Trust in Science, Homonegativity and HIV Stigma: Experimental Data from the United Kingdom and Germany

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Abstract

HIV stigma and its corollary HIV fear constitute significant barriers to HIV prevention. This quasi-experimental study examined social psychological predictors of HIV stigma and HIV fear, respectively, based on data from 516 participants in the United Kingdom and Germany. Participants completed baseline measures of HIV knowledge, trust in science and scientists and homonegativity. They were then randomly assigned to one of three experimental conditions with vignettes describing (1) a gay man with HIV, (2) a heterosexual man with HIV, or (3) the control condition. Participants completed post-manipulation measures of HIV stigma and HIV fear. HIV knowledge and trust in science and scientists were negatively associated with HIV stigma and fear. Baseline homonegativity was positively correlated with HIV stigma and fear. Being exposed to a vignette describing a heterosexual man led to less HIV stigma than being exposed to a vignette describing a gay man and the control condition (in which no sexual orientation was explicitly mentioned). The results suggest that, in addition to promoting HIV knowledge and trust in science and scientists, public health messaging concerning HIV should shift from a focus on gay men to heterosexuals and that homonegativity (higher in men) must continue to be tackled.

Keywords: HIV knowledge; trust in science and scientists; homonegativity; HIV stigma; HIV fear

Introduction

Since its first clinical observations in 1981, human immunodeficiency virus (HIV) has gone from being a terminal to a manageable condition in Western, industrialized countries. However, the success of HIV medicine – in terms of both treatment and prevention – is significantly undermined by HIV stigma and its corollary HIV fear (Earnshaw & Chaudoir, 2009). Stigma and fear can preclude not only HIV testing but also the acquisition of knowledge about the virus and discussions about it with potential and actual sexual partners. The United Kingdom (UK) and Germany have a similar HIV prevalence and advanced health systems that provide HIV testing and treatment free of charge and they share a common challenge around HIV stigma and fear in their general populations. HIV stigma and fear are likely to arise from stigma toward the groups commonly represented as being at risk of HIV, such as gay men, suggesting a potential role of homonegativity (in particular, negative attitudes towards gay men). Meanwhile, science and scientists are a major source of destigmatizing information about HIV and, consequently, public trust in them is likely to be a determinant of decreased HIV stigma and fear.

In this article, we describe a quasi-experimental study, drawing on the concept of attribute framing (Levin et al., 1998), in which participants from the UK and Germany were asked to read one of three vignettes describing: (1) a gay man living with HIV, (2) a heterosexual man living with HIV, or (3) the local health system (control condition); and then to complete measures of HIV stigma and fear. In view of previous research showing gender differences in relation to both homonegativity and HIV stigma, we also examined the effect of gender as a possible moderator of the relationship between vignette type (heterosexual vs. gay vs. control) and HIV stigma and fear. It was hypothesized that female participants would exhibit lower HIV stigma and fear when asked to read a vignette describing a heterosexual man than when asked to read a vignette describing a gay man or the control condition (in which the long-standing social representation of HIV as a "gay disease" was expected to be activated). We examine the effects of sexual orientation framing and gender, over and beyond those of HIV knowledge, trust in science and scientists and baseline homonegativity, on HIV stigma and fear.

HIV in the UK and Germany

The study draws on data from the UK and Germany as the two countries share epidemiological, medical and social similarities in relation to HIV. Both countries have also had similar HIV prevention campaigns, focusing on fear as a stimulant for prevention, and now focus much of their preventive activity on gay men (HIV Outcomes, 2019; Jaspal & Bayley, 2020). Residents in both countries can access sexual health services, including HIV testing, for free, although in Germany they must first be registered with either the statutory health insurance scheme or a private insurance scheme. One aim of this study is to examine whether similar patterns in relation to HIV stigma and fear emerge in data from two comparable Western, industrialized societies.

Both the UK and Germany are considered to have relatively low rates of HIV. In 2018, the UK population was estimated to be 66.65 million, of whom approximately 105,200 were living with HIV (O'Halloran et al., 2019). In 2019, Germany had a total population of 83.02 million and, in 2015, it was estimated that 85,000 people were living with HIV in the country (HIV Outcomes, 2019). The advent of antiretroviral therapy (ART), which is freely and easily accessible in both countries, and the emergence of pre-exposure prophylaxis (PrEP) as an effective biomedical approach to HIV prevention have reduced HIV incidence significantly. Regular HIV testing, engagement with HIV care and uptake of HIV prevention and treatment are essential for ending the HIV epidemic. Both countries now possess the scientific tools to end HIV transmission by 2030 but HIV stigma and fear constitute a key barrier to achieving this ambitious goal (Jaspal & Bayley, 2020).

