In paid employment	5 (4.8)	492 (21.3)	
Unknown/not recorded	12 (11.4)	971 (42.0)	
Type of accommodation before death			
Stable	58 (55.2)	1564 (67.6)	88.7 df 3 p >0.001
Unstable ¹	21 (20.0)	74 (3.2)	
Homeless	10 (9.5)	80 (3.5)	
Not known/other	16 (15.2)	594 (26.0)	
Mention of drug misuse/dependency			
Mention of drug misuse/dependency	102 (97.1)	1472 (63.7)	49.6 df 1 p >0.0001
History of ever having injected			
History of ever having injected	64 (61.0)	490 (21.2)	89.9 df 1 p >0.0001
Injecting at time of death			
Injecting at time of death	36 (34.3)	278 (12.0)	44.0 df 1 p >0.0001
Infection with a blood-borne virus²			
Infection with a blood-borne virus ²	11 (10.5)	93 (4.0)	10.2 df 1 p = 0.001
Location where death occurred			
Private dwelling	52 (49.5)	1287 (55.7)	22.9 df 4 p >0.0001
Public place/building	28 (29.7)	488 (21.1)	
Hospital	15 (14.3)	112 (4.8)	
Other	10 (9.5)	101 (4.3)	

1. This includes temporary living arrangements (e.g., living with friends on a temporary basis without paying rent). 2. Hepatitis B or C virus or HIV

TABLE 2 | Profile of individuals who died within one month (31 days) of release from prison, by number of days between release and death (N = 42)

	Days 1 to 2 N = 9	Days 3 to 7 N = 16	Days 8 to 31 N = 17	Total N = 42
Median age	29	26	24	25
Poisoning n (%)	9 (100.0)	13 (88.0)	16 (94.1)	38 (90.5)
Injecting at time of death n (%)	4 (44.4)	6 (37.5)	8 (47.1)	18 (42.9)
Days to death (mode)	1 day	3 days	15 days	1 day

TABLE 3 | Comparison of characteristics of individuals who died within one month (31 days) after release from prison compared to those individuals who died more than one month after release from prison

Characteristics	Died within one month N = 42	Died after one month N = 47	Chi Square
Age at time of death			
≤24 years	20 (47.6)	13 (27.7)	6.4 df 2 p = 0.04
25–29 years	10 (23.8)	23 (48.9)	
30+	12 (28.6)	11 (23.4)	
Median age	25	26	
Type of death			
Poisoning	38 (90.5)	25 (53.2)	14.9 df 1 p > 0.0001
Employment status before death			
Unemployed	35 (83.3)	41 (87.2)	0.27 df 1 p = 0.6
Type of accommodation before death			
Stable	20 (47.6)	31 (66.0)	3.5 df 2 p = 0.2
Unstable ¹ /homeless	16 (38.1)	10 (21.3)	
Not known/other	6 (14.3)	6 (12.8)	
History of ever having injected	27 (64.3)	26 (55.3)	0.74 df 1 p = 0.4
Injecting at time of death	18 (42.9)	13 (27.7)	2.3 df 1 p = 0.13
Location where death occurred			
Private dwelling	23 (54.8)	27 (57.4)	2.6 df 2 p = 0.3
Public place/building	15 (35.7)	11 (23.4)	
Other/unknown	4 (9.5)	9 (19.1)	

1.This includes temporary living arrangements (e.g., living with friends on a temporary basis without paying rent).

TABLE 4 Types of substance involved in deaths by poisoning within a month of release from prison (N = 38)

Substance	n (%) ¹
Heroin	19 (50.0)
Methadone	18 (47.4)
Benzodiazepines	11 (28.9)
Antidepressants	6 (15.8)
Stimulants ²	7 (18.4)
Other ³	11 (28.9)

1. Percentages in this column may not add up to 100% as individual cases may have more than one substance involved in their death.

2. Including cocaine and methamphetamines.

3. Other medication includes non-benzodiazepine sedatives, unspecified opiates and analgesics containing an opiate compound, antipsychotics, non-opiate analgesics, alcohol, solvents, cardiac and all other types of medication including over-the-counter products.

rary release (83.3%) recorded in the index. The ratio of males to females was 6:1. There were very few differences between the characteristics of those who died in the week after release and those who died up to one month post release. Small numbers in some of the variables made comparisons difficult. The vast majority (38, 90.5%) of deaths were poisonings, with many of the individuals injecting at the time of their death (Table 2). The majority (29, 69.0%) were not alone at the time of their death or at the time of the incident that precipitated their death.

There were some differences between those who died within one month of release and those who died after one month (Table 3). A higher proportion of those who died within one month were younger, almost all died from poisoning and many were injecting at the time of their death compared to those who died after one month.

Substances Involved in Deaths by Poisoning

Almost two thirds (63.2%) of deaths by poisoning within a month of release (n = 38) were attributed to two or more drugs and/or substances. An opiate (often heroin or methadone) was involved in 79% (11/14) of single-substance deaths, while opiates were involved in 96% (23/24) of polysubstance deaths.

Table 4 presents the substances involved in cases of death by poisoning within a month of release (both single and polysubstance). Heroin was involved in half (50.0%) of these cases, methadone in 47% and benzodiazepines in 29%.

The source of prescription medication, including methadone, benzodiazepines and other prescription products, was not always known and may in some cases have been illicit.

