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Self-esteem and sexual health: a multilevel meta-analytic review

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ABSTRACT

Sexual health reflects physical, emotional, mental, and social elements of sexual well-being. Researchers often position self-esteem (i.e., global or domain-specific evaluations of self) as a key correlate of sexual health. We present the first comprehensive meta-analysis of correlations between self-esteem and sexual health. Our synthesis includes 305 samples from 255 articles, containing 870 correlations from 191,161 unique participants. The overall correlation between self-esteem and sexual health was positive and small ($r = .12$, 95% CI: .09, .15), characterised by considerable heterogeneity and robust to different corrections. Sexual functioning ($r = .27$, 95% CI: .21, .34) was more strongly associated with self-esteem than were safe sex ($r = .10$, 95% CI: .07, .13) and sexual consent ($r = .19$, 95% CI: .13, .24), and sexual permissiveness was unassociated with self-esteem ($r = -.02$, 95% CI: -.05, .008). Most moderators were nonsignificant, although moderator data were inconsistently available, and samples were North American-centric. Evidence of publication bias was inconsistent, and study quality, theory usage, and background research were not reliably associated with study outcomes. Our synthesis suggests a need for more specific theories of self-esteem corresponding to unique domains of sexual, highlighting a need for future theorising and research.

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meta-analysis; self-esteem; safe sex; sexual consent; sexual health; sexual permissiveness; sexual functioning

Self-esteem and sexuality are topics with long, storied histories within psychology. Self-esteem is among our discipline's earliest constructs of scientific study (James, 1890), whereas sexuality featured front-and-centre in preliminary psychological theory (Freud, 1962). Both have been described as core areas of self-concept (Rosenberg, 1986; Snell & Papini, 1989), leading educators, clinicians, and researchers to view self-esteem as a crucial cause and consequence of sexual health (e.g., Finlayson, 1979; The Citizen, 1986; Toughill, 1986). The quantitative literature linking self-esteem (i.e., evaluations of the self as positive or negative) and sexual health, now active for nearly 50 years, is substantial. Attempts to synthesise this literature, however, have been relegated to periodic narrative (e.g., Baumeister, Campbell, Krueger, & Vohs, 2003) and vote-counting reviews (Goodson, Buih, & Dunsmore, 2006), most of which target literature pertaining to particular sexuality-related variables such as sexting or safe-sex practices (e.g., Cole, 1997; Klettke, Hallford, & Mellor, 2014) and/or particular developmental phases such as adolescence (e.g., Yarber & Parrillo, 1992; Zimmer-Gembeck & Helfand, 2008).

In the current review, we present the results of the first comprehensive meta-analysis to test relevant theories of self-esteem and sexuality. Our review focuses on documenting the direction and magnitude of the association between self-esteem (including both global and domain-specific conceptualisations) and domains of sexual health (Robinson, Bockting, Rosser, Miner, & Coleman, 2002;

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World Health Organization, 2006). We first describe various conceptions of self-esteem, present our broad conceptualisation of sexual health, describe existing reviews of this literature, and review some broad theories relevant to this topic, which we then empirically evaluate in the course of our meta-analytic review.

Self-esteem

Self-esteem entails evaluations of the self as either positive or negative, and has often been characterised as a crucial causal agent – and therefore a solution – for a myriad of social issues (Crocker & Wolfe, 2001). Self-esteem is conceptualised as either *global* (i.e., reflecting overall assessments of the self, Rosenberg, 1986), or *domain-specific* (i.e., reflecting assessments of the self within particular contexts, or ‘contingencies of self-worth’, see Crocker & Wolfe, 2001). In the present synthesis, we consider both global and domain-specific assessments of self-esteem.

Sexual health

Contemporary definitions of sexual health encapsulate a broad array of sexuality-related variables. The definition of sexual health offered by the World Health Organization (2006), for example, includes elements of ‘physical, emotional, mental, and social well-being in relation to sexuality’, including ‘the absence of disease, dysfunction, or infirmity’, ‘a positive and respectful approach to sexuality’, and ‘the possibility of having pleasurable and safe sexual experiences, free of coercion, discrimination and violence’. Such a definition places variables like condom use attitudes, sexual satisfaction levels, sexual desire dysfunction, and experiences of nonconsensual sex – to name a few – all under the same conceptual umbrella. Likewise, the Sexual Health Model (Robinson et al., 2002) encompasses prototypical sexual health variables, like those variables related to safer sex and sexual functioning, but also features sex positivity, relationship dynamics, and sexual communication, amongst others. A recent search of PubMed suggests that the concept of sexual health is an increasingly popular one, as more than 2,000 articles include ‘Sexual Health’ in the title, and the rate of publication of these articles is increasing.

Broad definitions of sexual health like those offered by Robinson et al. (2002), the WHO (2006), and others (e.g., Rohleder & Flowers, 2018) afford inclusion within our synthesis of the vast majority of sexuality-related variables studied alongside self-esteem. This is, however, not to say that we believe sexual health to be a homogenous construct – a point to which we return in discussing our analysis strategy. Rather, we saw framing our synthesis in terms of sexual health as an opportunity to speak to as much of the sexuality and self-esteem literature as possible, while also recognising that there may be distinct domains of sexual health with differing patterns of effects.

The presence of sexual health, however construed, has been linked to greater individual well-being (Blanchflower & Oswald, 2004; Laumann, Gagnon, Michael, & Michaels, 1994; Muise, Schimmack, & Impett, 2016), whereas its absence has been linked to poor well-being (Laumann, Paik, & Rosen, 1999; Simbayi et al., 2007). For all of its benefits, however, sexual health can be challenging – and expensive – to maintain for both individuals and institutions alike (Center for Disease Control [CDC], 2017; Muehlenhard, Peterson, Humphreys, & Jozkowski, 2017). Self-esteem is often positioned as a potentially cost-effective solution to promoting sexual health (Baumeister et al., 2003 for a review). Although studies in this area are almost exclusively correlational, there is a clear tendency for researchers to causally characterise compromised sexual health as a symptom of low self-esteem.

Previous reviews of self-esteem and sexual health research

With literature of hundreds of related effects, and given the subjective nature of narrative reviews (Card, 2012; Cooper & Rosenthal, 1980), it is perhaps unsurprising that narrative reviews have

drawn conflicting conclusions about the importance of self-esteem for sexual health. Some reviews suggest self-esteem may be of little importance to sexual health (Klettke et al., 2014; Zimmer-Gembeck & Helfand, 2008). Other reviews suggest that the association is more substantive and typically negative, as self-esteem might promote cognitive biases that lead people to engage in riskier sexual behaviour (Cole, 1997; Yarber & Parrillo, 1992). Finally, a comprehensive review concluded that sexuality-related domains of well-being may be an area of research in which the role of self-esteem is particularly inconsistent (Baumeister, Campbell, Krueger, & Vohs). The studies reviewed related to safe sex supported virtually every possible perspective on self-esteem: that self-esteem was unrelated to safe sex; that high self-esteem was linked to safer sex; and that high self-esteem was linked to unsafe sex. Sometimes conflicting findings like these even coexisted in the same study (e.g., Hollar & Snizek, 1996). As a result, narrative reviews of the self-esteem and sexual health literature suggest that the nature of the relationship between these two constructs is complicated.

The only review of the adolescent sexuality literature to use a quantitative reviewing methodology also underscores the inconsistency with which self-esteem is linked to sexual health (Goodson et al., 2006). These authors used a vote-counting methodology, whereby they tallied how many of the effects in their sample were statistically significant vs. non-significant, and whether self-esteem was linked to sexually healthy or unhealthy experiences. In 60% of the 189 findings they reviewed, associations between self-esteem and sexual health variables were non-significant. When associations between self-esteem and sexual health variables were statistically significant, they were about twice as likely to indicate that self-esteem was linked to sexually unhealthy experiences (26%) as they were to indicate that self-esteem was linked to greater sexual health (14%).

The reviews of self-esteem and sexual health literatures are beset by relatively straightforward methodological limitations. First, conclusions from narrative reviews are made without any discernable method by which reviewers weight and combine the results of studies to determine an overall trend (Card, 2012; Cooper & Rosenthal, 1980). Neither narrative nor vote-counting approaches are equipped to synthesise a specific effect size that takes study precision (e.g., sample size) into account. Moreover, neither provides a means of reliably assessing how effects in this literature vary as a function of within-sample or between-sample qualities, nor can they adequately assess or address various statistical biases and artefacts in the literature (e.g., publication bias, measurement artefacts). Second, none of the reviews are particularly comprehensive, despite there being hundreds of studies in the literature. The specific approaches taken imply that the effects within the more narrowly defined literatures may be substantively different than those effects within the broader literature. With meta-analysis, unlike narrative or vote counting approaches, implicit hypotheses like these can be tested directly, evaluating whether the specific domain of sexual health, for example, or sample characteristics, explain patterns of heterogeneity of effect sizes. Third, none of the reviews make explicit connections between the conclusions they draw and underlying theories that might explain patterns of correlation between self-esteem and sexual health. To this end, the self-esteem and sexual health literature gives the impression of being mostly exploratory and atheoretical. We now turn to describing some of these more prominent theoretical perspectives that have compelled researchers to study self-esteem and sexual health variables in tandem.