In both the UK and Germany, HIV/AIDS has historically been associated with gay men but there are also relatively high rates in heterosexual people (Brown et al., 2019). Research shows that heterosexual people are less likely than gay men to be informed about HIV or to see themselves as being at risk of infection and may therefore not seek to get tested for the virus (van der Bij, 2008). Heterosexual populations also tend not to be the focus of public health messaging campaigns in relation to HIV that are generally targeted at gay men. This may lead to the erroneous perception that only some groups (mainly gay men) are vulnerable to HIV that in turn may engender a low risk perception in heterosexuals. It may also perpetuate a reciprocal stigma toward both gay men and HIV as a condition. In this study, therefore, we examine the impact of sexual orientation framing (heterosexual vs. gay vs. control) on levels of HIV stigma and fear in two general population samples.

HIV stigma and fear

In his definition of stigma, Goffman (1963) refers to stigma as an attribute which is considered "a failing, a shortcoming, a handicap" and whose "discrediting effect is very extensive" (p. 12). He elaborates that stigma is:

> "an attribute that makes him [or her] different from others in the category of persons available for him [or her] to be, and of a less desirable kind – in the extreme, a person who is quite thoroughly bad, or dangerous, or weak. He [or she] is thus reduced in one's minds from a whole and usual person to a tainted, discounted one" (p. 12).

HIV stigma is comprised of cognitive, affective and behavioral components and encompasses stereotyping, prejudice and discrimination (Beaulieu et al., 2014). These factors can be examined individually but in order to capture the multi-faceted construct of stigma we examine them collectively. The cognitive dimension of stigma refers to stereotyping and includes moral judgements about people who are living with HIV, such as the notion that they are to blame for their infection or that they are a certain "type" of person. The affective dimension refers to prejudiced attitudes, such as feeling uncomfortable in the vicinity of someone living with HIV. The behavioral dimension of stigma focuses on the endorsement of discriminatory behaviors, such as interpersonal distancing from, and coercive measures against, people living with HIV.

In stigmatizing HIV as a condition, people also tend to stigmatize people who are at risk of, or living with, HIV. They may do so because they are uninformed about the condition, how it is transmitted, how it can be prevented and, crucially, what happens to an individual when they are infected (Beaulieu et al., 2014). HIV stigma tends not to operate in isolation – people are also likely

to stigmatize the groups seen as being most vulnerable to infection (Jaspal et al., 2020). Furthermore, much research demonstrates the insidious social and psychological effects of HIV stigma on individuals at risk of, and living with, HIV (see Earnshaw & Chaudoir, 2009).

HIV fear is an important corollary of HIV stigma. Stigma and fear have some conceptual overlap but should be viewed as distinct variables with a reciprocal relationship. On the one hand, stigma can arise from fear – after all, one seeks to distance oneself from a feared stimulus, including a "feared self", that is, something that one is afraid of becoming (Markus & Nurius, 1986). On the other hand, stigma may increase fear since disengagement from the stigmatized stimulus (in this case, HIV) may lead to misinformation, misunderstanding and perceived threat (Herek et al., 2002). Fear is manifested both as an emotional state in that individuals *feel* fear when thinking about HIV or about people living with HIV and as a cognition in terms of how people think about HIV, people living with HIV and their behavior (Bouton et al., 1987). Like stigma, fear is an important variable because it has been shown to be one determinant of behavior, guiding, for instance, level of contact one is willing to have with persons believed to be at risk of, or living with, HIV.

Homonegativity and sexual orientation framing

Homonegativity refers to the negative stereotyping of, and prejudiced attitudes and discriminatory behaviors toward, sexual minorities (Morrison et al., 1999). In this article, the term is used specifically to refer to gay men (as the target) because of the historical association of HIV with gay men in dominant social representations. The discovery of HIV and its linkage to gay men in public consciousness had a regressive effect on social attitudes toward gay men and long-standing tropes of gay men as subversive, sinful and sexually promiscuous have been mobilized in discourse on HIV (Jaspal & Nerlich, 2017). As well as gay men, people living with HIV have been widely represented as being morally flawed in public and media discourses (Jaspal & Nerlich, 2022). Consistent with previous research (Beaulieu et al., 2014; Herek & Capitanio, 1999), it is expected that baseline homonegativity will be positively associated with both HIV stigma and its corollary HIV fear. Since homonegativity is a key variable in this study, we focus on attitudes among heterosexual people. However, it is acknowledged that HIV stigma is also present in gay male communities and that the effects for psychological wellbeing and public health are considerable.

