



Mass media exposure and maternal healthcare utilization in South Asia

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ABSTRACT

Maternal mortality remains a major population health problem in the developing world due in part to inadequate healthcare before, during, and after childbirth. Mass media has the potential to disseminate information about maternal healthcare that can improve well-being for mothers and infants, particularly among women with limited educational attainment. This study examines the impact of mass media exposure (e.g., television, radio, and newspaper) and sociodemographic factors on maternal healthcare utilization in four South Asian countries: India, Bangladesh, Nepal, and Pakistan. Analyses use 2014–2017 Demographic and Health Surveys, which are nationally representative of women aged 15–49 years. Results show that maternal healthcare utilization is significantly higher among women exposed to mass media across countries, even after controlling for mother's, husband's, and household sociodemographic factors. Women exposed to mass media are 46–86% more likely to receive antenatal care, 24–53% more likely to deliver their babies by skilled birth attendants, and 36–94% more likely to receive postpartum check-ups across countries. Mother's educational attainment moderates the association between mass media exposure and some maternal healthcare services in three of the four countries. Governments and public health organizations can consider mass media as a key intervention in promoting maternal health in developing contexts.

Introduction

Although maternal mortality has decreased globally, it remains a major population health problem in many developing countries (Alkema et al., 2016; Grown, Gupta, & Pande, 2005; Hill, Johnson, Singh, Amuzu-Pharini, & Kharki, 2018). According to the World Health Organization (WHO), about 810 women died every day during pregnancy in 2017, and 94% of all maternal deaths occur in developing countries (WHO 2019). Maternal mortality rates are especially high in South Asia, with only sub-Saharan African countries exhibiting higher maternal mortality rates (WHO 2019). Many of these women die from preventable and treatable complications, such as severe bleeding, infections, or eclampsia. If pregnant women receive healthcare services during the three critical periods of pregnancy (antenatal, delivery, and postpartum), they can avoid pregnancy-related complications and reduce maternal mortality and morbidity (Acharya, Khanal, Singh, Adhikari, & Gautam, 2015).

Pregnant women need appropriate information about healthcare services, and mass media (e.g., television, radio, and newspaper) can disseminate information about maternal healthcare. Mass media plays a

key role in decision making for individuals, families, and organizations, in addition to being a source of news and entertainment (Katz, Haas, & Gurevitch, 1973; Viswanath, Ramanadhan, & Kontos, 2007). It can help mothers understand the importance of healthcare utilization by giving information through visual appealing, audio messages, and written reports. Mothers' sociodemographic characteristics also play a key role in utilizing maternal healthcare services. Maternal education is especially important for the utilization of maternal healthcare services since it can help mothers seek qualified health professionals, understand the risks of not receiving adequate healthcare during pregnancy, achieve the autonomy to make decisions about their own health, and communicate their pregnancy-related health issues to their husbands and other family members (Ahmed, Creanga, Gillespie, & Tsui, 2010; Bloom, Wypij, & Gupta, 2001; Singh, Rai, Alagarajan, & Singh, 2012; Weitzman, 2017). However, many mothers in South Asia have limited formal education or are illiterate. Thus, mass media campaigns may be especially important for disseminating maternal healthcare information to low-educated mothers (Ghosh, 2006).

This study examines the association between mass media exposure and the utilization of maternal healthcare services in four South Asian

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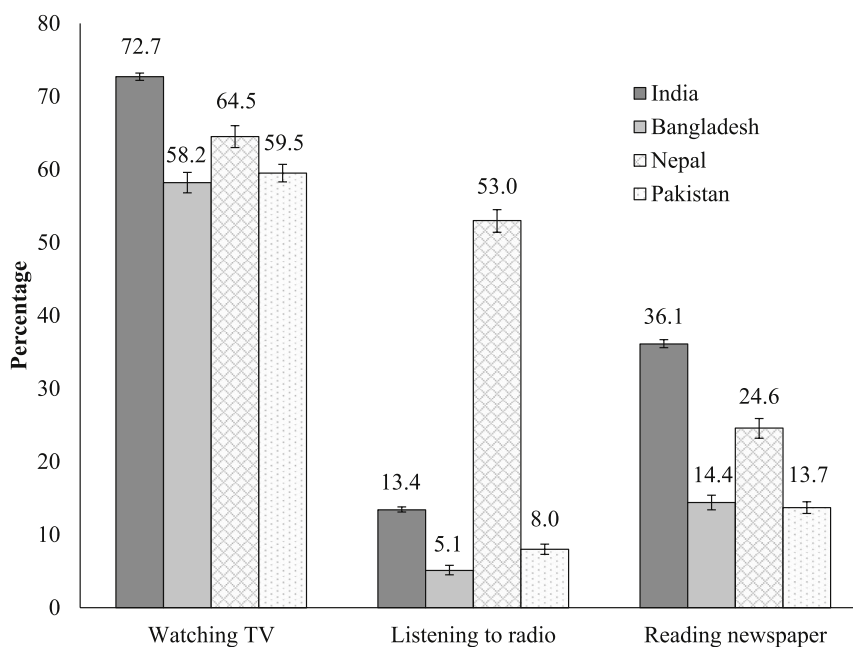


Fig. 1. Percentage distribution of forms of mass media exposure (95% confidence intervals)

countries, while accounting for sociodemographic factors as well. For this purpose, this study addresses the following research questions: Does mass media exposure increase maternal healthcare utilization in South Asian countries? Does mass media influence maternal healthcare use after controlling for the sociodemographic characteristics of the mother, her husband, and the household? Does the association between mass media and maternal healthcare vary by mother's education?

Background

Maternal healthcare

Maternal healthcare encompasses healthcare services received by a mother during pregnancy, delivery, and the postpartum period (Dairo & Owoyokun, 2010; Uddin, 2009). Unfortunately, many of these services are insufficient in developing countries, leading to poor maternal health. Negative health outcomes for the mother can be reduced by utilizing such maternal healthcare services as antenatal visits, delivery by skilled birth attendants, and postpartum checkups (Acharya et al., 2015).