DISCUSSION

This is the first study of its kind in Ireland to examine the relationship between release from prison and drug-related death. Of those deceased individuals who had a documented history of imprisonment, almost one third died within a week of release from prison and nearly half had died within a month. These findings are consistent with international research in this area which demonstrate the increased risk of mortality in those newly released from prison (Binswanger et al, 2007; Christensen et al, 2006; Farrell & Marsden, 2007; Singleton et al, 2003). Of the deaths within the first month of release, almost all were due to poisoning, and many of those who died were injecting drugs at the time of their death. Opiates, including heroin and other opiate substances, were responsible for many of these deaths. Nationally and internationally, opiates are implicated in the majority of deaths related to illicit drug use (European Monitoring Centre for Drugs and Drug Addiction, 2008; Lyons et al, 2008) and have also been frequently implicated in deaths in recently released prisoners (Seymour et al, 2000; Singleton et al, 2003). Polysubstance use was implicated in the majority of deaths by poisoning and included both illicit and licit drugs. Benzodiazepines were implicated in almost one third of deaths by poisoning. The findings in regard to polysubstance use, including benzodiazepines are reflected in international research (Farrell & Marsden, 2007; Seymour et al, 2000; Singleton et al, 2003).

The profile of the group of individuals described in this study is very similar to that of individuals committed to Irish prisons in the period under study, including gender, average age, and also percentages of those on temporary release (Irish Prison Service, 2006). The proportion of individuals with a documented history of imprisonment is much higher among those on the NDRDI database than among the general Irish population (Irish Prison Service, 2006).

According to NDRDI data, individuals with a documented history of imprisonment had significantly higher levels of unemployment, homelessness, and drug use. Almost all had a history of drug misuse or dependence and were more likely to have a history of injecting drug use than those who had no documented history of imprisonment.

Because a history of imprisonment, where it exists, is not always recorded in the information sources supplying data to the NDRDI, the number of individuals included in this study is likely to be underestimated, which limits the scope of the study. The date of release could not be confirmed for 15% of individuals. Reasons for this include imprisonment outside the State and the difficulty of confirming dates before computerisation of the prison service system. Results for other variables are also likely to be underestimated as collection of information is not standardised for coroners' records.

The small number of women included in the study makes interpretation difficult. An Australian study found that in the period immediately after release from prison, women had a reduced risk of suicide compared to men. The authors suggested that this might have been because women were more likely than men to have existing family support and the responsibilities of child care on release (Karimina et al, 2007). However, the risk of death among released women prisoners was found to be significantly higher than that among women in the general population in a recent American study (Binswanger et al, 2007).

The increased proportions of individuals who die so soon after release from prison highlights the need for preventative measures for this at-risk group. The findings support the need for an overdose strategy in Ireland, which would detail actions necessary to deal with overdoses in the community. Such measures include ensuring the release of drug-dependant prisoners in a planned manner (Farrell & Marsden, 2007), providing continuity of methadone and other forms of drug treatment, and providing accommodation and support to enter education or employment on release from prison. Improved communication between prison services and addiction treatment and reintegration services in the community would be required in order to put these measures in place. There should also be more support and overdose awareness training for those who are released at short notice, such as on temporary release, for example due to a family emergency (Donnelley, 2007).

Service providers and families should be made aware of the increased risk of overdose among newly released prisoners. As many of those who died were with someone at the time of the incident, the targeted dissemination of basic information among drug users and their families would be a very good start in saving lives. The basic information would include the signs and symptoms of overdose and immediate actions (such as putting the person in the recovery position and calling an ambulance) following an overdose. It would also help if the police, ambulance services, and the community agreed that the ambulance service would not be hindered in their duties; this would avoid involving the local police. Any overdose strategy in Ireland should also include making naloxone (to counter the effects of an opiate overdose) more widely available in the community (Singleton et al, 2003). Providing naloxone to non-medical personnel, family members and other drug users has proven to be effective in reducing drug-related deaths in several studies in other countries (Darke et al, 2007; Green et al, 2008). Data from the NDRDI could be used to evaluate the effectiveness of such policies in the future by monitoring trends in drug-related deaths over time.

CONCLUSION

Allowing for underestimation in the data presented in this paper, it appears that a number of prisoners die within one month following release from prison and it is possible that many of these deaths could be preventable through decisive, but inexpensive action, such as improving links between appropriate services and training in overdose prevention techniques.

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DECLARATION OF CONFLICTING INTERESTS

The authors declared no conflicts of interest with respect to the authorship and/or publication of this manuscript.

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Psychological Health and Bullying Among Adult Male Offenders

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Keywords: psychological health, bullying, victimization, offenders

ABSTRACT

One hundred and sixty-one male offenders housed at two medium-high risk institutions completed a revised version of the Direct and Indirect Prisoner Behaviour Checklist (DIPC-R) and the Symptom Check List, Outpatient Rating Scale (SLC-90). Offenders were categorized as bully/victims, pure victims, pure bullies, or not involved. For all measures of psychological health investigated, bully/victims reported more psychological problems than other offenders, followed by pure victims, suggesting that within a prison population, bully/victims should be regarded as a category of “victim” rather than a category of “bully.” Both the number of direct and indirect bullying behaviours experienced were related to each aspect of psychological health measured. The number of indirect bullying behaviours exhibited was more closely related to poor psychological health than the number of direct bullying behaviours displayed. The findings contribute to the current literature and provide further information about the psychological health of adult offenders.

INTRODUCTION

An estimated 85% of health problems are stress related (Chopra, 1990) with stress exerting a substantial impact on psychological well being, physical health, and mortality (Cui & Vaillant, 1996). The consequences of one specific stressor, victimization (e.g., domestic violence), have been demonstrated in child, adolescent, and adult populations. The tendency to be victimized is associated with a range of physical and psychological symptoms (Fekkes et al, 2006), including depression (Sweeting et al, 2006), post-traumatic stress disorder (Golding, 1999), self-harm (Salmon et al, 2000), and attempted suicide (Stark & Flitcraft, 1996). Importantly, the negative impact of victimization is not limited to specific interactions with the perpetrator. For example, victims of domestic violence report stress both during the abuse itself and when anticipating its onset (Mitchell & Hodson, 1983).