In this study, we draw upon the concept of attribute framing (Levin et al., 1998), which proposes that changes in the characteristics of an object can result in differential cognitive, affective and behavioral responses in the perceiver. Consistent with the concept, we propose that sexual orientation framing (that is, presenting a case study involving a gay vs. heterosexual person living with HIV) should have implications for HIV stigma and fear (see Herek, 1999). Public health promotion poses a dilemma – on the one hand, action to reduce HIV incidence in gay men is necessary but, on the other hand, the focus on gay men and their elevated risk of infection in public health messaging may increase homonegativity in society (Herek, 1999). In short, given that HIV has disproportionately affected gay men in the UK and Germany, it has come to be socially represented as a "gay disease". Similarly, some of the same tropes anchored to gay men, such as immorality, contagion (in the sense of "making" other men gay) and impurity, have also been anchored to HIV. Gay men and HIV have become socially and psychologically entwined in societal representation (Jaspal & Nerlich, 2017, 2020).

Since HIV is socially represented as a "gay disease", it is likely that, in the absence of overt information about the sexual orientation of persons living with HIV, it will be assumed that they are in fact gay. By extension, it is hypothesized that, when controlling for the effects of baseline homonegativity, people who are asked to read a vignette describing a heterosexual man living with HIV will exhibit lower HIV stigma and fear than when they are asked to read a vignette describing a gay man or a control condition (where, in the absence of actual information on the sexuality of the sufferer, the long-standing social representation of HIV as a "gay disease" will be activated). Consistent with the concept of attribute framing, it is proposed that sexual orientation framing will have significant effects on HIV stigma and fear, with exposure to a heterosexual target inducing more favorable attitudes than to a gay target or when no sexual orientation is overtly mentioned.

There has been much research into the predictors of homonegativity (e.g., Ahmad & Bhugra, 2010; McDermott & Blair, 2012). Gender is one of the strongest predictors of homonegativity with several studies showing that heterosexual men are more likely than women to exhibit negative attitudes toward gay men (Haney, 2016; Morrison et al., 2005). In view of the reduced proclivity toward homonegativity in women, it is expected that gender will also influence the relationship between sexual orientation framing and HIV stigma and fear. More specifically, it is hypothesized that the predicted relationship between sexual orientation framing and HIV stigma and fear will be moderated by gender, with heterosexual women exhibiting lower HIV stigma and fear than men when reading a vignette describing a heterosexual man living with HIV.

HIV knowledge and trust in science and scientists

In the context of HIV – those who report higher levels of HIV knowledge tend to report lower HIV stigma (James & Ryan, 2018). A lack of knowledge may mean that individuals are reliant on outdated perceptions of HIV, namely that it is invariably fatal, that there is no treatment, and that it can be contracted more easily than is actually the case. Those with lower knowledge may draw on erroneous social representations in order to form attitudinal and affective responses to HIV. Therefore, HIV knowledge should be inversely associated with HIV stigma and fear.

Mainstream science focuses on communicating accurate, up-to-date developments in HIV treatment and prevention. There is scientific consensus that HIV disease is preventable, treatable and manageable. Scientific developments, such as the advent of highly effective ART and of PrEP for preventing HIV and the discovery that viral suppression reduces risk of transmission, are the focus of mainstream science communication (Jaspal & Nerlich, 2022). These scientific developments can reduce uncertainty and, thus, stigma and fear surrounding HIV only if individuals actually trust science and scientists. Given that mainstream science is actively challenging HIV stigma, trust in science and scientists (as a precursor of accepting their messages) should be negatively correlated with HIV stigma and fear.

Trust in science and scientists may shift the lens through which HIV is viewed, i.e., from a moralizing lens to a scientific one. During the course of the HIV epidemic, trust in science and scientists has been challenged – due partly to scientific uncertainty, medical mistakes and policy failure (Nattrass, 2013). It should therefore not be assumed that people automatically do or will trust science and scientists. This has been demonstrated in empirical studies of the coronavirus pandemic, which have shown that individuals vary in their levels of trust in science and scientists and that this variable constitutes a robust predictor of fear of COVID-19 (Breakwell & Jaspal, 2021; Breakwell et al., 2022).