Antenatal care is an early component of maternal healthcare since it works as an entry point to the utilization of maternal healthcare services. It allows pregnant women to regularly monitor their health and screen for pregnancy-related complications. Previous studies show that antenatal care can reduce maternal mortality (Mishra & Retherford, 2008; Regassa, 2011; Tenkorang, 2016; Torche & Villarreal, 2014). The WHO advises that pregnant women should receive at least four antenatal care visits (Wang, Alva, Wang, & Fort, 2011). However, only 65% of mothers in developing countries utilized antenatal care, compared with 97% of mothers in developed countries (Dairo & Owoyokun, 2010).

Although the use of skilled birth attendants during delivery has increased globally (Adegoke & van den Broek, 2009), many mothers in developing countries do not deliver their babies with the assistance of skilled birth attendants (Prata et al., 2011). Skilled birth attendants can improve health outcomes for pregnant mothers and their infants since they have the skills and training to address complications that arise during delivery (Frankenberg & Thomas, 2001; Mishra & Retherford, 2008). In developing countries, many births are still assisted by unskilled birth attendants who are mainly female family members or neighbors. For example, in Bangladesh and Nepal, more than half of

deliveries are assisted by unskilled birth attendants (Baral, Lyons, Skinner, & Van Teijlingen, 2010; Wang et al., 2011). Many women in these contexts either see pregnancy and childbirth as natural phenomena that do not require healthcare services, or they lack access to such services during pregnancy (Baral et al., 2010).

Postpartum care is also essential since complication and infection risks remain following childbirth (Wang et al., 2011; WHO 2019). Despite having postpartum symptoms, such as fever, heavy vaginal bleeding, and pre-eclampsia, some mothers do not take appropriate and timely medical care after their delivery, instead seeking less effective care from relatives or traditional healers (Fikree, Ali, Durocher, & Rahbar, 2004). The use of postnatal care remains low in many developing countries (Dhakal et al., 2007; WHO 2019). For instance, in Nepal, 65% of mothers do not receive postnatal care after the delivery (Dhakal et al., 2007). Many mothers do not know that they should receive a postpartum checkup within the first 24 h after the delivery and, more generally, they are uninformed how to utilize postpartum care and from where they should receive postnatal care (Dhakal et al., 2007).

Mass media and healthcare

Women's exposure to mass media (e.g., watching TV, listening to the radio, and reading newspapers) can promote their utilization of maternal healthcare services. Mass media includes written, broadcast, or spoken communication that reaches public audiences and serves as an important mechanism for integration into a society (Katz et al., 1973; Viswanath et al., 2007). Media can disseminate information to large audiences in the form of public service announcements, entertainment, advertisement, or short drama quickly and at relatively low costs (Sarassat et al., 2015). Mass media has contributed to other demographic processes, especially regarding methods and motivations for family planning (Barber & Axinn, 2004) and health promotion and preventing disease (Head et al., 2015).

Mass media campaigns have the potential to raise awareness about maternal health globally by transmitting maternal healthcare-related information between countries through international news broadcasts, television programming, new technologies, film, and music (Matos, 2012; Randolph & Viswanath, 2004; Sarassat et al., 2015). Viswanath et al. (2007) theorize that mass media can affect attitudes toward

Table 1
Descriptive statistics of maternal healthcare, mass media exposure, and socio-demographic covariates.

Variables	India	Bangladesh	Nepal	Pakistan
Antenatal care (%)				
No	15.1 (14.7, 15.5)	21.5 (20.4, 22.7)	5.6 (4.9, 6.4)	12.1 (11.3, 12.9)
Yes	84.9 (84.5, 85.3)	78.4 (77.3, 79.6)	94.4 (93.6, 95.1)	87.9 (87.1, 88.7)
Delivery by skilled birth attendants (%)				
No	15.8 (15.4, 16.2)	46.7 (45.3, 48.1)	34.8 (33.3, 36.3)	27.9 (26.9, 29.0)
Yes	84.2 (83.8, 84.6)	53.3 (51.9, 54.8)	65.2 (63.7, 66.7)	72.1 (71.0, 73.1)
Postpartum care (%)				
No	28.5 (28.0, 29.0)	35.6 (34.3, 37.0)	43.7 (42.2, 45.3)	36.2 (35.1, 37.4)
Yes	71.5 (71.0, 72.0)	64.4 (63.0, 65.8)	56.3 (54.7, 57.8)	63.8 (62.6, 65.0)
Exposure to mass media (%)				
No	23.6 (23.1, 24.1)	38.4 (37.0, 39.8)	21.3 (20.0, 22.6)	36.6 (35.4, 37.7)
Yes	76.4 (75.9, 76.9)	61.6 (60.2, 63.0)	78.7 (77.4, 80.0)	63.4 (62.3, 64.6)
Mother's education (%)				
No education	26.1 (25.6, 26.6)	14.2 (13.2, 15.2)	31.4 (30.0, 32.8)	47.9 (46.7, 49.1)
Primary	12.9 (12.5, 13.3)	28.1 (26.8, 29.4)	19.3 (18.1, 20.5)	16.3 (15.4, 17.2)
Secondary	48.2 (47.6, 48.7)	47.6 (46.2, 49.1)	33.8 (32.3, 35.3)	22.2 (21.2, 23.2)
Higher	12.9 (12.5, 13.3)	10.1 (9.2, 11.0)	15.5 (14.4, 16.7)	13.6 (12.8, 14.4)
Mother's work status (%)				
Not working	78.1 (77.6, 78.5)	74.8 (73.6, 76.1)	61.0 (59.4, 62.5)	82.8 (81.9, 83.7)
Working	21.9 (21.5, 22.4)	25.2 (23.9, 26.4)	39.0 (37.5, 40.6)	17.2 (16.3, 18.1)
Mother's age (mean)				
	27.0 (26.9, 27.0)	24.6 (24.4, 24.8)	26.4 (26.3, 26.6)	29.4 (29.2, 29.5)
Husband's education (%)				
No education	16.3 (15.9, 16.7)	23.9 (22.6, 25.1)	13.8 (12.7, 14.9)	28.7 (27.6, 29.8)
Primary	14.0 (13.6, 14.4)	30.1 (28.8, 31.5)	21.2 (20.0, 22.4)	16.6 (15.7, 17.5)
Secondary	54.3 (53.8, 54.9)	31.8 (30.4, 33.1)	46.2 (44.7, 47.8)	35.2 (34.1, 36.4)
Higher	15.4 (15.0, 15.8)	14.2 (13.2, 15.2)	18.8 (17.6, 20.0)	19.5 (18.6, 20.5)
Husband's work status (%)				
Not working	4.2 (4.0, 4.4)	0.6 (0.4, 0.8)	2.4 (1.9, 2.8)	2.6 (2.2, 3.0)
Working	95.8 (95.6, 96.0)	99.4 (99.2, 99.6)	97.6 (97.2, 98.1)	97.4 (97.0, 97.8)
Place of residence (%)				
Rural	69.1 (68.6, 69.7)	73.9 (72.7, 75.2)	44.2 (42.7, 45.8)	66.7 (65.6, 67.9)
Urban	30.9 (30.3, 31.4)	26.1 (24.8, 27.3)	55.8 (54.2, 57.3)	33.3 (32.1, 34.4)
Wealth status (%)				
Poorest	21.9 (21.4, 22.4)	21.7 (20.5, 22.9)	20.3 (19.0, 21.6)	21.6 (20.6, 22.6)
Poorer	20.7 (20.3, 21.2)	18.9 (17.8, 20.0)	21.0 (19.7, 22.3)	19.3 (18.4, 20.3)
Middle	20.4 (19.9, 20.8)	19.2 (18.0, 20.3)	21.7 (20.4, 23.0)	20.6 (19.6, 21.5)
Richer	19.0 (18.6, 19.4)	20.6 (19.5, 21.8)	20.9 (19.6, 22.1)	20.0 (19.0, 20.9)
Richest	18.0 (17.6, 18.5)	19.5 (18.4, 20.7)	16.2 (15.0, 17.3)	18.6 (17.6, 19.5)

