



2 Impact of Mass Media on HIV/AIDS Stigma Reduction: A Systematic 3 Review and Meta-analysis

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7 Abstract

8 HIV-related stigma is a major barrier to HIV testing and care engagement. Despite efforts to use mass media to address
9 HIV-related stigma, their impact on reducing HIV-related stigma remains unclear. Thus, we conducted a systematic review
10 and meta-analysis of peer-reviewed publications quantitatively examining the impact of mass media exposure on HIV-
11 related stigma reduction and published from January 1990 to December 2020. Of 388 articles found in the initial screening
12 from scientific databases, 19 met the inclusion criteria and were included in the systematic review. Sixteen articles reported
13 the quantitative effect of mass media exposure on HIV-related stigma and were included in the meta-analysis. Systematic
14 review results showed considerable heterogeneity in studied populations with a few interventions and longitudinal studies.
15 Results suggested a higher interest in utilizing mass media by health policymakers in developing countries with greater
16 HIV prevalence to reduce HIV-related stigma. Meta-analysis results showed a modest impact of mass media use on HIV-
17 related stigma reduction. Despite heterogeneity in the impact of mass media on HIV-related stigma, Egger's regression test
18 and funnel graph indicated no evidence for publication bias. Results demonstrated an increase in the impact of mass media
19 on reducing HIV-related stigma over time and no correlation between the HIV prevalence in countries and the impact of
20 mass media. In summary, mass media exposure has a modest and context-specific impact on HIV-related stigma reduction.
21 More large-scale mass media interventions and studies addressing the impact of mass media on different forms of stigma
22 are required to inform policies.

23 **Keywords** HIV/AIDS · Stigma · Mass media · Systematic review · Meta-analysis

24 Introduction

25 About four decades have passed since the first group of HIV-
26 positive individuals were diagnosed among injection drug
27 users and gay men [1]. From the beginning, HIV/AIDS has
28 been associated with the “stigma” of a kind of perversion or
29 immorality. Mass media stories and anecdotal accounts from

the early 1980s reveal how people living with HIV/AIDS
(PLWH)—as well as people who were merely suspected of
being infected—were evicted from their homes, ousted out
from their jobs, and being avoided by family and friends [2].

HIV-related stigma is a barrier to finding an effective
response to the HIV/AIDS epidemic [3]. The Joint United
Nations Program on HIV/AIDS (UNAIDS) defines HIV
stigma as a process in which individuals living with or asso-
ciated with HIV/AIDS are devalued [4]. HIV stigma can
negatively impact HIV preventive measures [5–7], decrease
the access of PLWH to health services and social supports,
and limit social interactions of PLWH [5, 8, 9]. The HIV-
related stigma can be categorized based on how it manifests
or how it affects individual health. HIV stigma can manifest
at internal and external levels. Internal stigma is a kind of
stigma that manifests at the intrapersonal level, such as feel-
ing miserable or having shame and may result in a reluctance
to seek help. External stigma is at the interpersonal level

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48 and is imposed by families, communities, and the healthcare
49 system on PLWH [10].

50 Regarding the mechanisms that HIV stigma can affect
51 individuals' health, Earnshaw et al. [11] suggested three dis-
52 tinct mechanisms for HIV-related stigma, including antici-
53 pated, internalized, and enacted stigma resulting in different
54 health outcomes. Anticipated stigma explains how one might
55 expect PLWH to be abused and discriminated against based
56 on their HIV-positive status. Anticipated stigma is predicted
57 as the most influential HIV-related stigma in preventing indi-
58 viduals from adhering to antiretroviral therapy (ART) and
59 attending healthcare appointments [11]. Internalized stigma
60 points out being less valued or inferior to others due to hav-
61 ing HIV/AIDS and may lead to mental health issues such as
62 feelings of hopelessness and denial [12]. Internalized HIV-
63 related stigma states acceptance and adoption of negative
64 beliefs about having HIV in society and internalizing them.
65 While some studies demonstrated the adverse impact of
66 internalized HIV-related stigma on adherence to HIV treat-
67 ment, others found mixed results for this relationship [13].
68 Finally, enacted stigma reflects the experiences of unfair
69 treatment by others [14–18]. Enacted HIV stigma includes
70 experiences of prejudice, stereotyping, and discrimination
71 from others because of having HIV [11].

72 Given the importance of information, HIV knowledge,
73 culture, and public attitudes in HIV stigma [11, 19–21], and
74 the significant role of mass media in influencing these fac-
75 tors, mass media could have a high potential in reducing
76 HIV-related stigma across various cultural settings. Mass
77 media represents a diverse range of media technologies
78 that get to a large audience via mass communication (e.g.,
79 radio, TV, film, video and audio recordings, blogs, inter-
80 net, and print media like newspapers, magazines, brochures,
81 and visual media like billboards, bus stops, etc.). To study
82 the impact of mass media on HIV-related stigma, previous
83 studies have deemed exposure to mass media (mass media
84 use) as the mass media measure. Mass media exposure
85 can include all media programs (general exposure) [22] or
86 exposure to only HIV-related mass media content such as
87 HIV-related media campaigns [23], programs providing HIV
88 information [24] or TV series or stories related to HIV and
89 PLWH [25]. While general exposure to mass media could
90 be associated with higher socioeconomic status and elevate
91 people's awareness and general health knowledge [26], expo-
92 sure to HIV-related media content could provide essential
93 information related to HIV/AIDS, promote healthy behav-
94 iors, and encourage condom use [25].

95 However, despite the potential benefits of both general
96 and HIV-related mass media exposures, they do not always
97 lead to positive outcomes. Mass media can have their own
98 financial and political interests in stigmatization as it may
99 attract more “eyeballs” in the attention economy (REF).
100 Also, mass media may frame a group of people in a negative

light due to their political interests leading to prejudice and
discrimination against these people, like the example of
stigma against Asians in the COVID-19 pandemic [27].
Moreover, HIV/AIDS is associated with social interaction
difficulties and seclusion [1, 11] that may negatively affect
the efficacy of mass media programs in reducing HIV-related
stigma. Thus, mass media strategies are not as common as
other strategies of health communication among vulnerable
populations like PLWH.