Objective and hypotheses

Using a quasi-experimental design, this study examines the predictors of HIV stigma and fear in participant samples from the UK and Germany. We test the following four hypotheses:

1. HIV knowledge and trust in science and scientists will be associated with lower HIV stigma and fear of HIV.
2. Homonegativity (i.e., negative attitudes toward gay men) will be associated with higher HIV stigma and fear of HIV.
3. Being exposed to a vignette describing a heterosexual man living with HIV will lead to lower HIV stigma and fear of HIV than being exposed to either a vignette describing a gay man or a control condition.
4. There will be an interaction effect of participant gender and sexual orientation framing on HIV stigma and fear of HIV, with men exposed to a gay target reporting the most HIV stigma and fear of HIV.

Method

Ethics

[REMOVED FOR PEER REVIEW] provided ethical approval for this study. Data were provided

anonymously. Participants were fully debriefed and compensated for their time.

Participants

In January 2021, a convenience sample of 318 individuals in the United Kingdom and 198 individuals in Germany were recruited on *Prolific*, an online recruitment platform, to participate in a quasi-experimental study focusing on attitudes towards HIV. The total sample size was 516 participants. They were aged between 18 and 83 (M = 33.02, SD = 12.11). There was a fairly even distribution of men (N = 236, 45.7%) and women (N = 280, 54.3%). The vast majority of participants (N = 514, 99.6%)reported being heterosexual and 2 (0.4%) described their sexual orientation as "Other". Table 1 provides a detailed description of the participant sample.

[Insert Table 1 here]

Design and procedure

This was a between-subjects 3 x 2 quasi-experimental study with factors of experimental condition (heterosexual man living with HIV vs. gay man living with HIV vs. a control condition about the local health system) and gender of participant (male vs. female). There were pre-manipulation measures of trust in science and scientists, HIV knowledge and homonegativity: homonegativity, and post-manipulation measures of HIV stigma and fear of HIV. Participants were also asked to provide demographic information (e.g., age, gender, income, education).

Participants were randomly exposed to one of the following three conditions: (1) a vignette describing Jack, a gay man living with HIV who is receiving antiretroviral therapy (gay condition); (2) a vignette describing Jack, a heterosexual man living with HIV who is receiving antiretroviral therapy (heterosexual condition); or (3) a vignette describing the history of the national healthcare system (control). The purpose of including a control condition was to demonstrate the possible effect of sexual orientation ambiguity, whereby the sexual orientation of people living with HIV was not made clear. Of the 516 participants, 209 (40.5%) were assigned to the gay condition; 209 (40.5%) to the heterosexual condition; and 98 (19%) to the control condition. Following White (2018), it was determined that a sample size for the control group that was 50% of each experimental group would result in minimal loss of power.

After the manipulation, participants were asked to complete post-manipulation measures of HIV stigma and HIV fear, while keeping in mind the extract that they had just read. The study took approximately 15 minutes to complete.

Pre-manipulation measures

The Cronbach's alpha scores for the pre-manipulation variables are presented in Table 2.

Trust in science and scientists

The Trust in Science and Scientist Inventory (Nadelson et al., 2014) was used. It has 21 items, measured on a 5-point scale (1=strongly disagree to 5=strongly agree). Items included: "I trust the work of scientists to make life better for people" and "Scientific theories are untrustworthy". Possible scores ranged from 1 to 105. A higher score indicated greater trust in science and scientists.

HIV knowledge

An adapted version of the HIV Knowledge Questionnaire (Carey & Schroder, 2002) was used to measure HIV knowledge. Items focusing on the introduction of antiretroviral therapy, its reduction of transmissibility and its positive impact on life expectancy, were included to reflect recent developments in HIV medicine. The final version of the scale, which is included in Supplementary Material 1, has 17 items. Items included: "Coughing and sneezing DO NOT spread HIV." and "A person who has had an undetectable HIV viral load cannot pass HIV onto sexual partners". Possible responses were "true", "false" or "I don't know". A correct response was coded as 1 and an incorrect response or "I don't know" were coded as 0. A sum score was calculated for each participant. Possible scores ranged from 0 to 17. A higher score indicated greater HIV knowledge. Since the variable is

categorical and there is no assumption that the items will be correlated, the Cronbach's alpha score is not reported for this variable.