The consequences of victimization have particular relevance for the health of offenders. Previous research indicates that violence (Johnson, 1987) and bullying (Ireland, 1999) are fundamental aspects of prison life. Bullying may include a wide range of behaviours. For the purposes of the current study, the follow-

ing definition was employed: “An individual is being bullied when they are the victim of direct and/or indirect aggression happening on a weekly basis, by the same perpetrator or different perpetrators. Single incidences of aggression can be viewed as bullying, particularly when they are severe and when the individual either believes or fears that they are at risk of future victimization by the same perpetrator or others. An incident can be considered bullying if the victim believes that they have been aggressed towards, regardless of the actual intention of the bully. It can also be bullying when the imbalance of power between the bully and his/her victim is implied and not immediately evident” (Ireland, 2002).

Offenders experience a range of stressors including isolation, and potential physical, psychological, or sexual victimization (Greve, 2001), each of which may contribute to poor

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psychological health. In addition, offenders' ability to cope with the victimization may be compromised. For example, the stressors faced by prisoners are difficult to avoid (Poporino & Zamble, 1984) and a robust social network may not be available to weaken the impact of the victimization (Todd & Worrell, 2000). Consequently, initial research indicates that the distress experienced by prisoners contributes to increased levels of anxiety and depression, self harm, and suicide (Baillargeon et al, 2009; Zamble & Porporino, 1988).

The causal relationship between bullying and psychological health is difficult to determine. Both retrospective (Salmon et al, 2000) and longitudinal research (Rigby, 1998) suggest that bullying exerts a causal influence on the psychological health of the victim. However, research has also documented the manner in which individuals suffering from a mental illness are vulnerable to victimization. According to Blitz et al (2008), male inmates with a mental illness are 1.6 times more likely to be victimized by another inmate and 1.2 times more likely to be victimized by a member of staff, than inmates with no mental illness. This is consistent with research indicating that individuals suffering from a mental illness are of greater risk of victimization within the wider community (Teplin et al, 2005). Of particular importance for the current study, is the finding that offenders entering a correctional facility report greater prior victimization when suffering from a mental illness (James & Glaze, 2006). In part this may reflect the dependence, need for attention or lack of social and economic resources (Morrison, 1991) that make mentally ill offenders vulnerable.

In addition to the psychological health of those being victimized, research has also investigated the psychological health of perpetrators. For example, in non offender samples, depression occurs equally among victims and bullies (Kaltiala-Heino et al, 1999) suggesting that engaging in bullying is also associated with poor psychological health. Consistent with research documenting the incidence of perpetrator post-traumatic stress disorder (Spitzer et al, 2001), Evans et al (2007) found that almost half of all offenders convicted of killing or seriously harming another individual, experience distressing intrusive memories. Rates of post-traumatic stress disorder are lower in perpetrators than in victims (Halligan et al, 2003), the experience however is similar (Ehlers et al, 2004), suggesting that the psychological impact of perpetration should also be considered. In addition, compared to pure bullies or pure victims, individuals who act as both the perpetrator and victim of bullying (bully/victims) report the poorest psychological health (Kaltiala-Heino et al, 1999). These findings further highlight the complexity of this area and the importance of investigating both victimization and perpetration behaviour.

The current study explores the relationship between bullying and psychological health among adult male offenders.

Although limited, previous research suggests that there are important differences between the effects of physical and non-physical victimization (Perron et al, 2008). Consequently, the study also explores the extent to which different types of bullying behaviour (direct and indirect) are associated with psychological health.

METHODOLOGY

Participants

Sixty-five percent of the 248 male offenders approached, successfully returned the completed questionnaires, providing a final sample of 161 participants. Offenders were sampled from two British prison establishments, each housing medium-high risk adult offenders. Overall, offenders reported an average age of 34.02 years (SD = 16.39). Only 4% of prisoners were on remand. Sentences were most commonly served for violent offenses (36%), followed by sexual (36%) and acquisitive (16%) offenses (e.g., burglary). The remainder of offenders were serving sentences for other offenses such as fraud. The average amount of time spent in prison during their lifetime was 58.96 months (SD = 79.79).

Measures

The DIPC-R: Direct and Indirect Prisoner behaviour Checklist-Revised (Ireland, 2005a). The DIPC-R is a revised version of the DIPC (©: Ireland, 1999), which has been used extensively with men, women, young, and adult prisoners (Ireland, 2005b). The DIPC-R assesses the presence or absence of a number of discrete behaviours indicative of bullying. As with the DIPC, it measures both direct and indirect forms of aggression. Direct bullying relates to instances where the aggressor interacts directly with the victim. The DIPC-R specifically assesses physical, verbal, theft-related, sex-related, and psychological "direct" behaviours. Indirect bullying includes subtle behaviours where the aggressor does not interact directly with the victim such as gossiping, spreading rumours, and ostracizing a victim.

The DIPC-R has been revised to include a wider range of behaviours indicative of bullying, following a recent study (Ireland & Ireland, 2008). Like the DIPC, it is a behavioural checklist that avoids use of the term bullying, instead presenting participants with a series of discrete acts of behaviour indicative either of "bullying others" or of "being bullied." The DIPC-R consists of 144 items, 56 representing victim items and 57 perpetration items. The remaining 31 items represent "filler" items and items measuring positive, negative and drug-related behaviour and reactions to victimization. The focus in the current study was on the victimization and perpetration items.

SLC-90: Symptom Check List, Outpatient Rating Scale (Derogatis et al, 1973). The SLC-90 is a self-administered clinical symptom rating scale originally designed for use with psychiatric outpatients. The SLC-90 has been used in a variety of medical, educational, and research contexts. The SLC-90 assesses the symptoms associated with nine psychiatric constructs. Specifically, the SLC-90 contains 90 items, measuring somatization (12 items), obsessive-compulsive (10 items), interpersonal sensitivity (nine items), depression (13 items), anxiety (10 items), anger-hostility (six items), phobic anxiety (seven items), paranoid ideation (six items), and psychoticism (10 items). Seven “filler” items are also included. Participants rate the extent to which a problem has distressed them, from a scale of 0 (not at all) to 4 (extremely).