While many studies have addressed the relationship
between the use of mass media and HIV-related stigma in
distinct contexts, due to the complexity of this interaction,
little is known about how different contexts make mass
media strategies for HIV stigma reduction more or less effec-
tive. The factors that could characterize a context include the
form of mass media (TV, Radio, Newspaper, etc.), type of
mass media strategy, type of dominant stigma (anticipated,
internalized, and enacted), target country, HIV prevalence,
target population (general or vulnerable individuals), and the
time of exposure. These context characteristics could also
influence mass media policies and the number and content of
mass media products related to HIV and indirectly affect the
effect of mass media use on HIV-related stigma reduction.
In this study we explore how is the interaction between mass
media exposure and HIV stigma in different studies (con-
texts). We conducted a comprehensive systematic review
and meta-analysis of the current published literature on the
quantitative impact of mass media on HIV-related stigma
reduction and discussed how changes in characteristics of
the context may explain the results reported by various stud-
ies. The reviewed studies include studies that explore the
impact of mass media exposure (general and HIV-specific
contents) as well as some studies intended to remediate HIV
stigma.

Methods

The current systematic review and meta-analysis on the
impact of mass media on HIV-related stigma reduction were
completed by following the Preferred Reporting Items for
Systematic Reviews and Meta-Analyses (PRISMA) guide-
lines [28].

Search Strategy

We conducted a comprehensive search through international
indexing databases, including PubMed, Embase, Science
Direct, ISI Web of Science, Google Scholar, and Scopus.
We conducted the literature search using the keywords
including “HIV”, “stigma”, “HIV-related stigma”, “preju-
dice”, “mass media”, “media exposure”, “communication
exposure”, and “media use” in January 2021. The key string

used for databases search was (“stigma” OR “HIV-related stigma” OR “prejudice”) AND (“HIV” or “HIV/AIDS”) AND (“mass media” OR “media” OR “media exposure” OR “media use”). The field was limited to “title/abstract”. In addition, to find more eligible studies, we searched the reference list of articles. We used reference management software (Mendeley) to organize and evaluate titles and abstracts as well as to identify duplicate studies. The inclusion criteria for systematic review were (1) primarily focusing on HIV-related stigma, (2) discussing the impact of mass media on HIV-related stigma, (3) Using quantitative or mixed-method approaches, and (4) published in peer-reviewed journals from January 1990 to December 2020. The exclusion criteria were (1) not in English, (2) commentary, letters to the editor or opinion pieces, and protocols, (3) primary focus on social media, and (4) qualitative studies. In the meta-analysis, we included studies that passed the inclusion criteria for systematic review as well as (5) reported quantitative data for the effect of mass media on HIV-related stigma.

Data Extraction

We organized the review using a data extraction form, including author name, title, year of publication, setting, aims, study design, sampling method, type of questionnaire administration, sample size, population, and outcome. Two researchers separately extracted the information of interest from the studies. Cases that have not been agreed upon (12% of cases) were referred to another researcher. All three researchers discussed disagreement cases in a meeting by double-checking extracting strategies and potential reasons for disagreements. In this study, consensus (100% agreement) on all items was obtained through further inspection and discussion by all three researchers. In the first step in selecting materials, we removed articles with unrelated titles. Next, we reviewed the abstracts and texts of the articles to make sure that we only considered articles that meet the inclusion criteria. For assessing the methodological quality of extracted studies, we utilized the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) scale [29].

Statistical Analysis

We examined the studies’ heterogeneity using both Q test and I^2 statistics. Heterogeneity is a crucial subject in meta-analysis as it indicates the suitability of combining the studies and affects the reliability of results. The traditional method to examine heterogeneity is the Q test. However, because the Q test often has low statistical power and does not provide an insightful explanation for clinicians, most meta-analyzers also use other measures, such as the I^2 statistic, to quantify the level of heterogeneity [30]. The Q

statistic partitions the variability we find between studies into variability due to random variation and variability due to potential differences between the studies. The Q test produces p values that imply a binary decision of either presence or absence of heterogeneity [30]. The I^2 statistics determine the ratio of the observed variance, which cannot be assigned to the sampling error. I^2 indicates the amount to which confidence intervals (CI) of a study estimate overlap with one another. Thus, a significant overlap of confidence intervals results in low I^2 , and minimal overlap leads to a high I^2 value [31]. We considered heterogeneity statistic $I^2 > 75%$ or p-value < 0.01 to show notable heterogeneity.

We conducted a funnel plot and Egger’s regression test to examine if there was a publication bias. Publication bias seriously threatens the generalizability and validity of systematic review and meta-analysis results and could lead to under- or over-estimated effects. In assessing publication bias, the funnel plot illustrates each study’s effect size against its precision or standard error. If all relevant studies are included in the meta-analysis without a publication bias, a symmetrical shape for the funnel plot would be expected. The plot would be asymmetrical if not all relevant studies are included in the analysis [32]. However, the visual examination of the funnel plot is usually subjective. Thus, some statistical tests, such as Egger’s regression test, have been suggested for assessing publication bias in the funnel plot. Egger test is a widely used and standard procedure that is based directly on the funnel plot where it regresses the standardized effect estimate (i.e., the effect size divided by its standard error) on a measure of precision (i.e., the inverse of the standard error) [33]. If there is no publication bias, the regression intercept of the Egger test is estimated to be zero [34].

We employed the statistical package, Comprehensive Meta-Analysis Version 2 (CMA2) [35], to provide pooled estimates with corresponding 95% CI, and run heterogeneity analyses. There are two models for conducting a meta-analysis: fixed and random effects model. While fixed effect meta-analysis assumes a common effect, the random effects model assumes variations of effects from study to study. The fixed effects model considers differences between observed effect sizes because of sampling error. However, the differences in observed effect sizes in the random effects model are considered due to random error and variation in true effects. In this study, a random effects model was chosen for our analyses as the studies varied in terms of effect size. CMA2 automatically weights studies based on a random or fixed-effects model. Furthermore, the potential moderating role of PLWH population, country (location), and study time (year) that shape the context of each study and may influence HIV-related stigma and mass media policies were analyzed.

Results

After removing duplicates, we found 388 potentially relevant studies in initial screening. However, 19 studies met the criteria for systematic review and 16 studies met all criteria for meta-analysis (see Fig. 1).