Theories of self-esteem and sexual health

Researchers have approached the study of self-esteem and sexual health variables from numerous theoretical perspectives. Most theories either explicitly speak to a global sense of self-esteem, or at the very least do not specify to which specific domains of self-esteem these theories do and do not apply – a feature that makes gauging the applicability of these theories to domain of self-esteem a challenge. Further, these theories, originating in disciplines such as anthropology, health behaviour, and social psychology, span the gamut of specificity and complexity as to what each suggests about the association between self-esteem and sexual health.

In almost all cases, these theories are not articulated specifically enough by the original authors to make them strictly falsifiable. That is, theorists typically did not make clear (a) whether sexuality would *specifically* fall within their broader mandate, or rather, would be considered an exceptional case; (b) what shape or direction of association they would anticipate; and (c) what effect size(s) they would consider (in)compatible with their theoretical account. Theories that meet all of these criteria are rare in psychological science (see Hyde, 2005, for an exceptional cases), but the utility of such theories becomes evident when one conducts a meta-analysis, as with colossal statistical power it becomes all too easy (and uninformative) to reject nil-null hypotheses (i.e., that there is zero correlation; see Cohen, 1994; Meehl, 1990). Our predictions from each perspective, therefore, are most frequently derived from *our interpretation* of the theories; the original theorists did not necessarily specify these concrete predictions, but we nevertheless believe they logically follow from their core propositions.

Intuitive theories. Investigations of the literature on self-esteem and sexual health have been extensively guided by intuitive theorising. A nonspecific example of this sort of theorising is as follows: *Sexual health is an important facet of well-being, and self-esteem is an important indicator of well-being; the two must therefore, somehow, be related.* Intuitive theorising presents a non-trivial problem: it is remarkably difficult to falsify, as it fails to specify the expected direction (i.e., positive or negative), function (e.g., linear, quadratic), or boundary conditions (e.g., particular variables, particular samples) of this association.

Another common and intuitive basis for studying self-esteem and sexual health is the precedent set by prior findings reaching thresholds of statistical significance. The problem with this approach is that it seems immune to counterfactuals; reviews of this literature offer plenty of examples of null effects (see Baumeister et al., 2003). Therefore, when one considers the likely presence of publication bias (Rosenthal, 1979) and flexible data analysis strategies (John, Loewenstein, & Prelec, 2012) it is unclear why one would choose to believe one arbitrarily selected significant finding over another, without a more compelling theoretical imperative.

Problem behaviour and resilience. According to Problem Behavior Theory (e.g., Jessor & Jessor, 1977; Jessor, Van Den Bos, Vanderryn, Costa, & Turbin, 1995), low self-esteem is an instigation/risk factor that would promote an individual to engage in problem behaviour like sexual risk-taking. Self-esteem features in a similar role within some versions of Resilience Theory (e.g., Zimmerman & Arunkumar, 1994; see Fergus & Zimmerman, 2005, for a review). Compensatory theories of resilience, specifically, offer self-esteem as a *promotive asset* that can help to counteract the effect of risk factors. Problem Behaviour Theory and compensatory Resilience Theories both lead one to predict a positive correlation between self-esteem and sexual health, with Problem Behaviour Theory focusing on low self-esteem as a risk factor for poor sexual health, compared to compensatory Resilience Theories focusing on high self-esteem as an asset that can facilitate better sexual health decisions. As such, a positive, relatively unmoderated (i.e., neither stronger nor weaker for particular samples), association between self-esteem and sexual health variables would be interpreted as support for both of these theories.

The need for self-esteem. Two social psychological theories grapple explicitly with the human need for self-esteem, and make clearer how self-esteem would come to bear on individual sexual health: Terror Management Theory (Greenberg, Pyszczynski, & Solomon, 1986) and Sociometer Theory (Leary, Tambor, Terdal, & Downs, 1995). Both theories can be interpreted to suggest that self-esteem is linked to sexual health variables, as a by-product of the individual pursuit of relational or symbolic security.

Terror management theory. According to Terror Management theorists, humans have evolved the cognitive capacity to anticipate their inevitable and unequivocal demise, and as a result, pursue opportunities to cement their *literal immortality* (e.g., a religion-based afterlife) or, more commonly, their *symbolic immortality* (Greenberg et al., 1986; Pyszczynski, Greenberg, Solomon, Arndt, & Schimel, 2004). Individuals can strive for symbolic immortality through promoting the worldview of one's culture or through attempts to live up to one's cultural worldview, resulting in a feeling of

self-esteem (Greenberg et al., 1986). These sources of symbolic immortality have been integrated as part of a broader psychological system that promotes a sense of existential security (Hart, Shaver, & Goldenberg, 2005), which are theorised to be linked to health-related behaviours (Goldenberg & Arndt, 2008), like those related to sexuality (e.g., Goldenberg, Pyszczynski, Greenberg, & Solomon, 2000). One would therefore expect aspects of sexual health that are culturally valued (e.g., sexual virility) or devalued (e.g., having a sexually transmitted infection) to be more strongly linked to self-esteem.

Sociometer theory. Sociometer Theory (Leary & Baumeister, 2000) suggests that given their strong need to belong to social groups (see Baumeister & Leary, 1995), humans become preoccupied with their *relational value* – to what extent a relationship with a given individual is valued by others – with higher levels conferring greater social inclusion, support, and protection. Self-esteem, these theorists argue, functions to serve as measuring-stick – a *sociometer* – of one's current relational value; when one behaves in a way that makes others relationally value them to a greater degree (e.g., through satisfying sex), they will feel a greater sense of self-esteem, whereas failing to meet the standards of others (e.g., engaging in infidelity) will lead to a reduced sense of self-esteem. Leary (1999) further suggested that socially observable conduct should be more strongly linked with the sociometer (and therefore self-esteem), as it is verifiable, and therefore subject to reinforcement or punishment by close others, whereas intrapsychic variables may exist without the awareness of others. Thus, all else being equal, one would expect aspects of sexual health that are observable (e.g., whether a condom was used with a sexual partner) to be more strongly linked to self-esteem than aspects of sexual health that are not socially observable (e.g., personal attitudes or beliefs regarding condom use).

Similarities between terror management and sociometer theories. Both Terror Management Theory and Sociometer Theory suggest that people do not pursue self-esteem for its own sake, but rather, for what it is indicative of – either symbolic immortality (Pyszczynski et al., 2004), or relational value (Leary, 2004). And if one accepts the premise that there exist social and cultural standards for sexual conduct (see Simon & Gagnon, 1986; Stratton & Spitzer, 1967), then these theories suggest that cultural prescriptions and proscriptions for sexual conduct are likely intimately tied up in an individual's sense of symbolic and/or relational value, and thereby, their self-esteem. Terror Management Theory and Sociometer Theory would therefore be supported by associations between self-esteem and sexual health that were moderated by social context variables (social group, history, culture). Sociometer theory would be further supported via stronger associations between self-esteem and socially observable sexual health variables.

The role of social group and context. Paths to symbolic immortality and/or relational value related to sexuality – and thereby correlations with self-esteem – likely vary across social groups and contexts. We therefore see the following theory-driven variables – possible moderators of the self-esteem and sexual health connection – as more specific cases of the broader postulates of Terror Management Theory and Sociometer Theory. We provide a brief overview of hypotheses related to these moderator variables here but more detailed descriptions for their inclusion can be found in the Online Supplement.

Gender. According to gendered perspectives on Sexual Scripting Theory (see Sakaluk, Todd, Milhausen, & Lachowsky, 2014; Wiederman, 2005, for reviews), the sexual double standard (Crawford & Popp, 2003), and Evolutionary Psychology theories of sexuality (Buss & Schmitt, 1993; Penke & Denissen, 2008), a stronger, positive association would be expected between self-esteem and variables related to sexual permissiveness for samples with more men, versus a weaker (or negative) association for samples with more women.

Sexual orientation. In line with theory from minority stress perspectives (e.g., Hatzenbuehler, 2009; Meyer, 2013) suggesting LGB individuals are subject to increased levels of proximal and distal stressors related to their sexual identities and face greater stigmatisation over their sexual conduct (Katz-Wise & Hyde, 2012), self-esteem may be more strongly linked to sexual health for sexual minority group members.

Racial group. Racial groups may form their own norms for sexual conduct (e.g., Furstenberg Jr, Morgan, Moore, & Peterson, 1987; Sterk-Elifson, 1994) and assign their own levels of meaning to sexual health experiences (e.g., sexual risk taking, Stephens & Few, 2007). Racial norm perspectives would therefore be supported via a stronger association between self-esteem and sexual health variables for samples with more racially diverse individuals.

Age. Theorising pertaining to the developmental period of emerging adulthood (Arnett, 2000) suggests that sexual health variables might be especially self-relevant during the teenage and early adult years, when many young adults begin making their sexual debuts (e.g., Cavazos-Rehg et al., 2009). Therefore, the Emerging Adulthood perspective would be supported via a stronger association between self-esteem and sexual health variables for samples with a younger (vs. older) average age.