Source: Demographic and Health Surveys.

healthy behavioral changes through informational, instrumental, social control, and communal functions of health communication. First, media can promote healthy behavioral changes by routinely broadcasting programs, public service announcements, and advertisements that

describe new drugs, novel treatments, or risk factors. For example, in Bangladesh, the TV drama series Ujan Ganger Naiya covered maternal healthcare-related issues such as the importance of regular antenatal visits, birth preparedness, delivery by skilled birth attendants, postpartum check-ups, nutrition, and essential newborn care by entertaining audiences with stories set in a rural village (British Broadcasting Corporation, 2014). Second, media offers health information, including announcements of dates, times, and places for screening, vaccination, or free healthcare, that encourages audiences to take practical action toward healthy behavioral changes. In South Asian countries, an educational media campaign about safe motherhood by the United Nations Population Fund (UNFPA) included information about the symptoms of labor pain and where and who will be best for delivering a baby (Rahman, Curtis, Chakraborty, & Jamil, 2017). Lastly, media promotes social action by generating a spirit of connectedness and reciprocity within families and local communities (Viswanath et al., 2007). For instance, television programs like Ujan Ganger Naiya in South Asian countries targeted not only women of reproductive age but also their family members. In developing countries, whether women have autonomy to make decisions about their reproductive healthcare depends on their partner's authority as well as their in-laws' or other people's control in their family (Bloom et al., 2001; Umar, 2017). In patriarchal societies, husbands and mothers-in-law often still believe in traditional birth practices and prevent women from visiting healthcare centers (Biswas, Shovo, Aich, & Mondal, 2017). In this regard, mass media campaigns can build a connection between pregnant women and their family members for delivering a baby in a safer way instead of believing in traditional birth practices.

Based on these previous studies, we expect that:

Hypothesis I. Mothers exposed to mass media are more likely to utilize maternal healthcare at the antenatal, delivery, and postpartum stages of pregnancy.

Educational attainment, mass media, and maternal healthcare services

Maternal education is positively associated with utilization of maternal healthcare services (Ameyaw, Tanle, Kissah-Korsah, & Amo-Adjei, 2016; Bloom et al., 2001; Chakraborty, Islam, Chowdhury, Bari, & Akhter, 2003; Dhakal et al., 2007; Singh et al., 2012; Tenkorang, 2016; Uddin, 2009). Education helps mothers seek qualified health professionals and understand the risks of not receiving adequate healthcare during pregnancy (Singh et al., 2012). Additionally, education can help mothers achieve the autonomy to make decisions about their own health and the health of their child. For example, Weitzman (2017) found that education reduces the probability of short birth spacing and unwanted pregnancies through increasing modern contraceptive use and helps prevent pregnancy-related complications by increasing women's antenatal healthcare visits and deliveries in formal healthcare centers. Ahmed et al. (2010) found that having a skilled birth attendant during delivery is five times higher for women who have completed primary education than women without a primary education.

Among women with little or no formal education, exposure to mass media may be especially important for the utilization of maternal healthcare (Asp, Pettersson, Sandberg, Kabakyenga, & Agardh, 2014; Ghosh, 2006; Uddin, 2009; Zamawe, Banda, & Dube, 2016). In South Asian countries, many mothers have low levels of schooling, which poses challenges to instructing them about maternal healthcare services. Mass media can reach illiterate and less privileged mothers in rural areas (Ghosh, 2006) and inform them about maternal healthcare services by disseminating information on television, radio, and newspapers or other printed materials. Based on this argument, this study proposes the following hypothesis:

Hypothesis II. Educational attainment will moderate the association between mass media exposure and maternal healthcare, with low-educated mothers benefitting more from mass media exposure than

Table 2
Odds ratios of mass media exposure on maternal healthcare among mothers in India (n = 31,132).