Procedure

Ethical approval for the pilot and main study was obtained from the University Ethics Committee and from each prison. The need to ensure the anonymity of the data was emphasized. The sample included all offenders based on the prison wing or house at the time of the study. All completed the questionnaire on their own, in their cell. Questionnaires were distributed at the beginning of a lunch time period of lock-up (i.e., a period of time when cell doors are unopened, usually for an hour), or during a training afternoon whereby offenders were locked in their cells for a period of two hours. Questionnaires were collected between one and two hours after distribution. All questionnaires were distributed in an unmarked envelope which included a cover sheet containing an outline of the research. Anonymity was stressed to participants.

RESULTS

Each bullying scale (Ireland, 2005a) proved to be reliable, exceeding the .70 coefficient recommended (DeVellis, 2003), direct bullying (33 items: 0.97); physical (eight items: 0.93); verbal (eight items: 0.87); sexual (two items: 0.90); theft (13 items: 0.96); psychological (two items: 0.74); and indirect bullying (13 items: 0.94). Overall, 67.1% of participants reported engaging in at least one act of bullying over the previous week, with 40.9% of participants reporting at least one act of direct bullying and 55.3% reporting at least one act of direct bullying. The most frequently reported form of direct bullying was verbal bullying, reported by 29.7% of offenders, followed by physical (18.9%), theft (18.5%), psychological (15.8%), and sexual (3.8%) bullying.

Each victimization scale (Ireland, 2005a) proved to be reliable (DeVellis, 2003), direct bullying (33 items: 0.94); physical (eight items: 0.81); verbal (eight items: 0.73); sexual (two items: 0.90); theft (13 items: 0.93); psychological (two items: 0.67); and indirect bullying (14 items: 0.93). Overall, 77.4% of partic-

ipants reported being the victim of at least one bullying behaviour over the previous week, with 61.5% of participants reporting at least one incidence of direct victimization and 69.3% reporting at least one act of indirect victimization. The most frequently reported type of direct victimization was verbal victimization, reported by 47.1% of offenders followed by physical (40.9%), theft (38.5%), psychological (30.4%), and sexual (5.6%) victimization.

Each subscale of the SCL-90 (Derogatis et al, 1973) proved to be reliable, somatization (12 items: 0.91); obsessive-compulsive (10 items: 0.87); interpersonal sensitivity (nine items: 0.87); depression (13 items: 0.91); anxiety (10 items: 0.90); anger-hostility (six items: 0.87); phobic anxiety (seven items: 0.87); paranoid ideation (six items: 0.81); and psychoticism (10 items: 0.81). All item-to-total correlations were positive. Correlations between the subscales ranged from 0.42 (anger-hostility and depression) to 0.83 (anxiety and depression).

Offenders were classified as bully/victims (60.6%), pure bullies (6.5%), pure victims (16.8%) or not involved (16.1%). Mean scores for the SLC-90 total and across subscales are displayed for each bully category in Table 1. Higher scores indicate greater psychological health problems. For each subscale, bully/victims reported the greatest number of psychological health problems, followed by pure victims. With the exception of anger-hostility, little difference in the psychological health of bully/victims and pure victims was observed. For most subscales (somatization, obsessive-compulsive, depression, anxiety, anger-hostility, and phobic anxiety), pure bullies experienced the least psychological problems. Offenders that were not involved in bullying as either a bully or victim were least likely to report symptoms associated with interpersonal sensitivity, paranoid ideation and psychoticism.

A 2 X 4 factorial ANOVA was performed to investigate the influence of institution and bully behaviour (pure victim, pure bully, bully/victim, not involved) on overall psychological health. There was no significant main effect of institution ($F(1, 104) = .087, p > .05$; partial eta squared = .00) or interaction between institution and bullying behaviour ($F(3, 104) = .118, p > .05$; partial eta squared = .00). There was a significant main effect of bullying behaviour ($F(3, 104) = 3.046, p < .05$; partial eta squared = .081). Post hoc tests revealed a significant difference between the psychological health reported by bully/victims and offenders that were not involved in the bullying as either a perpetrator or victim ($MD = 47.75$). All other differences were non-significant.

A 2 X 4 factorial MANOVA was performed to investigate the influence of institution and bully behaviour (pure victim, pure bully, bully/victim, not involved) on psychological health. Nine dependent variables were included: somatization; obsessive-compulsive; interpersonal sensitivity; depression; anxiety; anger-

TABLE 1 | Mean subscale scores for bully categories on the SCL-90

Score	Bully Category			
	Pure Bully	Bully/Victim	Pure Victim	Not Involved
SCL-90				
Total SCL-90				
Mean	46.71	93.99	84.24	46.24
SD (n)	34.74 (7)	60.18 (67)	86.08 (17)	59.08 (21)
Somatization				
Mean	5.88	12.69	11.38	6.40
SD (n)	5.23 (9)	9.81 (83)	11.16 (24)	10.05 (25)
Obsessive-compulsive				
Mean	3.67	12.33	10.52	6.36
SD (n)	3.91 (9)	8.34 (84)	9.17 (21)	7.66 (25)
Interpersonal sensitivity				
Mean	5.57	8.65	7.38	2.67
SD (n)	8.73 (7)	6.95 (85)	8.23 (24)	5.81 (25)
Depression				
Mean	6.44	17.03	16.17	10.44
SD (n)	5.85 (9)	11.76 (80)	13.81 (23)	10.19 (25)
Anxiety				
Mean	3.25	8.96	8.67	4.14
SD (n)	5.85 (8)	8.09 (84)	10.01 (24)	7.47 (21)
Anger-hostility				
Mean	1.33	6.09	2.96	1.84
SD (n)	1.32 (9)	5.91 (86)	4.50 (24)	4.01 (25)
Phobic anxiety				
Mean	1.00	4.59	4.08	1.72
SD (n)	2.65 (9)	6.33 (88)	6.54 (24)	3.27 (25)
Paranoid ideation				
Mean	4.11	7.90	6.50	2.68
SD (n)	3.72 (9)	5.60 (86)	6.27 (24)	5.19 (25)
Psychoticism				
Mean	6.22	9.33	8.86	5.04
SD (n)	6.53 (9)	7.34 (85)	8.81 (21)	6.74 (23)