Systematic Review Results

The 19 included studies for systematic review were summarized by study time, setting (country), study design, sampling method, type of questionnaire administration, sample size, study population, media type, stigma type, and approach (see Table 1). Among these studies, nine studies were conducted in countries from Africa, eight from Asia, and two from North America (USA) in terms of geography. Indonesia and Nigeria each have been studied by three

separate studies. Unexpectedly, no eligible study was found that quantitatively measured the impact of exposure to mass media such as TV, Radio, Movies, and Newspapers on HIV-related stigma before 2007. This may indicate that while HIV's global prevalence and its related stigma were significantly higher in the late 1990s and early 2000s, assessing the role of mass media quantitatively could have been overlooked in those time periods. However, systematic review results showed that many studies (8 out of 19) investigated the role of mass media on HIV-related stigma in the last 5 years, displaying a growing interest in the quantitative evaluation of the impact of mass media on HIV-related stigma in recent years.

The recent growing attention to the relationship of mass media with HIV-related stigma can be explained in multiple ways. First, it may be an indicator of the significant amount of information provided by the mass media in recent years to shape our beliefs, attitudes, and

Fig. 1 Flow of studies into the systematic review and meta-analysis

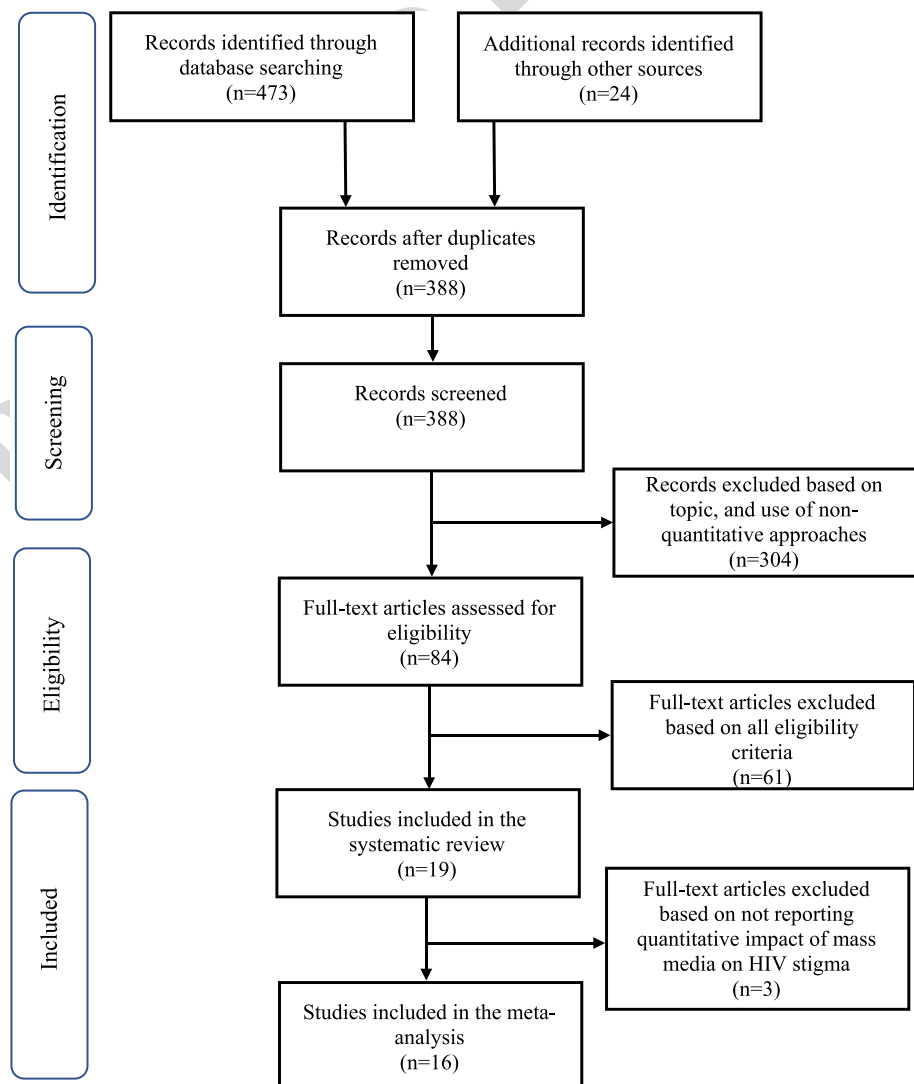


Table 1 Characteristics of studies in the systematic review

Authors	Year and publisher	Setting	Study design	Sampling method	Questionnaire administration	Quality assessment	Sample size	Population	Media form	Stigma type	Approach
Asamoah et al.	2017, Global Health Action	Ghana	Cross-sectional survey	Multistage cluster and stratified	Face-to-face	> 75%	3573	Young women	TV, Radio	Social Stigma	General media exposure
Babalola et al.	2009, Social Science and Medicine	Nigeria	Cross-sectional survey	Multistage random sampling	Face-to-face	> 75%	10,081	General population	TV, Radio, HIV media campaign	Social Stigma	Exposure to HIV-related messages in media; Media campaigns with messages about increasing the awareness of HIV, improving knowledge about modes of transmission, dispelling common myths about HIV transmission, and encouraging positive attitudes to PLWH
Bekalu et al.	2014, PloS One	Sub-Saharan Africa	Cross-sectional survey	Multistage stratified sampling	Face-to-face	> 75%	204,343	General population	TV, Radio, Print media	Social Stigma	General media exposure
Bekalu and Eggermont	2015, Journal of Communication in Healthcare	Ethiopia	Cross-sectional survey	Multistage cluster & random sampling	Face-to-face	> 75%	977	General population	TV, Radio	Social Stigma	HIV-related media use

Table 1 (continued)