Variables	Antenatal care			Delivery care			Postpartum care		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Mass media exposure	4.443***	1.777***	1.864***	3.844***	1.416***	1.378***	2.834***	1.571***	1.504***
Mother's education									
No education (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Primary		1.518***	1.499***		1.257***	1.256**		1.203***	1.142
Secondary		1.929***	2.103***		1.718***	1.598***		1.399***	1.316***
Higher		2.817***	8.271***		3.587***	6.673***		1.805***	2.282***
Mother's work status									
Not working (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Working		1.185***	1.185***		0.882***	0.883***		1.245***	1.245***
Mother's age		0.983	0.983		0.989	0.990		1.012	1.012
Mother's age ²		0.999	0.999		0.999	0.999		0.999*	0.999*
Husband's education									
No education (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Primary		1.368***	1.365***		1.055	1.057		1.042	1.044
Secondary		1.153**	1.151**		1.322***	1.321***		1.182***	1.183***
Higher		1.179*	1.186*		1.449***	1.451***		1.216***	1.217***
Husband's work status									
Not working (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Working		1.508***	1.511***		0.978	0.979		1.313***	1.315***
Place of residence									
Rural (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Urban		1.023	1.022		1.037	1.039		1.039	1.041
Wealth status									
Poorest (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Poorer		1.470***	1.459***		1.414***	1.416***		1.221***	1.223***
Middle		2.005***	2.006***		2.202***	2.195***		1.546***	1.544***
Richer		2.879***	2.906***		2.993***	2.975***		1.865***	1.859***
Richest		3.949***	4.052***		5.160***	5.143***		2.269***	2.265***
Mass media-by-mother's education									
Mass media × Primary			1.003			1.013			1.096
Mass media × Secondary			0.870			1.112			1.098
Mass media × Higher			0.309*			0.531			0.804
Nagelkerke R ²	0.107	0.186	0.186	0.089	0.190	0.190	0.061	0.103	0.104

Source: Demographic and Health Surveys.

Notes: *p < 0.05, **p < 0.01, ***p < 0.001. Model 1: Bivariate relationship with mass media exposure, Model 2: Mass media exposure and sociodemographic covariates, and Model 3: Includes interaction between mass media exposure and mother's education.

high-educated mothers.

Sociodemographic covariates of mass media exposure and maternal healthcare

Sociodemographic characteristics other than mother's education are also correlated with maternal healthcare services. Mother's age can contribute to gathering knowledge about and accessing healthcare services (Baral et al., 2010; Chakraborty et al., 2003; Regassa, 2011; Sunil, Rajaram, & Zottarelli, 2006; Uddin, 2009). Younger mothers have more knowledge of modern healthcare services than older mothers (Chakraborty et al., 2003). For example, in Ghana, young mothers were more likely to deliver their babies at health facilities than older mothers who may think that they already have experience about how to deliver a baby (Ameyaw et al., 2016). However, the influence of age varies across countries. In Bangladesh, for example, middle-aged mothers are more likely to use maternal healthcare services than other age groups (Uddin, 2009). Mother's employment can also increase their ability to afford quality healthcare services and allow them to play an active role in the decision-making process about their health (Chakraborty et al., 2003; Dhakal et al., 2007; Pebley, Goldman, & Rodriguez, 1996; Regassa, 2011).

Apart from the mother's characteristics, other familial factors may influence her use of maternal healthcare. Women who live in urban areas are more likely to utilize maternal healthcare services compared with their rural counterparts (Ameyaw et al., 2016; Baral et al., 2010; Dairo & Owoyokun, 2010; Sunil et al., 2006; Uddin, 2009). Urban areas feature more nearby hospitals, whereas mothers in rural areas may have to travel long distances to access healthcare (Ameyaw et al., 2016). Household wealth status also has a significant impact on maternal

healthcare services. In Nepal and India, women in wealthier households are more likely to deliver their baby at a health facility than women in poor households (Baral et al., 2010).

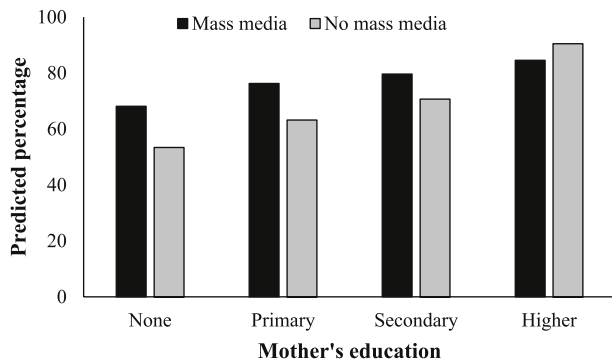
Husbands' socioeconomic characteristics can also be a factor in utilizing maternal healthcare services in developing countries. Husbands with formal education are more likely to encourage their wives to seek better healthcare treatments during their pregnancy (Adjiwanou, Bougma, & LeGrand, 2018; Pebley et al., 1996). Husbands without formal education may prevent their wives from obtaining reproductive healthcare if they disapprove of male health professionals examining or touching their wives' bodies. Likewise, husband's occupation can influence utilization of maternal healthcare services (Chakraborty et al., 2003; Dhakal et al., 2007). Many mothers in South Asian countries are homemakers and depend on their husband's income for their livelihood and healthcare. Therefore, husband's income can be considered as family income as well as social status since it helps mothers seek better healthcare (Chakraborty et al., 2003; Dhakal et al., 2007). These sociodemographic characteristics of the mother, her husband, and the household can potentially confound the association between mass media exposure and maternal healthcare utilization since they represent flexible resources for acquiring healthcare.