hostility; phobic anxiety, paranoid ideation and psychoticism. Univariate analyses were conducted on significant results only. There was a statistically significant effect of institution on psychological health ($F(9, 98) = 2.14, p < .05$; Pillai's Trace = .16; partial eta squared = .16). However, there was no significant effect of institution on psychological health when the dependent variables were considered separately. There was also no significant interaction between prison and bullying behaviour ($F(27,300) = 1.06, p > .05$; Pillai's Trace = .26; partial eta squared = .09).

There was a significant effect of bullying behaviour category on psychological health ($F(27,300) = 1.65, p < .05$; Pillai's Trace = .39; partial eta squared = .13). When the results for each of the dependent variables were considered separately, there was a significant difference between the psychological health displayed across the bully categories, with respect to somatization ($F(3,106) = 3.43, p < .05$; partial eta squared = .09); obsessive-compulsive ($F(3,106) = 3.75, p < .05$; partial eta squared = .10); anger-hostility ($F(3,106) = 4.82, p < .05$; partial eta squared = .12); and paranoid ideation ($F(3,106) = 4.23, p < .05$; partial eta squared = .11). For all conditions, participants in the bully/victim group reported significantly greater symptoms than those in the not involved group (somatization MD = 6.29; obsessive-compulsive MD = 5.97; anger-hostility MD = 4.25; paranoid ideation MD = 5.22). Bully/victims also reported significantly more obsessive-compulsive symptoms than pure bullies (MD = 8.67).

Correlations (two-tailed) were conducted to explore the relationship between overall SLC-90 scores and subscale scores, and the number of direct and indirect bullying behaviours experienced (as either a victim or bully). As displayed in Table 2, for each measure of psychological health included, the number of direct and indirect behaviours experienced as a victim was associated with poor psychological health. The number of indirect bullying acts reported was positively associated with poor psychological health for each measure, with the exception of somatization and interpersonal sensitivity. The number of direct bullying behaviours perpetrated was associated with a greater propensity to report anger-hostility, phobic anxiety, paranoid ideation, and psychoticism only.

DISCUSSION

For all measures of psychological health investigated, bully/victims reported more psychological problems than other offenders, followed by pure victims. Depression, somatization, and obsessive compulsive symptoms were the most commonly reported by bully/victims and pure victims. The similarity between the psychological profiles displayed by bully/victims and pure victims is consistent with previous research suggesting that within a prison population, bully/victims should be regarded as a category of "victim" rather than a category of "bully" (Ireland, 2002). For bully/victim offenders, the bullying behaviour may serve as a display of strength or status in order to deter potential bullies and reduce the extent of their own victimization (Ireland, 2002).

The use of bullying behaviour to deter potential bullies may account for the inconsistency between the current findings and previous research conducted with a non-offender sample. For example, Forero et al (1999) report that child and adolescent bully/victims have a similar psychological health profile to pure bullies, highlighting the importance of the context in which the bullying takes place. The current study indicated that pure bullies and offenders that were not involved in bullying behaviour (as either the bully or the victim) reported fewer psychological health problems than offenders in either victim category (bully/victim or pure victim). Overall the results suggest that for male adult offenders, the tendency to be victimized is associated with increased psychological problems, whether or not the offender is also engaging in bullying behaviour. If the prisoner does not experience victimization, perpetrating bullying behaviours does not substantially negatively impact on psychological health.

For most measures investigated, the psychological health of bully/victims was similar to the psychological health of pure victims. With regard to anger-hostility however, bully/victims reported substantially more symptoms than pure victims.

TABLE 2 Correlations between direct and indirect DIPC-R and overall SLC-90 and subscale scores

	DIPC-R Behaviours			
	Direct Bully	Direct Victim HTY	Indirect Bully YHD	Indirect Victim
SLC-90	.175	.453**	.272*	.431**
Somatization	.073	.400**	.135	.313**
Obsessive-compulsive	.150	.383**	.196*	.376**
Interpersonal sensitivity	.114	.424**	.150	.513**
Depression	.163	.409**	.232*	.451**
Anxiety	.167	.456**	.173*	.447**
Anger-hostility	.349**	.489**	.387**	.364**
Phobic anxiety	.299**	.404**	.246*	.381**
Paranoid ideation	.220*	.469**	.279*	.396**
Psychoticism	.225*	.410**	.238*	.460**

*p < .05 **p < .001

These findings do not reflect greater levels of anger required for the perpetration of bullying as pure bullies reported lower levels of anger-hostility than those who were not involved. The items contained within the anger-hostility subscale (e.g., “feeling easily annoyed or irritated” and “having urges to beat, injure, or harm someone”) may suggest that high levels of anger-hostility among bully/victims reflect anger at being victimized and the ability to express this anger at another target. Pure victims may experience anger when victimized but may to some extent suppress this in order to avoid negative repercussions. While pure bullies may not need to suppress their emotions in this way, victimization does not provoke the initial anger. Additional research to explore this subject area is required.

The research also considered the association between the number of direct and indirect bullying behaviours experienced and psychological health. Both the number of direct and the number of indirect bullying behaviours experienced (as a victim) were significantly related to each aspect of psychological health measured. Although even infrequent acts of victimization may result in poor physical or psychological health (Kaltiala-Heino et al, 1999), the findings suggest that individuals experiencing the most frequent victimization were most likely to experience poor psychological health. The strength of the associations between psychological health and direct victimization was similar to the association with indirect victimization, suggesting that future research and practice should consider the prevalence of both direct and indirect bullying.