Relationship status. Relationships often adapt or develop tailor-made sexual norms from their broader cultures in a way that may influence how sexual health experiences are valued (Masters, Casey, Wells, & Morrison, 2013), and (un)healthy sexuality might be most impactful on well-being to those in romantic relationships (e.g., Muise et al., 2016; see Impett, Muise, & Peragine, 2014, for a review). Close relationship perspectives would therefore be supported via a stronger association between self-esteem and sexual health variables for samples with more participants in romantic relationships.

Culture. Cultures, too, may influence patterns of associations between self-esteem and sexual health, as research has attested to the differing importance placed on the self within cultures varying on the cultural dimension of individualism-collectivism (see Triandis, 1996, for a review). Therefore, theories of culture and the self would be supported via a stronger association between self-esteem and sexual health variables for samples coming from countries that are more individualistic (vs. collectivistic). Although we did not have specific hypotheses regarding additional dimensions of culture (e.g., power distance, long-term orientation; Hofstede, Hofstede, & Minkov, 2010), we examined their moderating role in an exploratory fashion.

Time. Sexual norms – and therefore what sexual health experiences are considered relationally and/or symbolically valuable – may also change with time. For example, the increasing online availability of pornography could shift norms for sexual conduct via social learning processes (Petersen & Hyde, 2010), and norms related to sexual health (and correspondingly evaluations of the self) might be expected to shift over time as well, such that associations between self-esteem and sexual health will change among studies published in different years.

The present research synthesis

Our meta-analytic review entailed pursuing three novel goals, throughout which we strived to include all sexuality variables that could fit within a broad definition of sexual health (Robinson et al., 2002; Rohleder & Flowers, 2018; WHO, 2006). First, we endeavoured to provide a *range* of plausible meta-analytic estimates – both across the entire sample, and across particular domains of sexual health – taking into account the various measurement artifacts (i.e., measurement unreliability and artificial dichotomisation; Schmidt & Hunter, 2014) and biases (i.e., publication and other selection forces; Rosenthal, 1979; Stanley & Doucouliagos, 2014) that distort reported effect sizes. Both corrected and correction-free *naïve* estimates are imperfect and the use of either is not without controversy (Card, 2012; Schmidt & Hunter, 2014). We therefore synthesised a range of meta-analytic estimates in order to provide reasonable conclusions for *naïve* (i.e., unadjusted), *optimistic* (i.e., artefact-corrected), and *pessimistic* (i.e., bias-corrected) analytic conditions. Results across the three approaches that converged would provide robust evidence for a given level of correlation, while divergences across approaches would give readers an idea of reasonable estimates depending on what intuitions researchers have about the quality of the data in the literature.

Secondly, we structured our coding and moderator tests to directly inform the numerous theories relevant to the association between self-esteem and sexual health variables, seeing which theories were the most (in)consistent with observed meta-analytic estimates.

Finally, we sought to evaluate the importance of particular theoretical and methodological qualities of studies for shaping effects in the self-esteem and sexual health literatures. In particular, we were interested in the exploratory meta-scientific question of to what extent, if any, relying on theories and the findings in past literature (i.e., to inspire a given study's predictions and/or methods) led to substantively different outcomes in terms of observed effect sizes (e.g., McEwan et al., 2019). We also evaluated the impact of publication bias and elements of research quality on effect sizes.

Method

All of our meta-analytic data and analysis scripts are available on the Open Science Framework (<https://osf.io/hqd4u/>) as is our partial preregistration for our meta-analytic hypotheses and data analysis plan (<https://osf.io/8yc3d>).

Literature search process

We searched the databases *psycINFO* and *PubMed* for articles containing the terms 'self-esteem' and 'sexu*', including articles published in languages other than English that could be reliably translated. Initially, we sought to exclude terms relevant for nonconsensual sex, but eventually decided our reasons for doing so were specious. We therefore performed a second round of searches for both databases, this time searching for any of the additional terms of 'haras*', 'abus*', 'victim*', 'assault*', 'trauma*', 'revic*', 'coerc*', and 'offend*'. We later conducted forward-searches on all articles passing our screening protocol (described below), and conducted backwards-searches using the references contained in the screened articles. Finally, we sent emails to the listservs of relevant scientific professional organisations. We sent the list of confirmed references yielded by the previous literature searching steps, and asked members to send us any articles that were not included in this list and any unpublished data on self-esteem and sexuality. A flow diagram capturing our literature searching and subsequent screening process is presented in [Figure 1](#).

Study inclusion criteria and article screening

Candidate articles needed to report on quantitative data pertaining to an association (or associations) between self-esteem (global and/or domain-specific) and some facet(s) of sexuality. Articles that solely reported on data pertaining to sexual-orientation-specific variables (e.g., internalised homophobia, experiencing sexual orientation-based discrimination) were not included, as we hoped to compare effect sizes between samples composed of different degrees of sexual orientation diversity. We also excluded sexuality variables that ultimately could not be reconciled with our sexual health framing (e.g., dominant vs. submissive identification within bondage, domination, sadism, and masochism [BDSM] relationships).

A team of five undergraduate research assistants (including the third and fourth authors) first screened articles found by our literature search terms, forward-searches, and backward-searches to determine if the articles were topically relevant. Our research assistants were trained to be deliberately liberal when appraising articles, to ensure only blatantly obvious topical exclusions were made. Next, the first or second author read the full-text of articles passing the first stage of screening. Articles were either confirmed as: (1) reporting topically relevant data, and with sufficient detail (i.e., either zero-order correlations included, or enough other statistical information to facilitate conversion to zero-order correlations); (2) reporting topically relevant data, but without sufficient detail (i.e., requiring corresponding authors to provide additional information to calculate zero-order correlations); or (3) not reporting topically relevant data (e.g., the article was a review, the data were qualitative, the data were not about self-esteem and sexuality or a sexual-orientation-specific variable).

For articles lacking sufficient detail, we emailed corresponding authors requesting zero-order correlations, or additional detail that would allow us to estimate zero-order correlations ourselves. Most

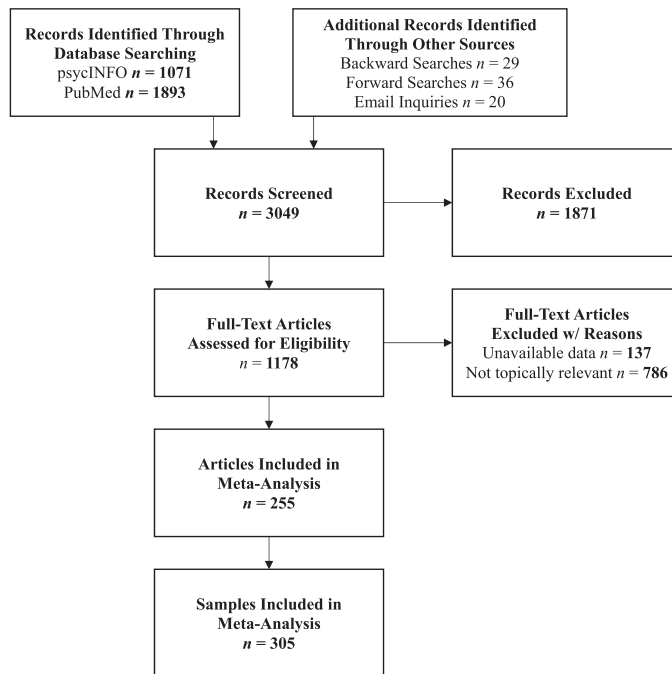


Figure 1. Flow diagram of literature searching and screening process.

of the time, these requests were necessary because relevant data were only analysed and reported in multivariate regression models, which assess the unique associations between predictor variables and outcome variables – not their bivariate association.

Effect size extraction, conversion, direction, and transformation

All effect sizes were extracted (or converted) by the first or second author. When zero-order correlations were present in articles, they – and their sample sizes – were simply extracted. Other times, however, we had to convert other statistical information (e.g., *p*-values, *t*-statistics, other effect sizes, etc.) to zero order correlations using the effect size calculator and conversion tools provided by Lakens (2013).

Correlations between self-esteem and sexuality variables were then directionally scored such that positive associations indicated that higher levels of self-esteem were associated with higher levels of the ostensibly sexual-health promoting direction of the sexuality variable. In many cases, endorsement of a given variable may or may not be truly related to health outcomes, per se. For example, one can participate in casual sex with a multitude of partners in a way that does not jeopardise sexual health (e.g., by using condoms regularly or getting regular STI screening). Nevertheless, we opted to frame the directions of our effects such that they reflect a positive association between self-esteem and the sexual health domain, *as the sexual healthy option is typically defined within a given literature*, in order to ease interpretation of our estimates. Thus, positive meta-analytic estimates will indicate a positive association between self-esteem and more condom use, consensual sex, sexual restrictedness, sexual function, delayed age of sexual debut and the like. In a select few cases correlations were removed from the sample because they did not provide an unambiguous health-related scoring direction.