Authors	Year and publisher	Setting	Study design	Sampling method	Questionnaire administration	Quality assessment	Sample size	Population	Media form	Stigma type	Approach
Boulay et al.	2008, Journal of AIDS Research	Ghana	Longitudinal survey	Cluster sampling	Face-to-face	> 75%	5672	General population	TV, Radio, Leaflets, Posters, Songs, Billboards	Social Stigma	HIV-related media campaign exposure; Encouraging compassion for PLWH by religious leaders; Highlighting the faith-based organizations' role in addressing HIV
Hutchinson et al.	2007, AIDS Education and Prevention	Botswana	Cross-sectional survey	Cluster sampling	Face-to-face	> 75%	1065	Households	Magazines, Billboard, TV, Radio, Newspaper	Social Stigma	Information about HIV; Stories about PLWH; HIV talks/discussions
Kerr et al.	2015, AIDS Patient Care STDS	USA	Experimental	Convenience & snowball	Audio computer assisted self-interviews	> 75%	1613	African American Households	TV, Radio, Culturally-tailored media intervention	Social Stigma	Sexual-risk reduction intervention; Enhancing HIV knowledge; Development of skills to reduce risky behaviors and increase self-efficacy
Lapinski and Nwulu	2008, Health communication	Nigeria	Quasi-experimental	Snowball	Face-to-face	> 75%	100	General population	Film	Social Stigma	A mediated intervention designed to reduce HIV-related stigma and risk perceptions

Table 1 (continued)

Authors	Year and publisher	Setting	Study design	Sampling method	Questionnaire administration	Quality assessment	Sample size	Population	Media form	Stigma type	Approach
Li Li et al.	2009, Journal of Psychology	China	Cross-sectional survey	Multistage random & stratified	Face-to-face	> 75%	1101	Food market workers	TV, Radio, Posters, Internet	Social Stigma	Exposure to HIV information through mass media
Rimal et al.	2015, Journal of Communication	Nepal	Cross-sectional survey	Multistage	Face-to-face	> 75%	13,845	General population	TV, Radio, Newspapers	Social Stigma	General media exposure
O'Leary et al.	2007, AIDS Education and Prevention	Botswana	Cross-sectional survey	Convenience	Face-to-face	> 75%	419	Viewers and nonviewers of the storyline	TV series	Social Stigma	Exposure to HIV-related TV series
Setiyawati and Meilani	2020, Journal of Education and Learning	Indonesia	Quasi-experimental	Convenience	Face-to-face	> 75%	100	Students	Video clip	Social Stigma	Intervention by providing HIV information through video clips
Siregar et al.	2019, Journal of Nursing and Health Services	Indonesia	Quasi-experimental	Convenience	Face-to-face	< 75%	53	Adolescents	Leaflets, Audio-visual media	Social Stigma	Health promotion intervention with leaflets and audiovisual media
Aghaei, et al.	2020, Journal of Informatics in Medicine Unlocked	Iran	Cross-sectional survey	Multistage clustering	Face-to-face	> 75%	315	General population	Print media, TV, Movies, Radio, Internet	Social Stigma	Exposure to HIV information through media
Tianingrum	2018, Lina Kesehatan	Indonesia	Cross-sectional survey	Multistage clustering	Self-administered	< 75%	785	High school students	TV, Books, Posters/leaflets, Magazines, Newspapers, Internet	Social Stigma	Exposure to HIV information through media

Table 1 (continued)

Authors	Year and publisher	Setting	Study design	Sampling method	Questionnaire administration	Quality assessment	Sample size	Population	Media form	Stigma type	Approach
Thaker et al.	2018, Journal of Health Communications	India	Cross-sectional survey	Snowball	Face-to-face	> 75%	225	Men who have sex with men and transgender females	Newspapers, TV programs, Movies	Experienced stigma, Self-stigma, Normative stigma, Vicarious stigma, Media stigma	Exposure to media stigma
Kingori et al.	2017, AIMS Public Health	USA	Cross-sectional survey	Convenience	Face-to-face	> 75%	200	College students	Posters, Signs and Billboards, Brochures, Newspapers, Presentations, TV, Radio; Internet	Social Stigma	Exposure to HIV information through media
Fakolade et al.	2009, Journal of Biosocial Science	Nigeria	Cross-sectional survey	Multistage cluster & random sampling	Face-to-face	> 75%	31,692	General population	Mass media campaigns	Social Stigma	Exposure to Mass media campaigns (viewer-ship, listenership, and frequency)
Dehghan et al.	2020, Shiraz E-Medical Journal	Iran	Cross-sectional survey	Stratified and convenience	Self-administered	> 75%	900	General population	Radio, TV, Newspapers, Magazines	Social Stigma	HIV information through media

283 perceived norms [36, 37]. Second, it may illustrate the
284 growing concerns of societies regarding the detrimental
285 effects of diseases-related stigma and discrimination on
286 people [38]. Third, from eight studies conducted in the last
287 5 years, seven studies addressed the impact of media on
288 HIV-related stigma in developing countries, especially in
289 Asia. This may indicate a shift in the approaches utilized
290 by health policymakers and governments in developing
291 countries with a greater HIV prevalence to employ mass
292 media for reducing HIV-related stigma in society and
293 address the health of vulnerable groups like PLWH. In this
294 regard, the 2021 state of HIV stigma study reported that
295 56% of non-LGBTQ respondents said they are seeing more
296 stories about PLWH in the media, up four points from
297 2020. UNAIDS also recently announced its intermediated
298 2025 targets in which incorporating laws and policies to
299 improve access to HIV care and minimizing discrimination
300 towards PLWH were the main themes of increasing
301 the quality of care in PLWH.

302 According to UNAIDS data, discriminatory attitudes
303 towards PLWH remain unacceptably high in all developing
304 countries where surveys have been conducted [39]. Moreo-
305 ver, the transition of HIV prevention, especially in Asian
306 countries due to lack of international funding, requires a
307 change toward more governmental strategies to address the
308 HIV epidemic [40]. Given the dominancy of state media
309 such as national TV and radio in many developing countries
310 [41] and the access of nearly all populations to these media,
311 more use of mass media to combat HIV-related stigma in
312 developing countries can justify, to some extent, the hetero-
313 geneity in systematic review results (see Table 1) in terms
314 of study' time and setting (country).

315 Among the different types of populations that have been
316 covered, the general population has been examined in nearly
317 half of studies (9 out of 19). As HIV-related social stigma
318 can adversely impact many aspects of PLWH life including
319 their access to healthcare, well-being, social support, etc.,
320 studies with the general population are needed to reflect the
321 social aspects of HIV-related stigma. Young women [22],
322 African American and Latino men [42], households [25, 43],
323 workers [44], students [45, 46], adolescents [47], and LGBT
324 communities [48] were other groups that have been inves-
325 tigated. While social stigma is an important type of HIV
326 stigma addressed by many studies, other types, like inter-
327 nalized stigma, are not fully addressed. Only one study [48]
328 investigated different types of HIV-related stigma among
329 men who have sex with men (MSM) as a population vulner-
330 able to HIV indicating an urgent need for more research on
331 the on non-social types of HIV-related stigma in vulner-
332 able populations in the danger of HIV and how mass media
333 could impact these stigmas. Depending on the study design
334 and population type, the sample size of these studies ranged
335 from 53 in a quasi-experimental study on adolescents [47]

to 204,343 individuals in a cross-sectional survey on general
population [26].