The number of direct bullying behaviours perpetrated was not related to overall psychological health or five of the nine psychological health subscales. In contrast, the number of indirect bullying behaviours exhibited was related to overall psychological health and all but two of the individual subscales. These findings suggest that the use of indirect bullying acts adopted is more closely related to psychological health than the use of direct bullying behaviours. This may indicate that perpetrators employing direct bullying behaviours do so because they do not fear retaliation. In contrast, a number of indirect bullying behaviours such as spreading rumors can be committed without confrontation. For offenders indirectly bullying a person, the threat of retaliation may present a substantial amount of stress. Further research is advocated to fully explore the role of specific bullying behaviours.

The findings of the current study contribute to the literature, providing further information about the psychological health of adult offenders. However, there are a number of methodological limitations that should be considered. The use of self-report psychological health data represents an important methodological limitation. Self-report data do however predict hospital admissions, disability, and mortality (Burston &

Fedlund, 2001; Idler & Benyamini, 1997), suggesting that self-report data is a reliable indicator of an individual's health. In addition, previous research exploring the relationship between victimization and health has found that victims (domestic violence) underestimate rather than overestimate the extent to which their health has been compromised (Sutherland et al, 2002). Consequently, the extent to which bullying behaviours are associated with psychological health may be greater than suggested by the current data.

While the results demonstrate a clear association between bullying behaviours and psychological health, the extent to which psychological health acts as a cause or consequence of bullying and victimization remains unclear. As outlined in the introduction, longitudinal research (Rigby, 1998) indicates that victimization can adversely affect an individual's psychological health. Conversely, poor psychological health may increase an individual's vulnerability to victimization (Teplin et al, 2005). Longitudinal research that addresses the causal relationship between offender bullying and psychological health is recommended. In particular, it is suggested that complete victimization profiles (detailing both current and historical victimization) are obtained as the cumulative effects of multiple stressors are more severe than single stressors (Felitti et al, 1998).

Coben & Friedman (2001) suggest that perpetrators of domestic violence will admit to their abusive behaviour when questioned in a medical setting. If, as suggested by the current study, bully/victims are most likely to experience poor psychological health, care-planning systems such as ACCT (Assessment, Care in Custody, and Teamwork) may represent an important way for the prison authorities to increase their understanding of this behaviour and reduce the incidence of bullying. While interventions designed to reduce the prevalence of bullying behaviours are recommended, the fact that victims may be reluctant to notify the prison authorities and the incidence of staff-prisoner bullying (Blitz et al, 2008), suggest that interventions are needed to help offenders cope with these events when they occur.

Effective coping styles can weaken the extent to which negative life events impact on an individual's physical or psychological health (Lazarus, 1999). The extent to which offenders are able to adopt their preferred coping strategies may be restricted, for example individuals are to an extent unable to avoid the stressor and separated from their primary support network. Social support has a positive impact on both physical (Unger et al, 1999) and psychological (Brown et al, 1986) health. Therefore, interventions designed to foster supportive relationships may weaken the negative impact of institutional bullying. A greater understanding of the manner in which current peer support schemes (e.g., the Listener scheme in which prisoners trained by the Samaritans listen to prisoners that require emo-

tional support) may be beneficial to the physical and psychological health of offenders is required.

To conclude, the current study explores the relationship between bullying/victimization and psychological health in a prison population. The psychological health profiles of bully/victims and pure victims were similar, supporting the assertion that offender bully/victims are more closely aligned to pure victims than pure bullies. Both direct and indirect victimization were associated with each measure of psychological health. In comparison, indirect bullying was more closely associated with psychological health than direct bullying. Future research is recommended to explore the causal relationship between victimization and psychological health.

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DECLARATION OF CONFLICTING INTERESTS

The authors declared no conflicts of interest with respect to the authorship and/or publication of this manuscript.

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Pattern of Visual Impairment and Blindness in a Nigerian Prison

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Keywords: visual impairment; blindness; ophthalmic care

ABSTRACT

Purpose: A cross-sectional survey of the ocular health status of inmates of a Nigerian medium security prison was carried out to identify the prevalence and causes of visual impairment and blindness in prisoners. **Methods:** An interviewer-administered questionnaire was used for the study. Ocular examination of 415 prisoners was carried out, consisting of visual acuity measurement, pen-torch examination, direct ophthalmoscopy, intraocular pressure measurement, refraction for those with refractive error, and visual field assessment by confrontation method. **Result:** Forty-one prisoners (9.9%) had visual impairment and four (0.9%) were blind bilaterally. Uncorrected refractive error (46%), traumatic cataract (25%), and glaucoma (10%) were the major causes of visual impairment. Blindness was from optic atrophy, phthisis bulbi, corneal opacity, and macular hole. **Conclusion:** The leading causes of blindness and visual impairment are avoidable among prisoners through screening, improved access to ophthalmic care, dispensing spectacles, and discouraging violence, including police brutality.

INTRODUCTION

Ilesa is one of the major towns in Osun State, Southwestern Nigeria. It is located 45 kilometers east of Osogbo, the state capital. The Ilesa prison is one of the two prisons in the state. The prison was designed to accommodate 300 prisoners, but currently has a population of 530. Prisoners comprise those awaiting trial (detainees) and those convicted of a criminal offence. Healthcare in the prison is provided by a medical clinic staffed with two doctors, four nurses, two pharmacy technicians, a community health officer, and two clinic attendants. Referrals are usually to Wesley Guild Hospital, Ilesa, or Obafemi Awolowo University Teaching Hospitals Complex, in Ile-Ife.