As is typical when meta-analysing zero-order correlation coefficients, we transformed correlations via Fisher's method (Fisher, 1915), along with their standard errors, using the formulas commonly

outlined in meta-analysis texts (Borenstein, Hedges, Higgins, & Rothstein, 2009). After fitting our meta-analytic models to these transformed correlations, however, we have converted back to standard zero-order correlations (r) whenever possible.

Meta-analytic coding

The first, second, and last author were responsible for coding each sexuality variable's (sub)domain of sexual health; all remaining coding was completed by the first or second author.

Domains of sexual health. After reviewing the entire list of sexuality variables in our sample, we determined that a coding scheme of four primary domains of sexual health drawn from the WHO definition (WHO, 2006) and other models of sexual health (e.g., Robinson et al., 2002) could effectively categorise the vast majority of our effects (see Table 1). These domains included: (1) *safe sex*, which encompassed psychological, behavioural, and health variables related to condom/contraception use, sexually transmitted infections or diseases, unintended pregnancy, or substance use during sex; (2) *permissiveness*, which encompassed variables related to sexual desire, engaging in sex, number of sexual partners, pornography, or extradyadic sex (scored in the direction of sexual *restrictedness*); (3) *sexual function*, which encompassed variables related to ease or difficulty with arousal, orgasm, and sexual pain, as well as subjective sexual well-being variables, such as (dis)satisfaction, and sexual esteem; and (4) *consensual sex*, which encompassed variables related to sexual assertiveness and negotiation, as well as experiences with sexual harassment, sexual assault, and sexual abuse. In a number of instances, a sexuality variable was deemed to be representative of more than one domain (e.g., 'sexual risk' composites often assess both safe sex practices and permissiveness related variables).

Our initial attempts at independently coding primary sexual health domains were highly reliable ($\kappa = .92$, $p < .001$; Fleiss, 1971). All instances of disagreement were resolved through a consensus-building discussion amongst the coders. As in all but one of the cases of disagreement two of the three coders agreed on the code to apply, these disputes were resolved without controversy. Finally, further attempts to categorise variables into sub-domains within each domain (e.g., condoms, STIs/STDs, and substance use within the safe sex domain) were not supported by later analyses.

Public vs. private sexual health variables. In order to test the sociometer theory (Leary, 1999) hypothesis, the first and second authors coded sexuality variables for whether they were *publicly verifiable* or *private* (see again Table 1); this roughly translated to coding *behavioural* variables as *public* and *intrapsychic* variables as *private*, though there were some behavioural variables that would not necessarily be easily verifiable (e.g., number of lifetime sexual partners). As this level of coding agreement was lower than desirable ($\kappa = .67$, $p < .001$), we assigned a code only in cases where both authors made the same initial coding decision.

Table 1. Example variables coded into domains of sexual health and public/private moderators.

Safe sex	Permissiveness	Sexual function	Consensual sex	Public (verifiable)	Private (unverifiable)
<ul style="list-style-type: none"> • Condom use self-efficacy (Klein et al., 2010)^a • HIV knowledge (Gakumo et al., 2012)^a • STD diagnosis (Salazar et al., 2005)^a 	<ul style="list-style-type: none"> • Hookup experience (Paul et al., 2000)^a • Number of sex partners in past year (Ritchwood et al., 2014)^a • Sociosexual orientation (Clark, 2006)^a 	<ul style="list-style-type: none"> • Sexual arousal function (Rehbein-Narvaez et al., 2006)^a • Sexual problems (Zamoni & Crawford, 2007)^a • Sexual satisfaction (Nelson et al., 1994)^a 	<ul style="list-style-type: none"> • Unwanted sexual attention (Wright & Fitzgerald, 2007)^a • Sexual abuse (Kuo et al., 2011)^a • Sexual assertiveness [refusal] (Jacobs & Kane, 2011)^a 	<ul style="list-style-type: none"> • Use of contraception (Holmbeck et al., 1994)^a • Receipt of STI screening (McCall et al., 2002)^a • Sexting behaviour (Hudson, 2011)^a 	<ul style="list-style-type: none"> • Positive attitudes towards birth control (Herold et al., 1979)^a • Perceived vulnerability [unplanned pregnancy] (Smith et al., 1997)^a • Sexual self-esteem (Adler, 1989)^a

^aThese reference details are available in the supplementary file.

Global vs. domain-specific measures of self-esteem. In our meta-analytic sample, the vast majority of correlations ($n = 621$) involved measures of global self-esteem (e.g., Rosenberg, 1986), but a non-trivial number involved domain-specific measures of self-esteem, mostly focused on evaluations of the self in terms of being: (1) sexually desirable and competent ($n = 202$); (2) physically attractive ($n = 33$); (3) socially valued ($n = 7$); (4) valued within one's family ($n = 4$); or academically talented ($n = 2$). We therefore coded effects for utilising *global* or *domain-specific* self-esteem measures.

Measurement artefacts. When variables are measured unreliably, or researchers restrict their continuous measurement by creating artificial categories, the underlying correlation will be underestimated (Schmidt & Hunter, 2014). We therefore applied corrections for both types of artefacts (Card, 2012) in order to synthesise *optimistic* meta-analytic estimates of the association between self-esteem and sexual health variables, free of measurement error and/or attenuation via artificial dichotomisation. We report these optimistic estimates (i.e., under perfect measurement conditions) alongside *naïve* (i.e., uncorrected) and *pessimistic* (i.e., more realistic after attempting to correct for publication bias) estimates.

Sample characteristics. We coded a number of other sample characteristics including: (1) the percentage of participants within each sample identifying as men; (2) the percentage of participants within each sample identifying as white/Caucasian/European; (3) the percentage of participants within each sample identifying as heterosexual; (4) the percentage of participants within each sample identifying as being in a romantic relationship; (5) the average age of participants; (6) the country of data collection, with which we coded the cultural dimensions of individualism/collectivism (for testing our preregistered prediction) as well as power distance, masculinity, uncertainty avoidance, long-term orientation, and indulgence based on the national estimates provided by Hofstede et al. (2010); and (7) the year of publication. Some of these characteristics were reported more consistently (e.g., age), whereas other characteristics were less consistently available (e.g., in a romantic relationship or not).

Exploratory metascientific variables. A tertiary research question was to examine to what extent awareness of previous theory and research on self-esteem and sexual health, as well as explicit hypothesising around these variables, would be associated with effect sizes. We tentatively expected that articles citing previous theory and research, as well as offering explicit predictions for effects, would be more likely to contain larger effect sizes. However, should this pattern be borne out, we would be unable to discern whether this is because previous research, theory, and hypothesising lead to more conscientious and careful research, or rather, because researchers were more invested in – and therefore motivated to produce – significant effects.

Publication bias variables and effect and study quality. We coded for the potential presence of publication bias using two different moderators: (1) type of publication (i.e., peer-reviewed articles, dissertations, or other unpublished sources); and (2) effect size precision (i.e., sample size, standard errors, and sampling variances).

Finally, we coded effects and samples for five indicators of methodological rigour that would be likely to translate to higher-quality correlations between self-esteem and sexual health variables. We then created an aggregate effect/sample quality index by summing across scores from the five aspects of quality (see Online Supplement for details).

Meta-analytic modelling strategy

Software. All of our models were fit using the *metafor* package (Viechtbauer, 2010) for R (R Core Team, 2016), using the *rma.mv* function to fit multilevel random-effects meta-analytic models. All visualisations were made using the *ggplot2* package (Wickham, 2009), and interrater reliability was calculated using the *irr* package (Gamer, Lemon, & Singh, 2012).

Multilevel meta-analysis models. We took a multilevel-meta-analysis approach, which allowed us to take the dependency of effect sizes into account (Cheung, 2014, 2015), an approach justified

by the high intraclass correlation among effect sizes reported from the same sample ($ICC = .44$). This approach enabled us to: (1) explicitly model the dependency among effect sizes, resulting in less biased and more powerful tests of meta-analytic estimates and moderator effects (López-López, den Noortgate, Tanner-Smith, Wilson, & Lipsey, 2017; Moeyaert et al., 2017); partition heterogeneity – and the amount of heterogeneity explained by moderators – into between-sample (τ^2_{b}) and within-sample levels (τ^2_{w}), giving us greater insight into the relative amounts (I^2_{b} and I^2_{w}) of, and systemic factors driving (R^2_{b} and R^2_{w}), variation in effects; and gave us greater flexibility than other multivariate meta-analytic approaches (Kalaian & Raudenbush, 1996), as it does not require a researcher to know all correlations between dependent effect sizes (Becker, 2000).

In addition to overall synthesised estimates of effect size, and indexes of heterogeneity, we report traditional 95% confidence and 95% credibility intervals for our multilevel estimates. Credibility intervals, though less frequently reported, give a more straightforward interpretation as the range within which 95% of future correlations from this population would be expected to fall (see Borenstein, Higgins, Hedges, & Rothstein, 2017).