Methods

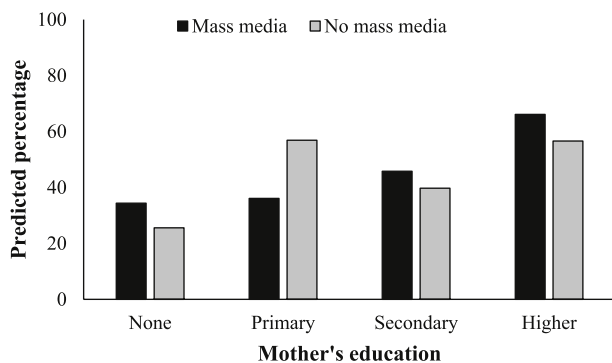
Data

This study employed 2014–2017 Demographic and Health Survey (DHS) data, which are nationally representative surveys of women aged 15–49 years in developing countries. The DHS collects information on women's sociodemographic characteristics, fertility, health-seeking

Panel A. Predicted percentage of receiving antenatal care in India



Panel B. Predicted percentage of delivery with a skilled birth attendant in Bangladesh



Panel C. Predicted percentage of delivery with a skilled birth attendant in Nepal

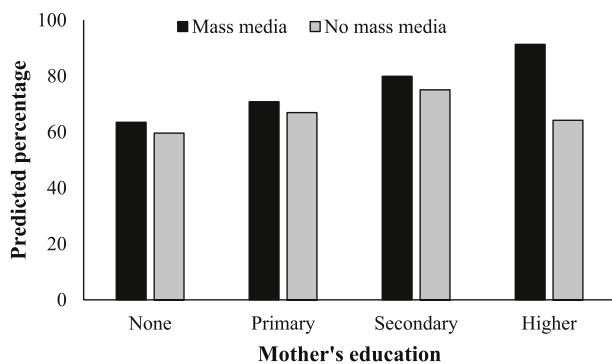


Fig. 2. Predicted percentage for interactions of mass media exposure and mother's education on maternal healthcare utilization.

Panel A. Predicted percentage of receiving antenatal care in India.

Panel B. Predicted percentage of delivery with a skilled birth attendant in Bangladesh.

Panel C. Predicted percentage of delivery with a skilled birth attendant in Nepal.

behavior, and maternal health service utilization. We include DHS data for four South Asian countries: India, Bangladesh, Nepal, and Pakistan. For these four countries, recent DHS data are available that consistently measure mass media exposure, maternal healthcare utilization, and sociodemographic factors. Maternal mortality in these South Asian countries remains relatively high, ranging from 140 to 186 per 100,000 live births (World Bank, 2019). DHS has not administered surveys in other South Asian countries such as Sri Lanka, Maldives, and Bhutan. The diversity in historical context, level of development, and health profiles among these countries allows us to determine whether the association between mass media exposure and maternal healthcare varies across contexts. The sample for this study is limited to ever-married women who had at least one child in the last five years. Respondents

with missing values on mass media, maternal healthcare, or control variables are listwise deleted. Sample sizes are as follows: n = 31,132 in India, n = 4583 in Bangladesh, n = 3916 in Nepal, and n = 6532 in Pakistan.

Measures

The dependent variables are three maternal healthcare services: antenatal care, delivery with a skilled birth attendant, and postpartum care. For the analysis, all three response categories are dichotomous variables. For example, DHS asked women whether they had received antenatal care during their last pregnancy. We recoded the variable so that 1 = women received antenatal care and 0 = women did not receive

Table 3
Odds ratios of mass media exposure on maternal healthcare among mothers in Bangladesh (n = 4583).

Variables	Antenatal care			Delivery care			Postpartum care		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Mass media exposure	4.054***	1.582***	1.587*	2.748***	1.156	1.526*	2.982***	1.595***	1.936***
Mother's education									
No education (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Primary		1.483***	1.444**		1.499***	1.896***		1.240*	1.241
Secondary		2.462***	2.616***		1.878***	1.917***		1.243	1.486**
Higher		3.359***	2.530*		4.279***	3.792***		3.197***	3.132**
Mother's work status									
Not working (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Working		1.061	1.059		0.878	0.882		1.415***	1.417***
Mother's age		0.990	0.990		1.005	1.002		0.975	0.976
Mother's age ²		1.001	1.001		1.000	1.000		1.001	1.001
Husband's education									
No education (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Primary		1.082	1.080		1.110	1.120		0.962	0.960
Secondary		1.377**	1.384**		1.489***	1.500***		1.181	1.192
Higher		2.136***	2.141***		2.425***	2.424***		1.136	1.153
Husband's work status									
Not working (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Working		1.249	1.270		0.525	0.519		1.255	1.278
Place of residence									
Rural (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Urban		1.281*	1.276*		1.228*	1.236*		1.403***	1.387***
Wealth status									
Poorest (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Poorer		1.359**	1.352**		1.257*	1.275*		1.199	1.170
Middle		1.765***	1.759***		1.343**	1.376**		1.233*	1.205
Richer		2.847***	2.845***		2.114***	2.142***		1.809***	1.772***
Richest		4.549***	4.550***		3.423***	3.457***		3.895***	3.888***
Mass media-by-mother's education									
Mass media × Primary			1.080			0.568**			0.957
Mass media × Secondary			0.899			0.840			0.696
Mass media × Higher			1.445			0.982			0.904
Nagelkerke R ²	0.117	0.225	0.226	0.076	0.222	0.222	0.086	0.172	0.174

Source: Demographic and Health Surveys.

Notes: *p < 0.05, **p < 0.01, ***p < 0.001. Model 1: Bivariate relationship with mass media exposure, Model 2: Mass media exposure and sociodemographic covariates, and Model 3: Includes interaction between mass media exposure and mother's education.

any antenatal care. The delivery by skilled birth attendant and postpartum care variables are similarly dichotomized. The key independent variable is exposure to mass media, which is measured by exposure to three forms of mass media: watching TV, listening to the radio, and reading newspapers. We created the mass media exposure variable by coding each form of mass media as a dichotomous variable, summing the three mass media variables, and then coding all non-zero values as exposed to mass media. Sensitivity analyses determined that results were consistent when using the individual forms of mass media or the sum of mass media forms as the independent variable.