Regarding the study design, most of the reviewed stud-
ies (14 out of 19 studies) were conducted through cross-
sectional surveys. Considering the limitation of the cross-
sectional study design in not establishing a true cause and
effect relationship, more experimental or longitudinal stud-
ies are needed to explore the impact of mass media on HIV-
related stigma reduction. A study [49] utilized data from a
longitudinal survey and one study utilized data of two cross-
sectional surveys at two timepoints [50] (see Table 1). Also,
three intervention studies [45, 47, 51] utilized various quasi-
experimental methods. Only Kerr et al. [43] employed a ran-
domized controlled trial approach (experimental) to study
the results of a mass media intervention and its impact on
HIV-related stigma. The face-to-face interview was the pri-
mary approach to collecting data. However, two studies [52,
53] utilized self-administered surveys and Kerr et al. [43]
used Audio computer assisted self-interviews. Regarding
methodological quality, 17 out of 19 studies have a quality
higher than 75% based on the STROBE scale [29].

In terms of mass media forms covered by reviewed stud-
ies, as expected, TV, Radio, and newspapers were among
the major mass media considering their accessibility to
many populations and their significant influence on adjust-
ing social beliefs and attitudes toward PLWH. However, in
the four mass media interventions (see Table 1), video clips
and films were frequently used media for interventions. The
lack of large scale mass media interventions to address HIV-
related stigma could be partly due to the numerous social,
cultural, and individual factors that interfere with the influ-
ence of mass media interventions and make them complex
and non-effective in many cases. As stated by LaCroix et al.
[54], mass media exposure could be related to personal char-
acteristics such as gender, income, age, and relationship sta-
tus, which make it hard to accurately evaluate the results
of studies that only focus on media exposure. Also, factors
such as social or political climate, public policy changes, and
everyday events can influence HIV/AIDS-related behaviors
leading to mixed results [54]. In this regard, a systematic
review of the effectiveness of mass communication pro-
grams to alter HIV/AIDS-related behaviors in developing
countries showed that for most of their studied outcomes, no
statistically significant impact of mass media programs was
found. Also, the effect sizes were usually small to moderate
among those with statistically significant results [55].

Most studies investigating the interaction between
mass media and HIV-related stigma were not interven-
tional studies. They only explored the relationship between
general media exposure or exposure to HIV information
through media with HIV-related stigma. Four interven-
tion studies that evaluated the effect of media on HIV-
related stigma utilized different approaches, including

389 a culturally-tailored sexual-risk reduction intervention
 390 by increasing HIV knowledge and skills to reduce risky
 391 behaviors [43], a mediated intervention through a film to
 392 reduce HIV-related stigma and risk perceptions [51], pro-
 393 viding HIV information through video clips [45], and a
 394 health promotion intervention with leaflets and audiovisual
 395 media [47].

396 Meta-analysis Results

397 Statistical heterogeneity of studies was substantial
 398 ($I^2 = 0.99$, $Q = 3292.565$; $P < 0.001$). The funnel plot indi-
 399 cates that there is no significant publication bias between
 400 studies (see Fig. 2). Egger's test also ascertained no signifi-
 401 cant publication bias ($t = 1.50$; $P > 0.05$). This test reveals
 402 that the relationship between media and stigma can vary in
 403 terms of the characteristics of studies. Therefore, utilizing
 404 moderating variables is essential to figure out the variance
 405 and place of these differences. Eleven studies found media
 406 was associated with stigma reduction [21, 23, 24, 26, 43,
 407 44, 47–49, 56, 57] and five found media was associated
 408 with increased stigma [22, 25, 45, 51, 53] (see Table 2).
 409 However, most of the reported effect sizes were near zero
 410 which led to the mean for media effect (effects of random
 411 composition) on stigma equal to -0.215 (see Fig. 3). As
 412 much as this estimated value is in the confidence range, we
 413 can say that the effect of media on reducing stigma is con-
 414 firmed. The resulting pointed estimation (-0.215) based
 415 on the Cohn criterion shows that although the impact of
 416 media on HIV-related stigma is statistically significant, it
 417 is in the moderate-to-low range.

418 Moderating Roles of the Country, Study Time (Year), 419 and HIV Prevalence

420 The meta-analytic results by considering countries as moder-
 421 ating variables showed Botswana, followed by the USA and
 422 China, has the highest impact of mass media on reducing
 423 HIV-related stigma (see Table 3). According to the meta-
 424 regression results, we can argue that the time that studies
 425 were conducted (1990–2020) has a moderate to weak effect
 426 ($R^2 = 0.16$) on the relationship between the mass media and
 427 stigma (see Figs. 4, 5). Moreover, the upward slope of the
 428 meta-regression graph suggests an increase in the impact
 429 of the mass media on reducing the HIV-related stigma over
 430 time. Results also suggest that there is no moderating role for
 431 the number of PLWH on the relationship between the mass
 432 media and HIV-related stigma (see Fig. 5).