Optimistic and pessimistic estimates. In order to provide a reasonable range of correlations between self-esteem and sexual health variables, we produced additional estimates correcting for biases that might attenuate (or exaggerate) the strength of these associations. For optimistic estimates, we meta-analysed correlations corrected for unreliability and artificial dichotomisation in both the measurement of self-esteem and sexual health (Card, 2012). For pessimistic estimates, conversely, we utilised the PET-PEESE estimation strategy for correcting publication bias (Stanley & Doucouliagos, 2014), in which we meta-analytically regressed correlations on estimation precision, and reported the intercept of these models (i.e., the predicted correlation when the influence of sampling imprecision was zero).

Moderation tests. Testing moderation of correlations between self-esteem and sexual health was, for the most part, to take place near the end of the analytic phase. However, previous meta-analyses of sexuality variables have typically distinguished between sub-domains of sexuality (see Oliver & Hyde, 1993; Petersen & Hyde, 2010). We therefore thought it prudent to first test for moderation by domain of sexual health, and, if significant (as we anticipated), to report subsequent meta-analytic output (including tests of moderation) across both the entire sample of sexual health outcomes, as well as by each domain of sexual health. Thus, we fit a multilevel mixed-effect model in which correlations were regressed onto dummy-coded categories of sexual health, and compared the fit of this model against a model in which no distinction between domains of sexual health was made. Afterwards, our final analyses consisted of testing the effects of our moderators on our naïve correlations between self-esteem and sexual health, as well as evaluating various indicators of potential publication bias in this literature, and evaluating the impact of effect/sample quality on effect sizes.

Results

Naïve, optimistic, and pessimistic meta-analytic estimates

Our total meta-analytic sample was substantial (see Table 2 for estimates, and Table S1 and Figure S1 for descriptive overview) – with 305 samples from 255 articles yielding 870 effects, representing 191,161 unique participants – and the distribution of Fisher-transformed correlations spanned the range of virtually all-possible values, from the most negative ($Z_r = -0.83$, $r = -.68$) to the most positive ($Z_r = 2.07$, $r = .97$). As the more than eight-hundred effects in our review were too unwieldy to create an informative (and more traditional) forest plot, we have instead depicted the range of estimates in our meta-analysis and their 95% confidence intervals in a Caterpillar plot (see Figure 2). Examining the distribution of leverage (i.e., hat values) suggested that none of the effect sizes were influential outliers (Viechtbauer & Cheung, 2010).

The overall naïve effect between self-esteem and sexual health variables was small ($r = .12$) and this remained the case under the most ideal artefact-corrected circumstances ($r = .14$) and pessimistic

Table 2. Meta-analytic sample description, estimates, and heterogeneity, for entire sample of effects and by subdomain of sexual health.

	Sexual health (all effects)	Safe sex	Sexual restrictedness	Sexual function	Consensual sex
Meta-analytic sample					
# of samples	305	95	123	81	92
# of effects	870	215	297	176	165
# of participants	191,161	58,956	88,739	23,067	53,610
Meta-analytic estimates					
Naïve	.12	.10	-.02	.27	.19
Confidence interval	(.09, .15)	(.07, .13)	(-.05, .008)	(.21, .34)	(.13, .24)
Credibility interval	(-.39, .57)	(-.23, .41)	(-.37, .33)	(-.40, .75)	(-.33, .62)
Optimistic	.14	.12	-.02	.33	.20
Pessimistic	.10	.13	.01	.29	.17
Heterogeneity					
Between-sample: τ^2_3/I^2_3	.032/.43	.008/.28	.02/.54	.045/.35	.061/.82
Within-sample: τ^2_2/I^2_2	.041/.55	.02/.66	.015/.42	.081/.63	.011/.16

bias-corrected circumstances ($r = .10$). Figure 3 depicts a simulated set of observations that would yield a correlation of this magnitude from the number of unique participants in our synthesis. Effect sizes were extremely heterogeneous; the 95% credibility interval for the overall estimate suggested that correlations within between moderately negative and strongly positive would be

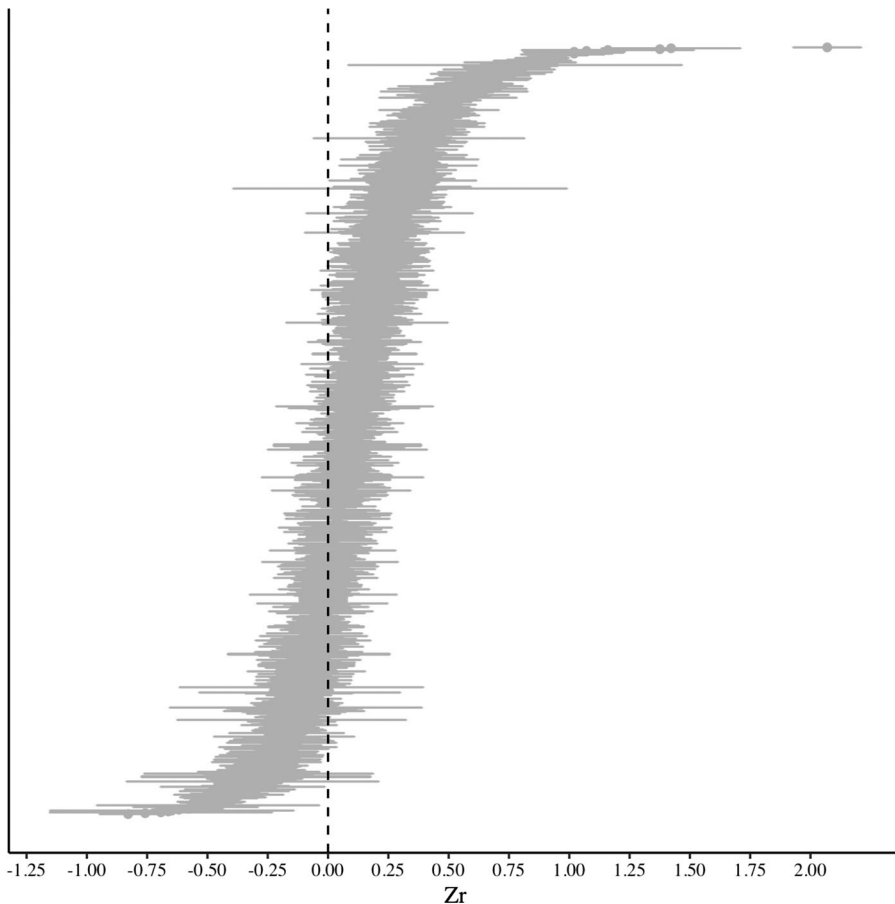


Figure 2. Caterpillar plot of all Fisher-transformed correlations in the meta-analysis and their 95% confidence intervals, arranged from most positive to most negative. Vertical dashed line corresponds to Zr of 0.

likely in future studies. Further, a high proportion of true effect size heterogeneity was located both between-samples and within-samples. Our test of moderation by sexual health domain revealed that a substantial portion of this variation could be explained by domains of sexual health, $QM(8) = 220.75, p < .001, R_3^2 = .49, R_2^2 = .25, R_{total}^2 = .35$.

The association between self-esteem and safe-sex ($r = .10$) was significant, positive, small, and relatively heterogeneous. The association between self-esteem and restrictedness (i.e., permissiveness), conversely, was indistinguishable from zero ($r = -.02$), and also heterogeneous at both levels of analysis. The associations between self-esteem and sexual function ($r = .27$) and consensual sex variables ($r = .19$) were positive and larger (approaching medium-sized) than other domains of sexual health. Most of the heterogeneity for consensual sex effects was located between-samples, whereas for sexual function effects, substantial heterogeneity was again located at both the within-sample and between-sample levels. Across subdomains of sexual health variables, meta-analysed correlations with self-esteem were relatively consistent across naïve, optimistic, and pessimistic estimation approaches; the only exception to this pattern was in the case of the bias-corrected estimate for consensual sex variables and self-esteem, for which the lower bound of the 95% confidence interval shifted much closer to zero. As with the overall estimate, 95% credibility intervals for each subdomain straddled the range of small-to-moderate negative correlations and moderate-to-strong positive correlations. Further, the high degree of heterogeneity did not appear to be driven by mere differences in measurement (i.e., general vs. domain-specific self-esteem; see Online Supplement for details).