Control variables include sociodemographic characteristics of the mother (education, age, and working status), her husband (husband's education and working status), and the household (rural/urban residence and wealth status). Mother's age is continuous and centered on 15 years. We also include an age² term to account for possible curvilinear associations between age and maternal healthcare utilization. Mother's and husband's education are categorized as none (reference group), primary, secondary, and higher education. The mother's and her husband's work status are dichotomous (working vs. not working [reference group]), as is place of residence (urban vs. rural [reference group]). DHS created a wealth index based on consumer goods and housing characteristics and then placed households into wealth quintiles. We use the wealth quintiles, with the lowest wealth quintile (poorest) as the reference group.

Analytic approach

Descriptive statistics present the country-specific percentage distributions for dependent, independent, and control variables. We also present the percentage of mothers who are exposed to the three forms of

mass media that comprise our key independent variable: watching television, listening to the radio, and reading newspapers. Multivariate logistic models test whether mass media exposure is associated with maternal healthcare utilization. Results are presented as odds ratios in three nested models for each of the four countries. The first model shows the bivariate relationship between mass media exposure and maternal healthcare utilization, separately for the three dependent variables (e.g., antenatal care, skilled birth attendant at delivery, and postpartum care). The second model determines whether the association between mass media and maternal healthcare utilization remains statistically significant while controlling for mother's education and other confounding variables. To further investigate whether the association between mass media and maternal healthcare varies by mother's education, Model 3 maintains the control variables of Model 2 and adds mass media-by-education interaction terms. Additionally, we graph predicted percentages for models with significant interactions to aid with interpretation. All analyses apply country-specific DHS sample weights.

Results

Descriptive statistics

Fig. 1 shows percentages of exposure to each form of mass media (watching TV, listening to the radio, and reading newspapers) among recent mothers in the four South Asian countries. Watching television is the most common form of mass media in each country. The majority of mothers in South Asia watch TV. In India, Bangladesh, and Pakistan, reading newspapers is the second most common form of media, with 36.1%, 14.4%, and 13.7% of mothers in India, Bangladesh, and Pakistan reading newspapers, respectively. In Nepal, listening to the radio is the

Table 4
Odds ratios of mass media exposure on maternal healthcare among mothers in Nepal (n = 3,916).

Variables	Antenatal care			Delivery care			Postpartum care		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Mass media exposure	3.142***	1.540**	1.460*	2.610***	1.244*	1.179	3.006***	1.473***	1.361*
Mother's education									
No education (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Primary		1.326	1.232		1.376**	1.371		1.239*	1.151
Secondary		2.849***	2.423		2.223***	2.040**		2.233***	1.876**
Higher		8.989***	1.854		5.425***	1.216		4.792***	3.210
Mother's work status									
Not working (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Working		1.006	1.006		0.928	0.929		1.213*	1.208*
Mother's age		0.957	0.956		0.910***	0.911***		0.986	0.985
Mother's age ²		1.000	1.000		1.002**	1.002**		1.001	1.001
Husband's education									
No education (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Primary		1.151	1.154		1.056	1.059		1.407**	1.411**
Secondary		1.250	1.255		1.273*	1.279*		1.337*	1.341*
Higher		1.808	1.786		1.333	1.326		1.429*	1.430*
Husband's work status									
Not working (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Working		1.443	1.441		1.165	1.178		1.528	1.532
Place of residence									
Rural (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Urban		1.157	1.158		1.437***	1.441***		1.394***	1.396***
Wealth status									
Poorest (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Poorer		1.673**	1.661**		1.476***	1.471***		1.273*	1.266*
Middle		3.562***	3.552***		3.090***	3.081***		2.173***	2.167***
Richer		2.681***	2.679***		3.234***	3.250***		2.785**	2.778**
Richest		2.575**	2.509*		6.530***	6.405***		4.109***	4.069***
Mass media-by-mother's education									
Mass media × Primary			1.128			1.018			1.118
Mass media × Secondary			1.238			1.122			1.244
Mass media × Higher			5.972			4.977**			1.565
Nagelkerke R ²	0.044	0.176	0.177	0.050	0.275	0.277	0.064	0.238	0.239

Source: Demographic and Health Surveys.

Notes: *p < 0.05, **p < 0.01, ***p < 0.001. Model 1: Bivariate relationship with mass media exposure, Model 2: Mass media exposure and sociodemographic covariates, and Model 3: Includes interaction between mass media exposure and mother's education.

second most popular form of media. When the three forms of mass media exposure are combined (Table 1), we find that 61.6–78.7% of mothers in each South Asian country are exposed to some form of mass media.

Table 1 includes the percentage of women who received the three maternal healthcare services. Antenatal care was least common in Bangladesh, where 21.5% of the mothers did not receive antenatal care. In India and Pakistan, 15.1% and 12.1% of mothers did not receive antenatal care during their last pregnancy, respectively. Only 5.6% of Nepalese mothers did not receive antenatal care. Nearly 50% of mothers in Bangladesh did not deliver their babies by skilled birth attendants whereas only 34.8% of the mothers in Nepal did not deliver their babies by skilled birth attendants. Receiving postpartum checkups after delivery was highest in India (71.5%) and lowest in Nepal (56.3%).

Descriptive statistics also show that, in Pakistan, nearly half (47.9%) of mothers have no formal education. In contrast, about 60% of mothers have completed secondary or higher education in India and Bangladesh, and 49.3% of mothers in Nepal have secondary or higher education. Regarding working status, less than 30% of mothers in South Asian countries do not work, except in Nepal where 39% of mothers are employed. On the other hand, nearly all their husbands are employed in all four countries. About 70% of women live in rural areas, except Nepal where over half (55.8%) of mothers live in urban areas.