Homonegativity

The Attitudes Toward Gay Men subscale of the Attitudes Toward Lesbians and Gay Men Scale (Siebert et al., 2014) was used to measure negative attitudes towards gay men. The subscale has 5 items, measured on a 5-point scale (1=strongly disagree to 5=strongly agree). Items included: "Homosexual behavior between two men is just plain wrong" and "Just as in other species, male homosexuality is a natural expression of sexuality in human men". Possible scores ranged from 5 to 25. A higher score indicated more negative attitudes toward gay men.

Post-manipulation measures

The Cronbach's alpha scores for the post-manipulation variables are presented in Table 2.

HIV stigma

The Stigmatizing Attitudes Towards People Living with HIV/AIDS Scale (Beaulieu et al., 2014) was used to measure HIV stigma. The scale has 23 items, measured on a 5-point scale (1=strongly disagree to 5=strongly agree). Items include: "People with HIV have only themselves to blame" and "People who have HIV should have the right to work serving the public, as waiters-waitresses, cooks, hairdressers". Possible scores ranged from 23 to 115. A higher score indicated more HIV stigma.

Fear of HIV and people living with HIV

An adapted version of the Fear of AIDS Scale (Bouton et al., 1987) was used to measure fear of HIV and people living with HIV. All references to "AIDS" were changed to "HIV". The scale has 12 items measured on a 5-point scale (1=strongly disagree to 5=strongly agree). Items included: "Even if a friend had HIV, I wouldn't mind touching him/ her" and "I would object to having a close family member associate with someone with HIV". Possible scores ranged from 12 to 110. A higher score indicated greater fear of HIV and people living with HIV.

Statistical analyses

All 516 responses were retained for analyses. The data were standardized for analysis (z-scores) and modelled using linear regression in R 4.0.3 (R Core Team, 2020), with model comparison of nested models established using chi-squared tests, whereby a statistically significant χ^2 statistic indicates that the additional estimated parameters provide a significant improvement in model fit. We calculated estimated marginal (EM) means for pairwise comparisons of the experimental manipulation of sexual orientation (gay vs. heterosexual vs. control) using the *emmeans* R package (Lenth et al., 2019) with Tukey HSD adjustments.

Results

Descriptive statistics and bivariate correlations

Table 2 provides the descriptive statistics and bivariate associations amongst the variables. HIV knowledge and trust in science and scientists were negatively associated with HIV stigma and fear of HIV. Homonegativity was positively associated with HIV stigma and fear of HIV.

[Insert Table 2 about here]

Differences between UK and German samples on the main variables of interest

Independent samples *t*-tests were conducted to examine differences between UK and German participants on the pre- and post-manipulation measures. There were significant differences only in levels of trust in science and scientists [$t(515) = 2.23$, $p < 0.05$; Cohen's d = 0.20; 99% CI (0.26, 4.11)] and baseline homonegativity [$t(515) = -1.98$, $p < 0.05$; Cohen's d = 0.18; 99% CI (-1.43, -0.01)]. German participants ($M = 81.84$, $SD = 10.30$) reported higher trust in science and scientists than UK participants ($M = 79.65$, $SD = 11.12$). UK participants ($M = 8.56$, $SD = 3.92$) reported higher baseline homonegativity than German participants ($M = 7.84$, $SD = 4.12$).

HIV stigma

We compared two nested models predicting HIV stigma. Model 1 is a main effects model with gender (male vs. female), HIV knowledge, trust in science and scientists, homonegativity, and the experimental manipulation of sexual orientation framing (gay vs. heterosexual vs. control). Previous HIV test (yes vs. no) and country (UK vs. Germany) were included in the model as covariates. For the experimental manipulation the heterosexual condition was used as the reference category. Model 2 includes the interaction effect of gender, whereby we included an interaction effect between each of the predictors in Model 1 and gender. This allowed us to examine any gender differences. The inclusion of gender as an interaction effect did not significantly improve the model fit (χ^2 (5) = 3.05, p =.35). Therefore, the estimates from Model 1 were retained for interpretation. Parameter estimates for the main effects model can be found in Table 3. Trust in science and scientists was negatively associated with HIV stigma, suggesting that individuals with relatively higher levels of scientific trust report lower levels of HIV stigma. Unsurprisingly, homonegativity was positively associated with HIV stigma whereby individuals with higher levels of homonegativity also reported higher levels of HIV stigma. A main effect was also observed for gender, whereby males reported significantly higher levels of HIV stigma than females ($M_{females}$ z-score = -0.17, M_{males} z-score = 0.16; Cohen's d = -0.38, t = -4.93, $p < 0.001$). There was also an effect of sexual orientation condition (see Supplementary Material 2). Specifically, those in the heterosexual condition reported significantly lower levels of HIV stigma ($M_{heterosexual}$ z-score = -0.19) than those in the gay condition (M_{gay} z-score = 0.05, Cohen's d = -0.27, t = -3.18, p = 0.004) or control condition ($M_{control}$ z-score = 0.15, Cohen's d = -0.39, t =-3.70, $p < 0.001$). There was no difference in self-reported HIV stigma between those in the gay and control conditions (Cohen's d = -0.12, t =-1.16, p = 0.48). Overall, the main effects model accounted for 46.5% of the variance in self-reported HIV stigma.