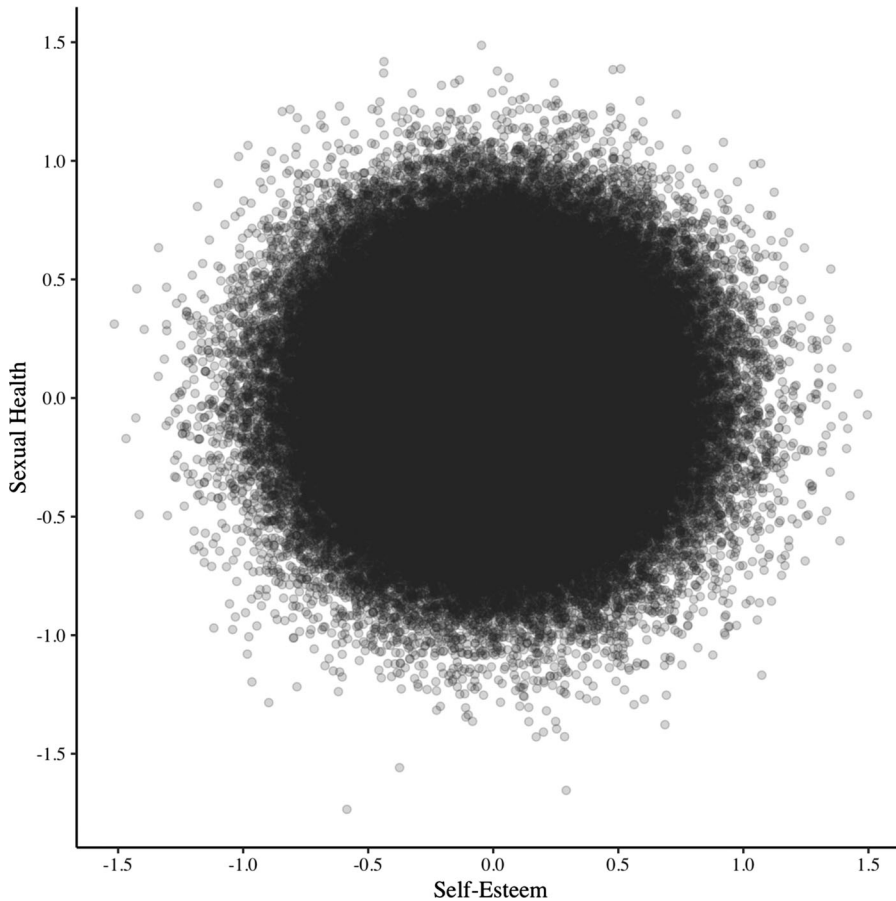


Figure 3. Scatterplot of 191,161 simulated observations from a population of $r = .12$.

Theory-driven moderator analyses

Moderator analyses both within the entire set of sexual health variables, and within subdomains of sexual health, were nearly all non-significant and generally accounted for a trivial amount of heterogeneity (see Table 3 for all except those pertaining to dimensions of culture). Self-esteem and sexual health variables were most strongly linked in samples with higher proportions of participants in romantic relationships. Self-esteem was also more strongly linked with sexual function variables amongst older samples. And though associations were stronger for all sexual health variables, and safe sex variables, specifically, within samples with a higher proportion of female participants, the magnitude of this moderating effect was extremely small.

Tests of moderation by individual cultural dimensions are presented in Table 4. These moderators were generally non-significant and explained a small amount of heterogeneity. The same was also true when using all cultural dimensions simultaneously, $QM(6) = 4.89$, $p = .55$, $R^2_{between} = .03$, safe sex variables, $QM(6) = 2.50$, $p = .87$, $R^2_{between} = .18$, sexual function variables, $QM(6) = 2.81$, $p = .83$, $R^2_{between} = .16$, and consensual sex variables, $QM(6) = 1.12$, $p = .98$, $R^2_{between} = .02$. Only for correlations between self-esteem and sexual permissiveness variables did cultural dimensions cumulatively explain a significant and considerable amount of heterogeneity, $QM(6) = 17.78$, $p = .007$, $R^2_{between} = .24$, with individualism emerging as a uniquely significant predictor of correlations between self-esteem and permissiveness variables, $b = -0.01$, 95% CI: $-0.02, -0.005$. Contrary to our predictions informed by theories of cultural variation regarding the importance of the self, however, samples from nations lower in individualism yielded stronger correlations between self-esteem and permissiveness (predicted $r = .56$), than did samples from nations higher in individualism (predicted $r = -.20$).

Tests of the public/private moderator, corresponding to sociometer theory (Leary, 1999), were also non-significant. Specifically, the public/private distinction in sexual health variables explained little heterogeneity for the entire sample of effects, $QM(1) = 0.03$, $p = .87$, $R^2_3 = .001$, $R^2_2 = .00$, $R^2_{total} = .001$ – a finding that was robust to whether or not differences in domain of sexual health were controlled. The public/private moderator remained non-significant for safe sex variables, $QM(1) = 0.24$, $p = .62$, sexual permissiveness variables, $QM(1) = 0.05$, $p = .82$, and sexual consent variables, $QM(1) = 0.11$, $p = .74$, and was unable to be tested for sexual function variables because of insufficient variation in the public/private moderator.

Exploratory meta-scientific moderator analyses

Meta-scientific moderators within the entire set of sexual health variables, and within subdomains of sexual health, were all non-significant and with one exception accounted for a trivial amount of heterogeneity (see Table 5). Self-esteem and sexual function variables were an exceptional case, where the presence of cited theory, cited background research, and articulated hypotheses combined to explain a moderate amount of heterogeneity, although none of the meta-scientific qualities were significant moderators when considered together, or on their own.

Evaluating the impact of publication bias and effect/sample quality

Evidence for the presence (or absence) of publication bias (see also Table 5) within the entire set of sexual health variables, and within subdomains of sexual health, was mixed. With the exception of correlations between self-esteem and consensual sex variables, reported correlations were consistently smaller or more negative in dissertation documents and other unpublished sources, and coding for publication type explained a considerable amount of effect size heterogeneity, particularly for correlations with sexual function variables. Results of Egger tests of publication bias, conversely, suggested that publication bias was relatively inconsistent across domains of sexual health, and when potentially present, its influence was small.

Table 3. Theory-based moderator tests for correlations between self-esteem and sexual health variables.

Domain	% Male		% White		% Heterosexual		% Relationship		Age		Year of Publication	
	<i>b</i> (95% CI)	<i>R</i> ₃ ²	<i>b</i> (95% CI)	<i>R</i> ₃ ²	<i>b</i> (95% CI)	<i>R</i> ₃ ²	<i>b</i> (95% CI)	<i>R</i> ₃ ²	<i>b</i> (95% CI)	<i>R</i> ₃ ²	<i>b</i> (95% CI)	<i>R</i> ₃ ²
Sexual health (all variables)	−0.001** (−0.001, −0.001)	.002	0.001 (−0.000, 0.002)	.04	−0.0002 (−0.002, 0.001)	.001	0.003** (0.001, 0.004)	.20	0.003** ^a (0.0001, 0.005)	.04	0.001 (−0.003, 0.004)	.00
Safe-sex	−0.007* (−0.001, −0.0001)	.05	0.001 (−0.0002, 0.002)	.00	0.001 (−0.001, 0.003)	.00	−0.0001 (−0.003, 0.003)	.007	−0.001 ^a (−0.005, 0.003)	.00	−0.001 (−0.005, 0.002)	.00
Restrictedness	0.0003 (−0.001, 0.001)	.03	−0.003 (−0.002, 0.001)	.00	−0.001 (−0.003, 0.0002)	.07	0.0006 (−0.002, 0.003)	.03	−0.002 ^a (−0.004, 0.004)	.006	0.0005 (−0.003, 0.004)	.003
Sexual function	−0.0003 (−0.002, 0.001)	.00	0.001 (−0.002, 0.004)	.00	−0.001 (−0.005, −0.002)	.01	0.0006 (−0.002, 0.004)	.17	0.007** ^a (0.001, 0.01)	.25	0.001 (−0.007, 0.010)	.00
Consensual sex	−0.0007 (−0.002, 0.0008)	.00	0.0004 (−0.001, 0.002)	.02	0.002 (−0.001, 0.001)	.14	0.001 (−0.001, 0.004)	.10	0.0002 (−0.005, 0.005)	.0001	−0.007 (−0.015, −0.0007)	.03

Note: Moderator tests include effects for which moderator-relevant data were available to code; *R*² for these models compared against naïve model based on the same (reduced) sample of effects where moderator data were present. Values represent unstandardised meta-regression coefficients. ^aThe possibility of a curvilinear association between sample age and correlations between self-esteem and sexual health was also tested, and found to be non-significant.

p* < .05, ** *p* < .01, * *p* < .001.

Table 4. Theory-based and exploratory moderator tests of cultural dimensions for correlations between self-esteem and sexual health variables.