Bivariate and multivariate analysis

India

The first model for India (Table 2) shows a positive, statistically significant association between mass media and each maternal healthcare utilization outcome. Mothers exposed to mass media are 4.4 times more likely to receive antenatal care, 3.8 times more likely to deliver

their babies by skilled birth attendants, and 2.8 times more likely to take postpartum care after their delivery, compared with mothers not exposed to mass media.

The second model shows that, controlling for sociodemographic factors, odds ratios for mass media exposure are attenuated but retain a statistically significant association with all three dependent variables. Thus, mass media is an important predictor of maternal healthcare utilization in India net of the mother's and husband's sociodemographic characteristics. Several control variables are also significantly associated with maternal healthcare. Mother's educational attainment has a statistically significant, positive, and graded relationship with antenatal care, delivery care, and postpartum care, with odds of receiving healthcare increasing with higher educational levels compared with mothers with no education. A positively graded relationship is also observed between household wealth status and all three maternal healthcare outcomes. Mothers in the richest households are five times more likely to use a skilled birth attendant than mothers in the poorest households.

The third model examines whether the association between mass media and maternal healthcare varies by education in India by adding mass media-by-education interaction terms. Illustrated with predicted percentages in Fig. 2, Panel A, percentages of antenatal care receipt are higher among mothers exposed to mass media versus those not exposed in the three lower educated groups. However, among higher educated mothers in India, antenatal care is higher among those with no mass media exposure compared to those with mass media exposure.

Bangladesh

In Bangladesh, exposure to mass media is positively associated with maternal healthcare utilization (Table 3). After controlling for

Table 5
Odds ratios of mass media exposure on maternal healthcare among mothers in Pakistan (n = 6532).

Variables	Antenatal care			Delivery care			Postpartum care		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Mass media exposure	4.502***	1.583***	1.569***	2.851***	1.307***	1.294***	2.823***	1.565***	1.612***
Mother's education									
No education (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Primary		2.621***	3.236***		1.293**	1.320*		1.334***	1.596***
Secondary		2.274***	1.540		1.592***	1.531*		1.576***	1.476*
Higher		12.670***	15.226		3.896***	2.550*		2.228***	1.809
Mother's work status									
Not working (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Working		1.365**	1.361**		0.808**	0.808**		1.168*	1.164*
Mother's age		1.015	1.014		0.992	0.992		1.045*	1.046**
Mother's age ²		0.998*	0.998*		1.000	1.000		0.998**	0.998**
Husband's education									
No education (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Primary		1.566***	1.577***		0.990	0.961		0.991	0.992
Secondary		1.601***	1.608***		1.188*	1.187*		1.185*	1.181*
Higher		1.371	1.363		1.596***	1.598***		1.415***	1.411***
Husband's work status									
Not working (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Working		1.336	1.342		1.070	1.065		0.959	0.955
Place of residence									
Rural (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Urban		1.124	1.125		1.164	1.165		1.201*	1.203**
Wealth status									
Poorest (ref.)		1.000	1.000		1.000	1.000		1.000	1.000
Poorer		1.463***	1.465***		1.101	1.103		0.873	0.870
Middle		2.867***	2.891***		1.734***	1.740***		1.193*	1.199*
Richer		4.999***	4.957***		2.475***	2.478***		1.440***	1.445***
Richest		10.327***	10.024***		4.546***	4.521***		2.614***	2.613***
Mass media-by-mother's education									
Mass media × Primary			0.701			0.974			0.764
Mass media × Secondary			1.811			1.056			1.067
Mass media × Higher			0.827			1.639			1.244
Nagelkerke R ²	0.106	0.275	0.276	0.074	0.219	0.219	0.077	0.170	0.170

Source: Demographic and Health Surveys.

Notes: *p < 0.05, **p < 0.01, ***p < 0.001. Model 1: Bivariate relationship with mass media exposure, Model 2: Mass media exposure and sociodemographic covariates, and Model 3: Includes interaction between mass media exposure and mother's education.

sociodemographic characteristics (Model 2), mothers exposed to mass media are 58% more likely to receive antenatal care and 60% more likely to receive postpartum care after their delivery. In contrast, the association between mass media and delivery by skilled attendant is reduced to non-significance with the addition of sociodemographic controls. Mother's education, urban residence, and wealth status significantly increase utilization of maternal healthcare services in Bangladesh. In Model 3 for skilled delivery care, the mass media-by-primary education interaction term is significant and less than 1.0. The predicted percentages (Fig. 2, Panel B) indicate that delivery with a skilled birth attendant in Bangladesh is higher among primary-educated mothers without mass media relative to those primary-educated mothers with mass media. In contrast, for the three other maternal education groups, skilled delivery care is higher among mothers with mass media exposure.

Nepal

In Nepal, exposure to mass media also significantly increases utilization of all three maternal healthcare services (Table 4). In Model 2, even after controlling for sociodemographic characteristics, mothers exposed to mass media are 54% more likely to receive antenatal care, 24% more likely to deliver their babies by skilled birth attendants, and 47% more likely to take postpartum care after their delivery. Mothers with higher education are 5 to 9 times more likely to receive maternal healthcare services than mothers with no education. The interaction in Model 3 for delivery care shows a different pattern in Nepal than in India and Bangladesh. Illustrated in Fig. 2, Panel C, a higher percentage of mothers with mass media exposure report delivery with a skilled attendant than mothers without mass media exposure in each education group. However, mothers with both higher education and mass media

exposure exhibit exceptionally high likelihood of delivery with a skilled attendant.

Pakistan

Finally, in Pakistan, media exposure is also positively associated with all three maternal healthcare outcomes (Table 5). In Model 2, after controlling for sociodemographic characteristics, mothers exposed to mass media are 58% more likely to receive antenatal care, 31% more likely to deliver their babies by skilled birth attendants, and 57% more likely to receive postpartum care after delivery. As in the other three countries, higher levels of mother's, husband's, and household socio-economic status tend to be positively associated with maternal healthcare use. Urban residence is positively related to postpartum care. In Model 3, none of the mass media-by-education interaction terms are statistically significant. Thus, unlike in the three other South Asian countries, mother's education does not moderate the association between mass media exposure and maternal healthcare at any of the three stages of pregnancy in Pakistan.