Two boreholes supply water to the prison. Cooking facilities are relatively basic and food is prepared in large pots on open fires before being served to prisoners in their cells. Two daily meals are provided to inmates, but the quality and quantity of the food appears to vary depending on available funds. Convicted prisoners live in cells shared by three to five people, while the detainees live in bigger rooms with one small window shared by 15 to 20 people. As with most prisons in Nigeria, overcrowding is partly due to the requirement that prisoners awaiting trial should be close to the law

courts. It is also, however, a reflection of both the lack of resources available to transport prisoners as well as poor overall prisoner data management (Krienert & Henderson, 2003). One of the biggest challenges facing the prison system in Nigeria is the number of prisoners awaiting trial, which constitutes 64% of those incarcerated. Furthermore, many of these prisoners have been held in custody for several years (Krienert & Henderson, 2003).

Ilesa prison receives convicts and prisoners awaiting trial from its catchment areas that include various police stations in Osun state and the neighboring states of Oyo, Ondo, and Ekiti. The prison population is an underserved section of society and, as a result, their health problems are often neglected (Bellad et al, 2007). Knowledge of the prevalence and type of eye disorders among prisoners will help to reduce the burden of visual impairment and blindness and contribute

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TABLE 1 | Age and sex distribution of the prisoners

Age Group (Years)	Sex		Total Frequency (%)
	No. Males	No. Females	
20 yrs and below	20	1	21 (5.1)
21 – 30 yrs	216	6	222 (53.5)
31 - 40 yrs	99	4	103 (24.8)
41 - 50 yrs	60	1	61 (14.7)
51 - 60 yrs	7	1	8 (1.9)
Total	402	13	415 (100)

TABLE 2 | Visual acuity in the better eye of all the prisoners

Visual Acuity In The Better Eye	Category of Vision	Frequency (%)
6/4 – 6/18	Normal vision	370 (89.1)
< 6/18 – 6/60	Visual impairment	34 (8.2)
< 6/60 – 3/60	Severe visual impairment	7 (1.7)
< 3/60 – NPL	Blindness	4 (0.9)
Total		415 (100.0)

TABLE 3 | Causes of blindness among prisoners

Causes	Frequency
Phthisis bulbi	1
Corneal opacity	1
Macular hole	1
Optic Atrophy	1
Total	4

TABLE 4 | Eye injuries in prisoners

Etiology of Ocular Injury, by History	Frequency	Percent (%) Out of 52
Fighting/assault	23	44.2
Police brutality	18	34.7
Occupation related	4	7.7
Missile objects thrown	7	13.5
Total	52	100.0

TABLE 5 | Uptake of ophthalmic services among prisoners

	Frequency	Percent
Yes	215	51.8
No	100	24.1
Stopped due to incarceration	10	2.4
Never	90	21.7
Total	415	100

toward attaining the targets of VISION 2020 - “The Right to Sight” initiative.

No study of the ocular health status of prisoners in south-western Nigeria has been reported in the past. The purposes of this study were to determine the prevalence and identify the causes of visual impairment and blindness in Ilesa prison and to suggest strategies for the elimination of these conditions.

METHODS

A cross-sectional survey of prisoners in Ilesa prison was conducted in March 2007. All the 415 prisoners present during the survey period were recruited for the study. Written consent to conduct the research was granted by the Comptroller of Prison Services and ethical clearance was obtained from the Research Ethical committee of Obafemi Awolowo University Teaching Hospital, in Ile-Ife.

An interviewer-administered questionnaire was used for the study. Four prison health workers (three nurses and one community health extension worker) were recruited and trained on how to administer the questionnaire and measure visual acuity. To assess reliability, the questionnaire was piloted on adults in four households in the neighborhood. Modifications were made to the questionnaire following the pilot exercise. The interviews and examinations of prisoners were held in the consulting rooms of the prison medical clinic.

Written consent was obtained from each participating prisoner. Visual acuity (VA) was measured one eye at a time using the standard Snellen chart placed at six meters and VA <6/6 was reassessed with pinhole. Color vision was assessed with Ishihara pseudo-isochromatic plates. The anterior segment was examined with a bright pen-torch and head-worn loupes. The intraocular pressure was measured with a Perkin’s hand-held tonometer and dilated funduscopy was performed with Keeler direct ophthalmoscope. Visual field assessment was measured using confrontation method. Prisoners whose VA improved with pinhole had refraction measured with a Keeler streak retinoscope and trial lenses.

Data collected were recorded in a personal computer and analyzed using the Statistical Package for Social Sciences (SPSS) software (Version 12).

RESULTS

Table 1 shows the age and sex distribution of the 415 prisoners studied. There were 402 (96.9%) males and 13 (3.1%) females (M:F = 31:1). The age ranged from 15 years to 60 years with a mean of 32 years +/- 9.81.SD. Two hundred twenty-two (53.5%) of the prisoners were in the age group of 21-30 years while 21 (5.1%) were aged less than 21 years old.

A total of 41 (9.9%) prisoners had visual impairment and four (0.9%) were blind in both eyes (Table 2). Blindness was caused by

phthisis bulbi, corneal opacity, macular hole, and optic atrophy (Table 3). The leading causes of visual impairment were uncorrected refractive error (46%), traumatic cataract (25%), glaucoma (10%), optic atrophy (7%), and maculopathy (7%) (Figure 1). Of the 52 (10.1%) prisoners who sustained ocular injury in prison, 23 (44.2 %) were reportedly injured during a fight/assault and 18 (34.7%) from police brutality or torture. Seven (13.5%) prisoners had missiles thrown at them by fellow inmates while four (7.7%) sustained injury while working within the prison (Table 4). The majority (54.2%) of the prisoners had accessed ophthalmic services in the past, before being incarcerated; 10 of whom could no longer keep follow-up appointments (Table 5).