Domain	Power distance		Individualism ^a		Masculinity		Uncertainty avoidance		Long-term orientation		Indulgence	
	<i>b</i> (95% CI)	<i>R</i> ₃ ²	<i>b</i> (95% CI)	<i>R</i> ₃ ²	<i>b</i> (95% CI)	<i>R</i> ₃ ²	<i>b</i> (95% CI)	<i>R</i> ₃ ²	<i>b</i> (95% CI)	<i>R</i> ₃ ²	<i>b</i> (95% CI)	<i>R</i> ₃ ²
Sexual health (all variables)	0.002 (−0.002, 0.005)	.003	−0.001 (−0.003, 0.001)	.01	0.0001 (−0.002, 0.003)	.00	0.0001 (−0.002, 0.004)	.001	0.001 (−0.002, 0.003)	.00	−0.003 (−0.006, 0.0004)	.02
Safe-sex	0.002 (−0.002, 0.006)	.007	−0.001 (−0.003, 0.0005)	.003	0.0001 (−0.002, 0.003)	.00	0.0003 (−0.004, 0.004)	.003	0.0007 (−0.002, 0.003)	.00	−0.003 (−0.006, 0.0004)	.01
Restrictedness	0.0007 (−0.005, 0.006)	.00	−0.002 (−0.004, 0.0004)	.04	0.0001 (−0.0002, 0.003)	.03	−0.0007 (−0.005, 0.003)	.001	−0.0007 (−0.002, 0.003)	.007	−0.002 (−0.006, 0.003)	.0004
Sexual function	0.003 (−0.005, 0.01)	.04	−0.001 (−0.005, 0.003)	.02	−0.002 (−0.009, 0.006)	.01	0.005 (−0.003, 0.01)	.07	−0.0002 (−0.005, 0.005)	.006	−0.003 (−0.01, 0.004)	.03
Consensual sex	−0.0001 (−0.006, 0.006)	.00	0.001 (−0.003, 0.005)	.006	0.001 (−0.003, 0.006)	.005	−0.001 (−0.007, 0.005)	.002	−0.0006 (−0.006, 0.005)	.001	0.002 (−0.006, 0.009)	.003

Note: Moderator tests include effects for which moderator-relevant data were available to code; *R*² for these models compared against naïve model based on the same (reduced) sample of effects where moderator data were present. Values represent unstandardised meta-regression coefficients.

^aThe moderating role of individualism was theory-based and part of our meta-analytic preregistration; the remaining moderator tests were conducted in light of reviewer suggestions and should be considered more exploratory.

p* < .05, ** *p* < .01, * *p* < .001.

Table 5. Metascience moderator and publication bias tests for correlations between self-esteem and sexual health variables.

Domain	Theory ^a <i>b</i> (95% CI)	Background research ^a <i>b</i> (95% CI)	Hypotheses ^a <i>b</i> (95% CI)	Model R_3^2	Pub. Bias (Egger)		Pub. Bias (Publication type)		Model R_3^2
					<i>b</i> (95% CI)	R_3^2	<i>b</i> _{Dissertation} (95% CI)	<i>B</i> _{Other} (95% CI)	
Sexual health (all variables)	-0.006 (-0.07, 0.05)	-0.003 (-0.07, 0.07)	0.009 (-0.05, 0.06)	.04	0.22 (-0.45, 0.89)	.00	-0.020 (-0.10, 0.05)	-0.26* (-0.48, -0.05)	.04*
Safe-sex	0.03 (-0.04, 0.10)	0.06 (-0.03, 0.15)	-0.004 (-0.07, 0.60)	.00	-0.45 (-1.49, 0.59)	.00	-0.08 (-0.15, 0.001)	0.03 (-0.23, 0.31)	.12
Restrictedness	-0.006 (-0.07, 0.06)	-0.003 (-0.09, 0.08)	0.007 (-0.06, 0.07)	.005	-1.23** (-2.08, -0.38)	.06**	-0.10* (-0.19, -0.01)	-0.22* (-0.39, -0.05)	.17*
Sexual function	-0.006 (-0.15, 0.14)	0.03 (-0.14, 0.20)	0.10 (-0.03, 0.24)	.16	-0.09 (-1.55, 1.38)	.01	0.10 (-0.06, 0.26)	-0.61*** (-0.91, -0.30)	.41***
Consensual sex	-0.03 (-0.17, 0.11)	-0.03 (-0.17, 0.11)	-0.04 (-0.17, 0.10)	.03	0.31 (-1.08, 1.69)	.004	-0.11 (-0.30, 0.07)	-	.01

Note: Values represent unstandardised meta-regression coefficients. Dummy codes for publication type compare against referent group of peer-reviewed journal articles. Results of Egger publication bias tests were robust to different estimates of effect size precision (reported using standard error of the effect, also tested using sampling variance of the effect, and inverse of sample size for the effect).

^aEstimates for moderating effects of cited theory, cited background research, and specific hypotheses come from the same meta-regression model.

Finally, effect/sample quality had little impact on the correlations between self-esteem and sexual health in most cases. Only for sexual permissiveness and sexual function was there a small and inconsistently reliable moderating effect of study quality, with higher quality studies generally producing correlations somewhat closer to zero (see Online Supplement).

Discussion

Our meta-analytic synthesis suggests that self-esteem and sexual health are positively, but weakly, associated. The association varies depending on the domain of sexual health being assessed – it is strongest for sexual function and sexual consent, weaker for safe sex, and indistinguishable from zero for sexual restrictedness. Regardless of domain, however, our estimates were consistently and considerably heterogeneous, making it difficult to discern what direction and magnitude of correlation to expect in future studies. Moreover, most of our selected moderating variables did not explain a significant amount of heterogeneity in effect sizes, and there is some evidence (albeit inconsistent) of publication bias within this literature.

Evaluating current theories of self-esteem and sexual health

Problem behaviour, resiliency, and intuitive perspectives. Although the significant positive correlation between self-esteem and sexual health variables might be interpreted as support for Problem Behaviour and compensatory Resilience perspectives, it is important to point out that, in our meta-analysis, self-esteem barely explained 1% of the variability in sexual health variables, broadly construed (Cohen, 1994; Meehl, 1990).

That self-esteem has been studied alongside sexual health variables in literally hundreds of studies, while lay media began to make much ado about the connection between the two almost as soon as they were studied in tandem (e.g., Finlayson, 1979; The Citizen, 1986; Toughill, 1986), suggests to us that the intuitive basis of the possible connection between self-esteem and sexual health is a powerful one. That is, had we assigned an anticipated synthesised effect size on the basis of these theories, or of the strength of intuition underlying the self-esteem and sexual health literature, we would have expected something at least – or even above – the average effect size of social psychological effects ($r = .21$; see Richard, Bond, & Stokes-Zoota, 2003). Sampling decisions for articles within our review support this conjecture, as researchers would require sample sizes more than twice the size ($n = 540$) than what was typical of studies in our meta-analytic review (*Mdn* $n = 199$) to have adequate power ($1 - \beta = .80$) to detect the average effect yielded by our synthesis ($r = .12$). The discrepancy between the strength of lay intuitions and such a small meta-analysed effect size suggests, to us, that the connection between self-esteem and sexuality must be reconsidered.

Sociometer theory and terror management theory. The other main theoretical perspectives tested via our meta-analysis fared no better. Sociometer Theory and Terror Management Theory would both lead one to anticipate a connection between evaluations of the self and aspects of sexuality, if not broadly, then at the very least within particular contexts, or for particular groups of people, in which a person's sense of symbolic or relational value is more closely tied to sexual conduct. And yet, in the vast majority of cases, our theory-driven moderators were not significant predictors of variation in effect sizes, either within the entire sample of sexual health variables, or within specific sub-domains of sexual health. Moreover, effects did not depend on whether the sexual health variable under consideration was socially observable or not, posing another challenge to the sociometer theory perspective (Leary, 1999).

That correlations between self-esteem and sexual health variables did not, for the most part, depend on gender, race, sexual orientation, age, time, or aspects of culture, are challenging patterns of data to explain for many of the theoretical perspectives we considered. The considerable discrepancy between theory and our meta-analytic results is perhaps no better demonstrated than in the case of correlations between self-esteem and sexual restrictedness variables. Evolutionary

perspectives (Buss & Schmitt, 1993; Penke & Denissen, 2008), and theories of the gendered socialisation of sexual conduct (Simon & Gagnon, 1986; Wiederman, 2005), would strongly lead one to expect that associations between self-esteem and sexual restrictedness would take very different forms for men and women. If men and women experience different reputational consequences for engaging in sex, and one's reputation is tied to their relational or symbolic value, then self-esteem ought to have corresponded accordingly.

Identifying the underlying reason(s) for this unexpected null effect are challenging, and any possibility contradicts one deeply held belief about sexuality (and/or self-esteem) or another. Findings from research on gendered sexual scripts and the sexual double standard tradition (Milhausen & Herold, 1999, 2002; Sakaluk et al., 2014; Wiederman, 2005) suggest that people reliably perceive different expectations of sexual conduct for men and women. Two alternative explanations for our null moderator effect of gender therefore remain. First, it may be the case that self-esteem does not reliably track relational and/or symbolic value, a possibility supported by the mixed meta-analytic evidence for the value-tracking function of self-esteem (Blackhart, Nelson, Knowles, & Baumeister, 2009; Gerber & Wheeler, 2017). Should self-esteem's value-tracking function be strongly affirmed in later research, the remaining possibility is that it may be the case that the importance of sexuality for men and women's general sense of relational and/or symbolic value is overstated. This possibility is not altogether different from the discrepancy between perceptions of the sexual double standard and quantitative evidence of the double standard in action (see Crawford & Popp, 2003, for a review). Stated simply, people's (and researchers') intuitions about what motivates them, sexually or otherwise, may not always square with the psychological data (Nisbett & Wilson, 1977). Whatever the explanation may be – and it is beyond the scope of our data to determine – it seems clear that new theoretical perspectives on self-esteem and sexuality will be needed in order to accommodate the unexpectedly trivial connection between self-esteem and sexual restrictedness.