433 Discussion

434 This study examines the impact of exposure to mass media
 435 such as radio, TV, newspapers, and movies on HIV/AIDS
 436 stigma. We conducted a systematic review and meta-analysis
 437 of quantitative studies addressing this relationship. Systematic
 438 review results showed considerable heterogeneity in the
 439 studied populations and the need for more interventional
 440 and longitudinal studies on this subject. Results also indi-
 441 cated the lack of research on internalized stigma and the
 442 impact of mass media on them. Results suggest a higher
 443 interest in utilizing mass media by governments to reduce
 444 HIV-related stigma in developing countries with greater
 445 HIV prevalence. The meta-analysis results showed that,

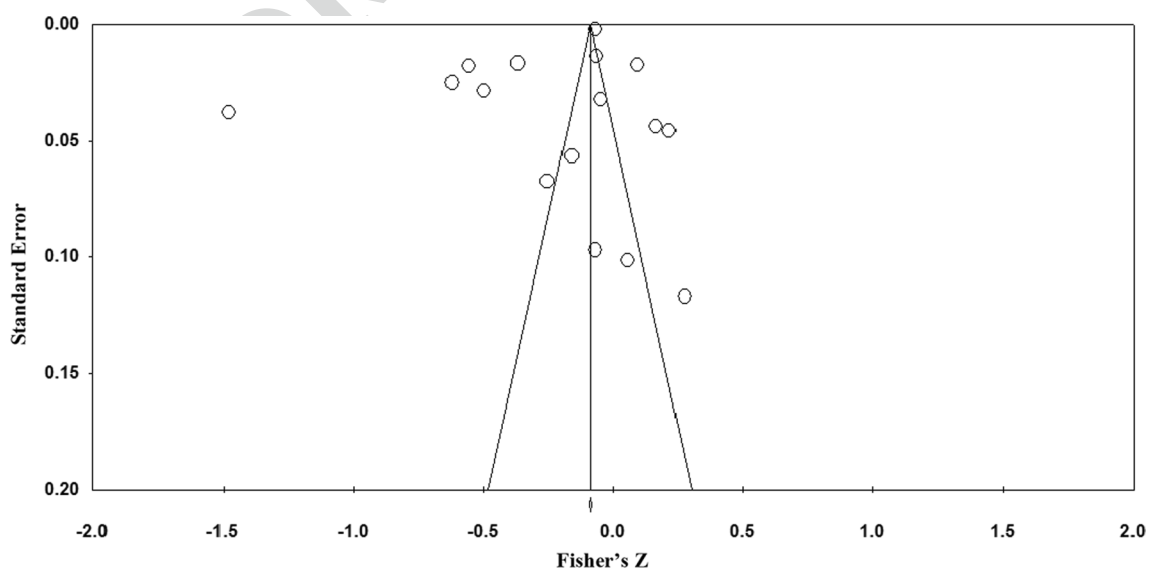


Fig. 2 Funnel plot of standard error by event rate shows no significant publication bias. Each circle shows a study

Table 2 Basic statistics for studies in the meta-analysis

Study	Country	Number of HIV cases	Effect size (r)	Lower limit	Upper limit	Z-value	p-value
Asamoah et al. (2017)	Ghana	340,000	0.164	0.080	0.247	3.785	<0.001
Babalola et al. (2009)	Nigeria	1,800,000	-0.506	-0.531	-0.480	-31.739	<0.001
Bekalu et al. (2014)	Sub-Saharan	23.1million	-0.070	-0.074	-0.066	-31.694	<0.001
Bekalu and Eggermont (2015)	Ethiopia	670,000	-0.048	-0.110	0.015	-1.499	0.134
Boulay et al. (2008)	Ghana	340,000	-0.066	-0.092	-0.040	-4.997	<0.001
Hutchinson et al. (2007)	Botswana	380,000	0.093	0.059	0.126	5.415	<0.001
Kerr et al. (2015)	USA	1,200,000	-0.550	-0.583	-0.515	-24.812	<0.001
Lapinski and Nwulu (2008)	Nigeria	1,800,000	0.055	-0.143	0.249	0.542	0.588
Li Li et al. (2009)	China	861,000	-0.350	-0.378	-0.321	-22.268	<0.001
Rimal et al. (2015)	Nepal	30,000	-0.460	-0.503	-0.415	-17.470	<0.001
O'Leary et al. (2007)	Botswana	380,000	-0.902	-0.915	-0.887	-39.139	<0.001
Setiyawati and Meilani (2020)	Indonesia	640,000	0.267	0.045	0.464	2.345	0.019
Siregar et al. (2019)	Indonesia	640,000	-0.069	-0.254	0.120	-0.716	0.474
Aghaei et al. (2020)	Iran	59,000	-0.159	-0.265	-0.049	-2.883	0.005
Tianingrum (2018)	Indonesia	640,000	0.214	0.127	0.297	4.747	<0.001
Thaker et al. (2018)	India	2,349,000	-0.247	0.366	-0.120	-3.758	<0.001
N	Heterogeneity test		I ²	Egger's test		Effect size	
	p-value	Q Cochrane		p-value	t-value	r	p-value
16	<0.001	3292.565	99.544	0.121	1.646	-0.215	0.002