DISCUSSION

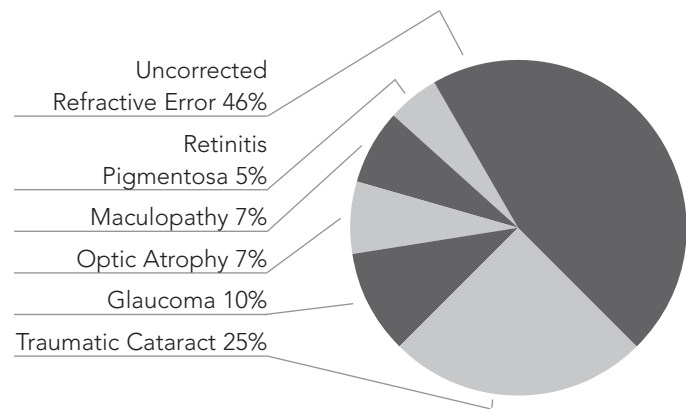
The preponderance of young male prisoners in Ilesa prison is similar to reports from other studies in Onitsha and Benin city prisons (Ekwenchi, 2000; Atamah, 2005). This is not unexpected because males are generally recognized as being more likely to break the law or get arrested than their female counterparts (CIA World Fact Book, 1991).

Globally, 161 million people are estimated to be visually disabled; 37 million of these are blind (Resnikoff et al, 2004). The global prevalence of blindness is 0.7%. In sub-Saharan Africa, the blindness prevalence rate averages 1.4%, while in countries with established market economies it is 0.3% (Resnikoff et al, 2004). Various factors such as lack of basic eye care services, poverty, ignorance, malnutrition, and poor environmental and personal hygiene have been identified as the reasons for this difference in prevalence of ocular morbidity in sub-Saharan Africa (World Health Assembly, 2003). Within prisons, these factors may play significant roles in the prevalence of ocular morbidity and the overall burden of visual impairment and blindness among prisoners. The prevalence rate of visual impairment in this study was 9.9% (10.8% including blindness). This is higher than data from studies in Onitsha prison which reported a prevalence of 3.6 % (Ekwenchi, 2000) and Benin prison which reported 4% (Atamah, 2005).

In this study, visual impairment was diagnosed from various causes ranging from uncorrected refractive error, traumatic cataract, glaucoma, maculopathy, and optic atrophy secondary to retinitis pigmentosa. These etiologies are similar to those reported in studies carried out with Adjunani refugees (Kawuma, 2000) and Afghan refugees. (Awan & Ihsan, 1998).

Uncorrected refractive error was the commonest cause of visual impairment in this study which is similar to previous studies with prisoners in Onitsha (Ekwenchi, 2000) and Benin City (Atamah, 2005). Refractive errors are correctable with the aid of vision correction devices such as spectacles or contact lenses; in many countries, uncorrected refractive errors are the

FIGURE 1 | Causes of visual impairment



second most common cause of treatable blindness after cataracts (Brien et al, 2000). The global initiative for the elimination of avoidable blindness (VISION 2020) has recognized that refractive errors are a major cause of visual disability. As a result, refractive services have been listed as part of the primary health care and school services, including the dispensing of locally-produced corrective lenses and corrective optical devices (Thylefors, 1998). Free spectacles can be provided to alleviate the burden of refractive error among prisoners. This allows them to re-integrate into society with full visual correction upon release.

In this study, 89.2% of the total prison sample had normal vision, 9.9% had visual impairment, and 0.9% were blind. A history of ocular trauma is a challenge among the prison population. While in police custody, crime suspects are subjected to varying degrees of trauma and torture in a bid to extract information which may assist the law enforcement agents in crime investigation (CIA World Fact Book, 1991). We found that a history of fights, assault, and police brutality were the main cause of ocular injuries in prisoners during their period of incarceration, often resulting in traumatic cataract. This was similar to the results of studies among prisoners in Onitsha (Ekwenchi, 2000) and Benin City (Atamah, 2005). It is our view that minimizing police brutality against prisoners, along with health education with an emphasis on prevention of ocular trauma, will reduce the occurrence of visual impairment among prisoners.

More than half (54.2%) of the prisoners had benefitted from various ophthalmic services at one time or another before their incarceration due to a variety of eye complaints, while 24.1% had never been to hospital for any eye problem. Of the whole sample, only 2.4% of the prisoners in the sample indicated that they stopped accessing ophthalmic services due to incarceration. We did not collect data on the proportion of those with visual impairment whose care was interrupted by incarceration.

In Nigeria, 32 561 inmates were reported to be in the nation's 144 prisons in the year 2006. This accounts for approx-

imately 0.03% of the total Nigerian populace (CIA World Fact Book, 2006). Factors such as malnutrition, trauma, infections, and underlying environmental problems such as overcrowding/over population promote occurrence and worsening of eye, skin, and psychiatric disorders (Krienert & Henderson, 2003). The possible risk factors identified for visual impairment and blindness in this study were age of the inmates, sex, ocular trauma from assaults/fights and police brutality and, due to their incarceration, the lack of access to good ophthalmic care.

Limitations of this study include information bias (which may be a recall or interviewer bias), which might have affected some of the important variables such as history of eye injury and past medical history of the subjects. The inability of the study design to prove the causation of eye disease is also noted. Slit lamp examination was not possible since bringing a slit lamp biomicroscope into the prison was considered a security risk by the authorities. Thus classification of glaucoma was not possible in this study.

Screening of prisoners for eye disorders at the beginning of a prison term and easy access to prompt eye care for visual preservation is essential. Advocacy for improvement in prison health services through several approaches are also needed. This could include appealing to humanitarian and religious sentiments or a constitutional and human rights approach (Awofeso, 2008). Released prisoners need good vision to function adequately upon re-integration into the information and computer technologically aware communities that now exist and also to achieve gainful employment.

DECLARATION OF CONFLICTING INTERESTS

The authors declared no conflicts of interest with respect to the authorship and/or publication of this manuscript.

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