[Insert Table 3 about here]

[Insert Figure 1 about here]

Fear of HIV

Like the HIV stigma data analysis, we compared two nested models. Again, Model 1 is a main effects model with gender (male vs. female), HIV knowledge, trust in science and scientists, homonegativity, and the experimental manipulation of sexual orientation (gay vs. heterosexual vs. control). Previous HIV test (yes vs. no) and country (UK vs. Germany) were included in the model as covariates. Model 2 includes the interaction effect of gender, whereby we included an interaction effect between each of the predictors in Model 1 and gender. The interaction model did not significantly improve the fit to the data (χ^2 (5) = 2.96, p = .55) and therefore the estimates from the main effects model were retained for interpretation (see Table 4). The relationship trends for the fear of HIV model were similar to the HIV stigma model. Trust of science and scientists and HIV knowledge were negatively associated with fear of HIV, in that individuals with relatively higher levels of scientific trust and knowledge about HIV report lower levels of HIV stigma. Homonegativity was positively associated with fear of HIV whereby individuals with higher levels of homonegativity also reported higher levels of fear of HIV. Homonegativity was also the strongest predictor of fear of HIV (b = 0.39). A main effect was also observed for gender, whereby males reported significantly higher levels of HIV fear than females ($M_{females}$ z-score = -0.10, M_{males} z-score = 0.09; Cohen's d = -0.11, t = -2.50, p = 0.002). There was also an effect of sexual orientation condition (see Supplementary Material 3). Specifically, those in the heterosexual condition reported significantly lower levels of fear of HIV ($M_{heterosexual}$ z-score = -0.16) than those in the control condition ($M_{control}$ z-score = 0.12, Cohen's d = -0.15, t =-2.63, p = .03). There was no observed difference in self-reported fear of HIV between those in the gay and heterosexual conditions (M_{gay} z-score = 0.03, t = - 2.28, p = .07) or between those in the gay and control conditions (t =-.81, p =.70). Overall, the main effects model accounted for 28.0% of the variance in self-reported fear of HIV.

[Insert Table 4 about here]

Discussion

This study set out to examine the effects of sexual orientation framing and gender, over and beyond those of HIV knowledge, trust in science and scientists and baseline homonegativity), on HIV stigma and fear. The results show that trust in science and scientists was significantly and negatively associated with HIV stigma and that both HIV knowledge and trust in science and scientists were negatively associated with fear; that baseline homonegativity was significantly and positively correlated with HIV stigma and fear; and that being exposed to a vignette describing a heterosexual man living with HIV led to lower HIV stigma than being exposed to a vignette describing a gay man and the control condition (in which no sexual orientation was explicitly mentioned). The fourth hypothesis that there would be an interaction effect of participant gender and sexual orientation of the target on HIV stigma and fear of HIV, with men exposed to a gay target reporting the most HIV stigma and fear of HIV, was not supported in the data.

Building HIV knowledge and trust in science and scientists

Forty years after the first clinical observations of HIV, there remains a need to continue to equip the general population with scientifically accurate and up-to-date information about developments in HIV science and medicine. In this study, HIV knowledge was a significant negative predictor of both HIV fear. While much of the early campaign activity in the 1980s and 1990s focused on increasing fear of possible exposure to HIV in order to change sexual behavior (Jaspal & Bayley, 2020), there is now only limited discussion of HIV in mainstream societal channels of information, such as the print media and television, and largely stigmatizing and sensationalist representations of HIV remain prominent in these contexts (Kilty & Bogosavljevic, 2019). This study found that that trust in science and scientists was significantly and negatively associated with both HIV stigma and fear, indicating that the more people trust science and scientists, the less likely they are to exhibit stigma and fear. Trusting science and scientists may mean that people endorse the content of mainstream scientific discourse concerning HIV, namely that it is preventable, treatable and manageable.