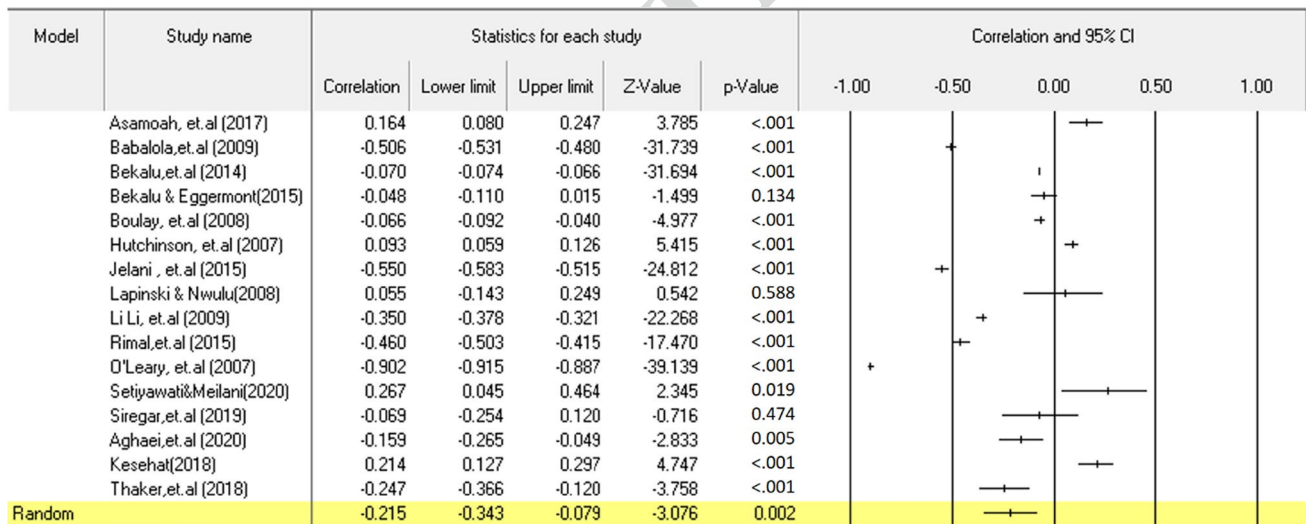


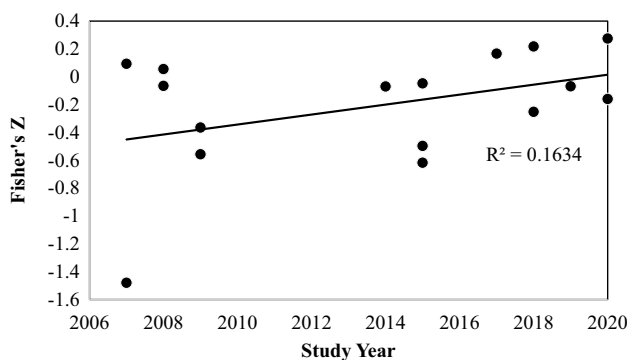
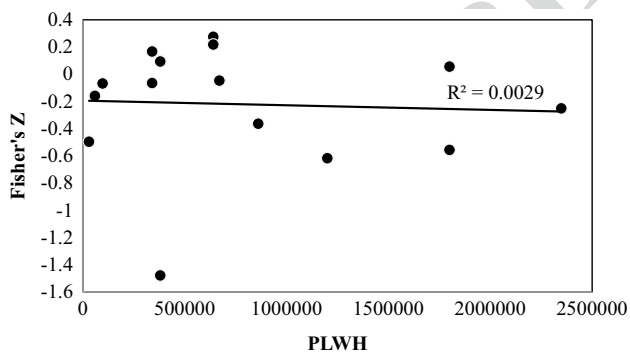
Fig. 3 The statistics and Forest plot of each study. Each study is shown by the point estimate of the prevalence (p) and 95% confidence interval for the p (lines)

on Cohen's measure, the acquired effect size (-0.215) of media on HIV-related stigma is on a medium to low scale. This result agrees with previous studies showing the significant but moderate influence of mass media exposure on reducing HIV-related stigma [21]. However, as shown in our meta-analytic results, the beneficial influence of mass media on HIV-related stigma reduction is not the same for all studied contexts, and six studies even report a harmful

effect of mass media on HIV-related stigma. Regarding the bidirectional role of mass media in strengthening or weakening the process of HIV/AIDS stigmatization, Goepfert et al. [58] showed that even portraying sensitive moments in movies that have potentially stigmatizing content can affect stereotypes and negative emotions. Moreover, as mass media create moral panics, in some cases, they could portray PLWH as "folk devils" and contribute to their stigmatization

Table 3 Relationship between mass media and HIV-related stigma in terms of the country

Location	Effect size (r)	Lower limit	Upper limit	Z-value	p-value
South Africa	0.011	-0.148	0.169	0.131	0.896
Botswana	-0.902	-0.915	-0.887	-39.139	<0.001
China	-0.350	-0.378	-0.321	-22.268	<0.001
Ethiopia	-0.048	-0.110	0.015	-1.499	0.134
Ghana	0.046	-0.179	0.267	0.398	0.691
India	-0.247	-0.366	-0.120	-3.758	<0.001
Indonesia	-0.069	-0.254	0.120	-0.716	0.474
Iran	-0.159	-0.265	-0.049	-2.833	0.005
Nepal	0.460	-0.503	-0.415	17.470	<0.001
Nigeria	-0.254	-0.696	0.328	-0.847	0.397
USA	-0.550	-0.583	-0.515	-24.812	<0.001

**Fig. 4** Regression of studies' time (year) on Fisher's Z. Each circle shows a study**Fig. 5** Regression of people living with HIV (PLWH) in each country on Fisher's Z. Each circle shows a study conducted in a country

impact. Heterogeneity in effect size for different studies can originate from many factors. Thus, we selected the HIV prevalence, country, and study year as the moderating variables. Our results showed that media were most effective in reducing stigma in Botswana, followed by USA and China in terms of the country. In the potential impact of the country variable on the mass media-HIV stigma relationship, the cultural context could play an important role. Culture is a dynamic process that portrays the way of life of a group of people and can include their life experiences and innovations of individuals. Botswana has seen a fast socioeconomic development since the 1970s [59].

The Botswana government has instituted several initiatives, such as decentralization and integration of services to enhance the physical and mental health of the population. Botswana culture is rich in values, institutions, and practices that can be further developed and integrated with the Western healthcare system currently dominating their healthcare system [59]. As the mass media play an essential role in delivering health messages in Western healthcare systems, in countries like Botswana that use the Western healthcare system similar to the United States, we expect a higher impact of mass media on HIV-related behaviors and stigma. We also have demonstrated how the underdeveloped role of the mass media in HIV-related debates in some developing societies like Iran could diminish its impact on reducing HIV stigma [21]. However, given the relatively small number of countries covered here, further studies would be recommended.

Moreover, the meta-regression analysis showed that the study's time (year) variable could weakly moderate the relationship between mass media and stigma (see Fig. 4). As time went on, the mass media became more effective in reducing stigma. Therefore, we can argue that as time passes, people's exposure to media will increase, and the more exposure to mass media, the greater the knowledge transmitted to the audience through the media. In this regard, we previously [21] showed a lower HIV-related stigma following increased HIV-related knowledge through media

[21]. Moral panic explains a scenario where a condition or individual will be considered a threat to societal values and interests. In this situation, mass media try to "make sense" of the problem and portray it stereotypically by discussing the moral meanings of risk and excessive attention to anxieties about pollution and contagion [21].