The heterogeneity problem and its meaning for theory

One of the key findings of our synthesis is the considerable amount of heterogeneity within the self-esteem and sexual health literature. Our analytic approach offers several clues as to the source of this heterogeneity: imprecise theory, hypothesising, and construct measurement.

More than 50 effects in our sample, for example, relied on variables that simultaneously aggregated across multiple domains of sexual health. Likewise, many samples ($k = 88$) yielded effects from different domains of sexual health, with the author(s)'s theorising being applied uniformly across these domains. The pattern of analysing disparate sexual health variables within the same study is likely responsible for the considerable within-study heterogeneity. Since sexual health domain was one of the only reliable and substantial moderators, collapsing across domains in the course of theorising and/or measurement therefore seems inadvisable and is likely a key factor in the ambiguity of the estimates our analyses have yielded.

The imprecision of theory guiding self-esteem and sexual health research is further demonstrated in the results of our exploratory metascientific moderator analyses. Presumably, one would expect that good theory would lead to more informed literature of the phenomenon under consideration. Subsequently, new studies based on the existing literature – and the theory upon which it that literature was premised – should lead one to make more accurate predictions in new investigations, which should either yield different estimates, or the same estimates accompanied by more effective designs on account of better sample-size planning. And yet, studies in our sample that were armed with citations to theory and previous research yielded effects that, with only one exception (i.e., within the sexual function domain), were no different than from studies that appeared to approach the study of self-esteem and sexual health in an entirely exploratory fashion. Moreover, the state of statistical power was no better ($Mdn n = 196.50$) in studies guided by previous theory than those in our broader sample. Taken together, the limited effectiveness of theory and the low statistical power in this area

of research support growing concerns about the robustness of the broader sexual science literature, and the need for strategies to ensure its evidential value (Sakaluk, 2016; Sakaluk & Graham, 2018).

Researchers appear to have been casting too broad a net when studying self-esteem and sexual health variables. We too cast a broad net in our meta-analytic review, as we sought to synthesise the literature as it was, as international health agencies and researchers alike describe sexual health as a broad unifying framework (e.g., Robinson et al., 2002; Rohleder & Flowers, 2018; WHO, 2006), and researchers study multiple sexual health domains simultaneously with some regularity. That there are currently more than 2000 research articles indexed in PubMed with the 'Sexual Health' term in the title – and the rate of publication for these articles is increasing – attests to the popularity of the broad sexual health framework.

Thus, if nothing else, our synthesis suggests that the broad construal of sexual health, as well as the theories guiding predictions within this literature, may need to be rethought. A reasonable bare minimum revision would involve theories acknowledging the processes by which self-esteem might play out in unique ways across different domains of sexual health. Ideally, new theories would specify particular anticipated correlations between self-esteem and sexual health domains (akin to Hyde, 2005), and declare for whom and under what circumstances they would apply (Simons, Shoda, & Lindsay, 2017) in order to better facilitate more informative theory-testing (LeBel, Berger, Campbell, & Loving, 2017).

Likewise, theories of measurement of sexual health need boundary refinement. Though for some perspectives and goals it may be beneficial – or even imperative – to think of sexual pleasure, condom use, sexual arousal difficulties, and consensual sex, as representative of sexual health, broadly defined, our analyses suggest that this ambiguous construct does not manifest in such a homogenous way within individual psychology. Each domain may require their own individualised theories and measures, at least as far as their interplay with self-esteem is concerned. Moving in this direction might require complicating the ways scientists and health promoters discuss sexual health with each other, health agencies, and the public, but this complication would likely bring communications into closer alignment with their affiliated data.

Limitations of the synthesis

Our meta-analysis was primarily limited by being North American-centric, and the unavailability and usability of moderator data (when available). Testing the moderating effect of being in a relationship, for example, was limited in that only 234 of our effects (26.90%) had corresponding relationship status sample data. We would have been in an even better position to perform a strong test of this moderator had more studies reported data on relationship status.

Even when studies reported sample-level data for relevant moderators, these data were not always fully usable. Reporting of sample sexual orientation, for example, was often so discrepant – lesbian, gay, and bisexual participants were grouped together into numerous idiosyncratic categories – that we could only reliably extract a consistent percentage of the sample that identified as heterosexual, across a sufficient number of effects. Though we believe there was still something informative to be gained from analysing patterns of correlation on the basis of this oversimplified moderator, it would have been preferable to have consistent access to sample-level data reported in a more nuanced and standardised fashion.

Next steps in self-esteem and sexual health research

Situating sexuality among contingencies of self-worth. Our meta-analysis suggests that the correlations between sexual health variables and both global and domain-specific measures of self-esteem are modest. Still, our meta-analysis provides indirect evidence about the relative (un)importance of sexuality as a contingency of self-worth (Crocker & Knight, 2005; Crocker & Wolfe, 2001). Directly comparing sexuality to other contingencies (e.g., appearance, school performance) would

therefore be a fruitful avenue of future research, as it could allow researchers to better calibrate their intuitions about correlations between self-esteem and sexuality. Relatedly, it would seem pertinent to situate wherein the hierarchy of contingencies of self-worth sexuality might fall. Research by Crocker and colleagues (2003) suggests that domains of *others' approval*, *appearance*, and *virtue* are some of the broader contingencies underlying global evaluations of the self, but it is unclear under which sexual health variables would be best located, and in some cases (e.g., number of lifetime sexual partners), sexual health might have some bearing on multiple contingencies (e.g., *others' approval* and *virtue*). Qualitative investigations – and eventual syntheses – of self-esteem and domains of sexual health could be particularly useful for the purpose of capturing reflections of the ways, contexts, and domains in which individuals feel as though sexual health cognition and behaviour impacts and is impacted by their sense of self-worth. Knowing to which broader contingencies particular domains of sexual health are linked will likely prove illuminating in terms of understanding for whom, and under what circumstances, global self-esteem is linked to sexuality, and how an individual's sense of self might react to particular sexual experiences.

Experimental studies. The self-esteem and sexual health literature almost exclusively rely upon correlational and quasi-experimental designs. Moving forward, researchers should consider the use of experimental designs, so that a better understanding of the causal link (if any) between self-esteem and sexual health can be better understood. Though the experimental manipulation of some sexual health variables will be difficult, if not impossible (e.g., for sexual permissiveness variables), there are many forms of sexuality-relevant social-cognitive variables (e.g., knowledge, attitudes, perceptions) that are amenable to experimental manipulation (e.g., Tankard & Paluck, 2017). Experimentally affirming or threatening self-esteem, meanwhile, is a relatively well-established methodological practice in the social psychological literature (e.g., Crocker, Thompson, McGraw, & Ingerman, 1987; Tesser, 2000).

Promoting replicability. Most studies in our meta-analytic sample were severely underpowered given the overall average estimated effect ($r = .12$). Future studies of self-esteem and sexuality wishing to detect such a small effect in a cross-sectional study would need more than 500 participants in order to reach 80% statistical power. Researchers may need to consider using more powerful designs (e.g., Maxwell, Cole, Arvey, & Salas, 1991), efficient sequential data collection strategies (e.g., Lakens, 2014), large-scale collaborative data collection networks (e.g., Chartier, 2017), or supplementing traditional significance tests with other indexes of evidential value (e.g., Sakaluk, Williams, Kilshaw, & Rhyner, 2019), in order to produce informative contributions within the self-esteem and sexual health literature.

Our analyses also suggest that publication bias is of concern in self-esteem and sexual health literature. Recent simulation work suggests that, despite considerable attention from statisticians, it remains remarkably difficult to accurately correct for the distorting influence of publication bias (Carter, Schönbrodt, Hilgard, & Gervais, 2017). The best remedy to publication bias may therefore be to prevent it from occurring in the first place. Preregistration (see Nosek, Ebersole, DeHaven, & Mellor, 2017) and registered reports (Chambers, Dienes, McIntosh, Rotshtein, & Willmes, 2015) are approaches to conducting and publishing research that could help to ensure that future self-esteem and sexual health findings are not selectively reported.

Conclusion

Researchers have studied self-esteem alongside sexual health variables for nearly half of a century. This literature has amassed hundreds of effects, and numerous theoretical perspectives have emerged to explain the underlying patterns of data. Our meta-analytic review suggests that much may need to be reconsidered regarding the association between self-esteem and sexual health. The overall effect in this literature is much smaller and more unpredictable than most theories would lead one to anticipate. Further, theorised differences in patterns of correlation between self-esteem and sexuality were consistently unsupported by our analyses, and the presence or

absence of guiding theories seemed to have little impact on the outcome of research. Though this conclusion may seem exceptionally critical, we think there is room for considerable excitement, as there is a clear need for theoretical innovation in self-esteem and sexual health research. These forthcoming theories – hopefully both specific and falsifiable – should help to usher in a new era of informative research on sexuality and the self.

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