Our correlational analyses showed that trust in science and scientists was a significant positive correlate of HIV knowledge. This suggests that the more one trusts science and scientists, the more likely one is to accept and assimilate scientific information, thereby enhancing one's own level of knowledge. Furthermore, people who are more trusting of science and scientists may be more likely to inform themselves proactively about scientific and medical developments (Allen Catellier & Yang, 2012). Conversely, those who exhibit mistrust of science and scientists may reject scientific information and, in some cases, endorse conspiracy theories. Indeed, HIV conspiracy theorizing (itself a corollary of decreased trust in science and scientists) has been shown to be inversely associated with the endorsement of scientifically proven approaches to HIV prevention, such as PrEP (Jolley & Jaspal, 2020). In short, increasing trust in science and scientists and HIV knowledge may play an important role in reducing HIV stigma and fear.

The significance of homonegativity

Consistent with previous research (Beaulieu et al., 2014; Herek, 1999), we found a positive association between baseline homonegativity (that is, negative attitudes toward gay men) and HIV stigma and fear. Indeed, the multiple regression models showed that homonegativity was the strongest predictor of both variables. In view of the dominant social representation that HIV is a "gay disease", it may be that people who report higher homonegativity attribute the same negative characteristics to an infection that it socially represented as being especially relevant to this stigmatized population. Indeed, homonegative tropes are often attributed to HIV in both media and societal discourse (Jaspal & Nerlich, 2017).

Yet, even when controlling for the effects of baseline homonegativity, HIV knowledge and trust in science and scientists, we found that being exposed to a vignette describing a heterosexual man living with HIV led to lower HIV stigma than being exposed to a vignette describing a gay man and the control condition (in which no sexual orientation was explicitly mentioned). This indicates that, when the long-standing representation of HIV as a "gay disease" is overtly challenged by describing a heterosexual person living with HIV, HIV stigma appears to wane. In other words, when

the social representational association between gay men and HIV is broken (as it explicitly was in the heterosexual condition in our experiment), a reduction in HIV stigma is also observable. Given the strong social representational link between gay men and HIV, it is plausible that individuals are thinking about this link (and thus a *gay* prototype with HIV) when responding to the HIV stigma and fear scales. However, it is possible that participants were thinking about the specific case of the individual described in the vignette and not gay men or heterosexual men living with HIV. This limitation should be addressed in future experimental research.

There was a significant difference in levels of HIV fear only between participants in the heterosexual vs. the control conditions (and not between participants in the heterosexual vs. gay conditions). Participants in the control condition exhibited higher HIV fear than those in the gay condition. This was not entirely consistent with our original hypothesis. The non-significant difference between the heterosexual vs. gay conditions suggests that exposure to a vignette regarding a heterosexual person with HIV does not necessarily lead to a more favorable affective reaction to HIV (vs. a gay person). It may be that, in the absence of overt information about the (gay) sexual orientation of the person living with HIV, individuals may believe that the risk of HIV infection is more widespread (i.e., that it affects heterosexual people too). This "increased" risk perception may in turn generate a negative affective reaction – in this case, greater fear of HIV. This hypothesis will need to be investigated in future research. However, our results do demonstrate the importance of distinguishing between stigma and fear responses in the context of HIV.

Gender differences

There were main effects of sexual orientation framing and participant gender (male vs. female) on HIV stigma and fear, with men reporting higher HIV fear and stigma than women (see also Thainiyom & Elder, 2017). However, our fourth hypothesis that there would be an interaction effect of participant gender and sexual orientation of the target on HIV stigma and fear of HIV was not supported in the data. Although men do report more HIV stigma and fear than women and that sexual orientation framing impacts HIV stigma and fear (with a heterosexual target prompting the least stigma and fear), there is no differential reaction to sexual orientation framing (between men and women). This emphasizes the general value of using attribute framing in health messages that are aimed at breaking down dominant but erroneous social representations of a disease.