Furthermore, heterogeneity analysis of studies revealed the key role of moderator variables in understanding this

508 exposure. A similar finding was observed in a study inves- 550
 509 tigating the effect of a health promotion intervention using 551
 510 pamphlets and audio-visual on adolescents' knowledge and 552
 511 attitudes toward the risk of HIV/AIDS [45]. 553

512 This study showed that audio-visual media are more 554
 513 effective in increasing adolescents' knowledge and attitudes 555
 514 toward HIV/AIDS risk than pocketbook. Earlier studies 556
 515 also reported mass media as an important source of HIV/ 557
 516 AIDS information that decreases stigmatizing behaviors [60, 558
 517 61]. Thus, more interactions between health policymakers, 559
 518 governmental organizations, and mass media companies 560
 519 are needed to promote HIV/AIDS messages to vulnerable 561
 520 individuals experiencing HIV/AIDS stigma. In this regard, 562
 521 as suggested by Asamoah et al. (2017), Singhal and Rogers 563
 522 (1999), and Xiao et al. (2015), health messages are more 564
 523 effective through high-impact mass media, particularly 565
 524 radio and television, that can successfully change health 566
 525 behaviors even in people with low literacy and can com- 567
 526 municate sensitive health messages to the individuals with 568
 527 HIV/AIDS stigmatizing behaviors [22, 60, 61]. Moreover, 569
 528 since HIV/AIDS is a global issue affecting many countries 570
 529 and requires national, regional, and supra-regional coopera- 571
 530 tion and coordination, a proper understanding of the patterns 572
 531 of globalization can help us in the policymaking for mass 573
 532 media to combat HIV-related stigma. Alignment of national 574
 533 and local media with global media can ease persuading the 575
 534 audience to stop the HIV stigma. We summarized some of 576
 535 the do's and don'ts for mass media based on the review of 577
 536 available studies which can be used to inform future policies 578
 537 and programs in mass media (see Table 4). 579

538 One of the main challenges in evaluating the impact of 580
 539 mass media on HIV stigma is the limitation of available 581
 540 studies in measuring mass media impact. Most reviewed 582
 541 studies considered mass media exposure as their independ- 583
 542 ent variable (see Table 1). Measuring general mass media 584
 543 exposure cannot capture all aspects of mass media and its 585
 544 impact on HIV-related stigma. While some studies partly 586
 545 addressed this limitation by measuring exposure to HIV- 587
 546 related programs, the variety of HIV programs and their 588
 547 content makes it challenging to determine what content or 589
 548 program is effective and what is not. Thus, more longitudinal 590
 549 and intervention studies on mass media stigma reduction 591

550 programs with predesigned content need to be conducted 551
 552 for accurate evaluation. Moreover, there is an inconsistency 553
 554 between studies regarding the impact of mass media on HIV- 555
 556 related stigma (see Table 1). As discussed before, some level 557
 558 of this inconsistency originates from the context-dependent 559
 560 effect of mass media on HIV-related stigma. However, errors 561
 562 in the sampling and limitations of available studies could 563
 564 also contribute to this inconsistency. For example, the stud- 565
 566 ied population type and intervention types might be biased. 567

568 Our study also has some potential limitations. First, esti- 569
 570 mates of effect size obtained in this study should be inter- 571
 572 preted cautiously. High I^2 statistics in the outcomes indicate 573
 574 a large proportion of the total variation in effect sizes due to 575
 576 between-study variation rather than sampling error. Thus, 577
 578 we utilized a random effect model for meta-analysis in this 579
 580 study. We also explored different sources of heterogeneity. 581
 582 Second, in this study, while we included 16 quantita- 583
 584 tive studies measuring the impact of mass media on HIV 584
 585 stigma in the meta-analysis, a higher number of studies may 586
 587 increase the accuracy of meta-analysis results. 588

589 Although, in this study, we didn't include social media in 590
 591 our review of mass media studies considering the significant 591
 592 differences between social media and traditional mass media 592
 593 like TV, Radio, and print media, social media, provides a 593
 594 new framework for HIV vulnerable groups to communicate 594
 595 and can be used in media intervention studies. For example, 595
 596 MSM (men who have sex with men), a sexual and gender 596
 597 minority group with a high risk of HIV, are increasingly 597
 598 using social media to seek their social and sexual partners 598
 599 [62]. As shown by PEW Research Center, while 58% of the 599
 600 general people used social media platforms in 2013, the 600
 601 social media use was 80% for LGBT adults [63]. Also, social 601
 602 media do not have typical limitations of other mass media 602
 603 like control by governments (power) or limited to a specific 603
 604 country or culture, and measurement of the impact of HIV 604
 605 media programs on people is more accessible and less costly. 605
 606 Thus, social media can compensate for the lack of studies on 606
 607 HIV vulnerable groups and non-social HIV-related stigma 607
 608 by facilitating more media intervention programs among 608
 609 HIV vulnerable groups to reduce their stigma. However, 609
 610 although we are in the digital age, mass media strategies are 610
 611 still beneficial for reducing HIV-related stigma. Mass media 611

Table 4 Do's and don'ts for mass media

Do's	<ul style="list-style-type: none"> ● Make programs with a rich content of HIV-related information to increase HIV knowledge ● Provide culturally tailored health messages ● Alignment of national and local media with global media ● More interactions with health policymakers and governmental organizations regarding HIV-related policies ● Focus on health messages through high-impact mass media like TV and radio ● More brochures and audio-visual media
Don'ts	<ul style="list-style-type: none"> ● Do not portray sensitive moments that have potentially stigmatizing content ● Do not prioritize their economic or politic interests over health-related issues ● Do not present people living with HIV as patients

592 is still the most accessible way for health communication
593 and social marketing in resource-restrained settings, espe-
594 cially in developing countries; it represents some authority
595 (either from the government or from the health professions);
596 it is kind of material-based, papers, brochures, and other
597 printed materials can be saved, shared, and read again and
598 again, and it can cover different audiences based on their
599 age and preferences.

600 In summary, by systematically reviewing and meta-analyzing
601 the quantitative studies exploring mass media effects on HIV-related
602 stigma, we showed that there is a modest and context-specific
603 impact of mass media on the reduction of HIV-related stigma.
604 We showed that different study contexts in terms of study time
605 and country can impact the relationship between mass media
606 and HIV-related stigma. We also revealed a lack of knowledge
607 on the current literature about the effectiveness of various mass
608 media programs on HIV-related stigma especially among PLWH
609 due to the limited large-scale studies exploring mass media
610 interventions as well as research on the relationship between
611 mass media and non-social types of HIV-related stigma among
612 PLWH and vulnerable groups at risk of HIV infection.
613

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617 original draft preparation: AA, AK, AS; writing—review and
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622 **Code Availability** Not applicable.

623 Declarations

624 **Conflict of interest** The authors have no relevant financial or non-fi-
625 nancial interests to disclose.

626 **Ethical Approval** Not applicable.

627 **Research Involving Human and Animals Rights** Not applicable.

628 **Informed Consent** Not applicable.

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