Discussion

Although previous studies have investigated the association between mass media exposure and maternal healthcare (Asp et al., 2014; Ghosh, 2006; Uddin, 2009; Zamawe et al., 2016), they did not consider the impact of mass media on comprehensive maternal healthcare services such as antenatal, delivery, and postpartum care. This study considers the association between mass media and maternal healthcare services at all three critical stages of pregnancy in South Asia, a developing context defined by insufficient maternal healthcare and elevated levels of maternal mortality. Our results show that mass media is positively

associated with maternal healthcare utilization in all four South Asian countries. This finding supports the first hypothesis. After controlling for sociodemographic characteristics of the mother, her husband, and the household, mothers exposed to mass media are 46–86% more likely to receive antenatal care, 24–53% more likely to deliver their babies by skilled birth attendants, and 36–94% more likely to receive postpartum check-ups after their delivery. Overall, we are impressed with the similarities across the four countries, given their variation in historical context, level of development, and health profiles. The similar patterns across these South Asian countries suggests a high degree of consistency in the association between mass media exposure and maternal healthcare.

This study finds that the association between mass media exposure and some maternal healthcare services varies by educational attainment in three of the four countries, which partially supports the second hypothesis. In India and Bangladesh, both mass media exposure and maternal education are positively associated with maternal healthcare. However, for some education groups in India and Bangladesh, healthcare utilization is not higher among mothers exposed to mass media relative to their counterparts without mass media exposure. Educated mothers already have more knowledge about science and biology; therefore, media exposure may not play as substantial a role in accessing healthcare among educated mothers in India and Bangladesh. However, in these two countries, mass media easily reaches less educated mothers and encourages them more in receiving maternal healthcare services. This pattern was also observed by Ghosh (2006), with exposure to mass media playing an important role in reaching vulnerable populations of illiterate and less privileged mothers in rural areas.

A different pattern among mass media exposure, mother's education, and maternal healthcare utilization is observed in Nepal and Pakistan. In Nepal, the disparity in delivery by skilled birth attendant between women exposed to mass media and women not exposed to mass media is exceptionally wide among higher educated mothers. In Pakistan, the mass media-by-education interactions are not statistically significant for any of the maternal healthcare outcomes. In other words, education does not moderate the association between mass media exposure and maternal healthcare utilization among Pakistani mothers. In Pakistan, 48% of mothers report no formal education, and many women still live in religiously conservative and male-dominated society (Biswas et al., 2017; Bloom et al., 2001; Umar, 2017). Their husbands and other family members may not allow them to attain education and may have control over women's media exposure. Moreover, their husbands, in-laws, and other family members may dictate whether and how they receive maternal healthcare, regardless of their educational level (Biswas et al., 2017). In sum, the second hypothesis is not supported in Pakistan, but it is modestly supported for some healthcare outcomes in India, Bangladesh, and Nepal.

This study makes several important contributions to the literature. First, it shows that the need for maternal healthcare services is unmet for many women in South Asian countries. For instance, 47% of Bangladeshi mothers did not deliver their child by skilled birth attendant and 44% of Nepalese mothers did not receive postpartum care. Second, this study suggests that mass media can have a vital impact in reducing maternal mortality and morbidity in developing countries. For example, organizations like WHO and UNICEF can broadcast maternal healthcare related information about antenatal visits, healthcare at delivery, and postpartum check-ups to pregnant women through TV, radio, and newspapers. Third, our data, which are drawn from DHS, are nationally representative surveys with comprehensive information regarding maternal healthcare services. Mass media exposure, maternal healthcare utilization, and sociodemographic factors are measured in a similar fashion across countries, which permits cross-country comparisons. Finally, our evidence that mass media can disseminate maternal healthcare-related information suggests that health organizations can also use mass media to communicate other health messages, such as the harmful effects of smoking, drinking alcohol, and risky sexual behavior.

Limitations

This study has four notable limitations. First, it focused on South Asian countries, so findings may not be generalizable to other developing countries. Future research should particularly examine whether mass media increases maternal healthcare in Sub-Saharan Africa since this region is also characterized by high levels of maternal mortality (Alkema et al., 2016; WHO 2019). Second, DHS did not consistently collect information on exposure to the internet and social media sites (e.g., Facebook, Twitter, etc.) that can also impact utilization of maternal healthcare services. DHS data collected in recent years are now assessing how women use cell phones. Third, our data included limited information about the amount or content of mother's mass media exposure. For example, mothers who watch TV daily may have more knowledge about maternal healthcare than mothers who occasionally watch TV. Finally, women were not asked about the quality or amount of the healthcare they received. For example, mass media exposure may not simply promote the utilization of healthcare, but it could increase their total number of antenatal visits and lead women to experience more respect when interacting with obstetricians or midwives (Vedam et al., 2017).

Conclusion

In sum, exposure to mass media is positively associated with utilizing maternal healthcare services at antenatal, delivery, and postpartum stages of pregnancy in South Asia. Importantly, mass media has the potential to reach low-educated mothers and encourage them to utilize maternal healthcare services. Policymakers, healthcare providers, and health organizations can implement mass media campaigns to publicize maternal health messages and motivate pregnant women to receive maternal healthcare services. In this way, exposure to mass media can help to reduce maternal mortality in developing countries.

Declaration of competing interest

None.

Credit authorship statement

Kaniz Fatema: Conceptualization, Methodology, Formal analysis, Writing - original draft. **Joseph T. Lariscy:** Supervision, Methodology, Writing - review & editing.

Ethical statement

This study did not require Institutional Review Board approval because we analyzed public-use secondary data.

Declaration of competing interest

None.

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