Limitations and future directions

First, virtually the entire sample was heterosexual because an aim was to examine the impact of heterosexual homonegativity on HIV stigma and fear. However, there are also concerns about HIV stigma and fear in gay men which may have significant public health consequences, such as decreased testing, HIV status disclosure and risk behavior as an avoidance strategy (Smit et al., 2012). Future research should replicate this study in a gay male sample. Second, the vignettes focused only on men living with HIV, which does not enable us to ascertain the impact of perceiving a woman living with HIV on the dependent variables. Given the noteworthy incidence of HIV in women (Brown et al., 2019), this would be a worthwhile next step. Third, the correlations between trust in science and scientists and HIV knowledge and HIV stigma and fear, respectively, require further attention. The direction of these relationships (i.e., whether trust in science and scientists is generating more HIV knowledge or whether HIV knowledge is generating more trust) cannot be unequivocally ascertained on the basis of our data. Fourth, although self-report measures of stigma and fear may be susceptible to social desirability biases, we did find a significant effect of the manipulation on these variables. Future research ought to use more sophisticated assessments of stigma and fear, such as the Implicit Association Test, to triangulate our findings. Finally, it is recommended that future research use a different type of control condition that is more directly relevant to the experimental conditions (i.e., the description of an individual rather than the health system). Furthermore, it is possible that the pre-manipulation measures primed some participants to think about HIV and gay men which should be addressed in future research in this area.

Implications for health communication

While HIV stigma is widely recognized as a societal problem to be challenged, there has been ambivalence about the public health value of HIV fear. There has been much debate about the long-term effectiveness of "fear appeals" in HIV prevention messaging, with some arguing that this should be incorporated into health communication (i.e., that greater fear equals positive behavior change) and others arguing that its effectiveness is questionable because of the insidious effects of fear (see Green & Witte, 2006). Globally many of the early public health campaigns – in both the UK and Germany - have historically focused on inducing fear in the general population in order to promote behavior change that might reduce the incidence of HIV (Federal Centre for Health Education, 2009; Jaspal & Bayley, 2020). Incidentally, exploring the role of age in HIV stigma, and especially fear, would be valuable given the social representations of death and dying in HIV campaigns during the early phase of the epidemic which would be recalled by older participants.

Our results suggest that, in the era of effective HIV prevention and treatment, there needs to be a shift from fear appeals to enhancing trust in science and scientists and HIV knowledge in the general population. Trust in science and scientists has changed over time, not least during the coronavirus pandemic, where misinformation, conspiracy theorizing and uncertainty have surrounded public understanding of science (Agley, 2020). Moreover, our data indicate that trust in science and scientists is lower in the UK sample than in the German sample, indicating a greater need to focus on this particular variable in the UK context. Health communication, which emphasizes the trustworthiness of science and the science community, may be a beneficial step toward encouraging information-seeking and the acceptance of accurate scientific information in the general population. Crucially, our data also suggest that this may serve to decrease HIV stigma and fear in the general population and that this should also form part of sexual health education initiatives.

The most noteworthy contribution this study makes is in evidencing the effect of sexual orientation framing on HIV stigma. Much HIV prevention campaign activity (since the discovery of AIDS and the virus that causes it) has generally targeted gay men, given that this population has historically been, and remains, most vulnerable to HIV in Western countries (Jaspal & Bayley, 2020). This has undoubtedly led to the erroneous perception that HIV is an exclusively "gay disease". Our study also shows that baseline homonegativity is strongly associated with HIV stigma and fear. Thus, challenging homonegativity will continue to be an important societal mission, especially in the UK context where participants reported higher baseline homonegativity than in Germany. Importantly, reducing homonegativity may also have a positive effect on reducing HIV stigma and fear.

As rates of HIV are relatively high in heterosexual people, there is legitimate cause to broaden the focus of HIV prevention messaging from gay men alone to other at-risk groups in society, such Black Africans, transgender people and intravenous drug users (O'Halloran et al., 2019). However, as gay men remain at high risk of HIV, non-stigmatizing prevention messaging must continue to be targeted at them as well but in a non-stigmatizing manner. This would not only address the current barriers in eradicating new HIV infections but, as our study demonstrates, may also have the social psychological effect of de-coupling HIV and gay men and of reducing the stigma and fear that currently surround HIV.. As the design of our study was not longitudinal, it is difficult to assess the longevity of these promising effects. However, sustained public health messaging that focuses on a diverse range of groups, including heterosexual people, is likely to crystallize these cognitive and affective effects (i.e., less stigma and less fear) over time. In the long term, HIV stigma reduction will undoubtedly aid not only our efforts to prevent HIV but also to create more favorable social and psychological conditions for those living with this chronic condition.

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