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Article

Knowledge Gap Hypothesis and Pandemics: Covid-19 Knowledge, Communication Inequality, and Media Literacy in Lebanon

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Abstract
The study examines the knowledge gap hypothesis during the Covid-19 pandemic in a country experiencing severe social, political, and economic turmoil and inequality. The research design assesses Covid-19 knowledge through 13 variables and incorporates income, education, gender, and media literacy among the socioeconomic status variables. It also includes television exposure, social media exposure, and social media posting as media use measures. A cross-sectional survey of adults living in Lebanon was implemented between March 27 and April 23, 2020. The study aimed for a nationally representative probability sample of 1,536 participants (95% CI, ±2.5%) and received 792 valid responses (51.6% response rate). The results show a positive relationship between Covid-19 knowledge and education, media literacy, and social media exposure, but no relationship between Covid-19 knowledge and income, gender, television exposure, and social media posting behavior. The evidence shows a widening of the knowledge gap for those more likely to post on social media and a narrowing of the knowledge gap for those more exposed to social media news, but the observed narrowing of the knowledge gap for television exposure was not statistically generalizable. Finally, the evidence shows that media literacy maintains the knowledge gap by almost identically increasing the knowledge level for both low and high socioeconomic groups, although the limitations in measuring media literacy merit further exploration.

Keywords
communication inequality; Covid-19 pandemic; health communication; knowledge gap hypothesis; media literacy

Issue
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1. Introduction

Covid-19 caused immense loss of life and wealth and resulted in global disruptions at scales not experienced in decades. Like previous health emergencies, those at the margins of society suffered disproportionately from the disease (Viswanath et al., 2020). Socioeconomic inequalities and structural discrimination have historically prevented marginalized communities from accessing quality healthcare, safe living quarters, proper education, and essential conditions for protecting themselves during health crises (Braveman et al., 2011; House & Williams, 2000). Such inequalities manifested themselves through higher Covid-19 mortality and morbidity rates among racial minorities, migrants, and lower-income classes (Greenaway et al., 2020; Lopez et al., 2021; Yaya et al., 2020). Associated with these systematic material inequalities are disparities in reaching quality health information, yet “virtually no attention has been paid to the issue of inequalities in communication and how they may have widened the divides and exacerbated the structural inequities” (Viswanath et al., 2020, p. 1743). The ubiquity of false health information on social media only exacerbated the situation.

The Covid-19 pandemic subsumed media attention and amplified what the World Health Organization (2020) called infodemics—misinformation and disinformation rapidly spreading on social media associated with transmission patterns, resistance to vaccination, and less knowledge about the disease (Pierri et al., 2022; Sallam

et al., 2020; Siddiquea et al., 2021). Nevertheless, credible media and information sources played a critical role in helping mitigate the viral spread (Sun et al., 2021), particularly because people rely on trusted information sources during crises (Van Aelst et al., 2021).

However, access to such information is not uniform across different groups, which has led to gaps in knowledge across social strata (Tichenor et al., 1970). The knowledge gap hypothesis suggests that when mass-mediated information is introduced into a social system, the higher socioeconomic status segments are likely to access and grasp this information faster than those of lower socioeconomic status, thereby widening the gap between groups (Tichenor et al., 1970). Unless communication campaigns intentionally disseminate information equally to various socioeconomic segments, a knowledge gap will arise, which will impede efforts to limit the spread of a disease (Ho, 2012).

Recent studies have shown that knowledge about Covid-19 symptoms, causes, transmission, and prevention was associated with positive health behavior, including vaccine acceptance, despite previous and recent literature questioning the strength of this relationship and explaining it through mediating variables (Bono et al., 2021; Ho, 2012; Iorfa et al., 2020; Viswanath et al., 2006). Recent meta-analyses have reported relatively high levels of good Covid-19 knowledge globally—in most cases more than 75% of the surveyed populations (Saadatjoo et al., 2021; Siddiquea et al., 2021), but most of these studies may have under-sampled underprivileged communities (Siddiquea et al., 2021). Therefore, this study aims to test the knowledge gap hypothesis by examining the public's Covid-19 knowledge levels and investigating how media behaviors may have helped widen or narrow the knowledge gap between different socioeconomic groups, as defined by gender, income, education, and media literacy.

The significance of the study lies in its application of the knowledge gap hypothesis to a country stark with its inequalities, particularly during the pandemic (Melki et al., 2022). Covid-19 reached Lebanon amid social, political, and economic turmoil. The country was experiencing a popular uprising, a severe economic crisis, hyperinflation, a governmental collapse, and a major explosion that devastated its capital. The currency suffered a 96% devaluation and unemployment surpassed 50%, all while Lebanon hosted 1.5 million refugees and suffered indirectly from regional conflicts (Kozman & Melki, 2018; Melki & Kozman, 2020). Despite that, Lebanon successfully mitigated the pandemic through effective strategic communication and collaboration between its government, media institutions, and private and public sectors. The country's chronically divided government and partisan media atypically unified their efforts to focus public attention on fighting Covid-19 by depoliticizing the disease, countering misinformation, and quickly diffusing accurate health information (Melki et al., 2022). Despite scarce resources and dire circumstances, Lebanon outdid many rich and stable countries in mitigating the disease. The outcome of its response materialized in one of the lowest case counts and test positivity rates globally, and the effort received international accolades for successfully mitigating the disease in the early phase of the pandemic and up until the devastating Beirut port explosion (Khoury et al., 2020). Therefore, Lebanon's multiple-crises situation provides a unique case where a starkly disparate population faced severe economic deprivation and political instability. Thus, the successful mitigation plan could be confidently attributed to communication efforts that informed the public.

Prior to Covid-19, few studies examined the knowledge gap hypothesis within a pandemic (Ho, 2012). Even fewer studies covered the Arab region and the Global South (Melki et al., 2021, 2022), despite renewed interest in examining communication inequalities associated with health inequalities (Viswanath et al., 2020). This study applies knowledge gap research for the first time in Lebanon, and in addition to the typically used socioeconomic status variables (education and income), it also examines gender and media literacy, two variables often ignored. Furthermore, the study includes legacy media exposure and social media exposure, as well as social media posting, a ubiquitous media behavior rarely examined in such contexts.

2. Literature Review

Knowledge gap research has traditionally used education as a key measure of socioeconomic status, although some scholars also incorporate income (Viswanath et al., 2006; Viswanath & Finnegan, 1996). Most research has found education to be positively associated with public knowledge of various health issues (Pitts et al., 2009; Seng et al., 2004; Slater et al., 2009; Viswanath et al., 2006; Wong et al., 2002). The theory suggests that highly educated individuals possess stronger cognitive structures, which provide stronger abilities to manage communication and a higher drive to seek new information (Viswanath et al., 2006). Indeed, emerging research has established a positive relationship between higher education level and better Covid-19 knowledge (Gerosa et al., 2021; Sallam et al., 2020; Wang et al., 2021; Zhong et al., 2020). However, income did not garner consistent results. While some previous studies established a positive relationship (Viswanath et al., 2006), others reported no relationship (Seng et al., 2004). Although we would assume that those with higher income also may have access to quality information and knowledgeable social networks, recent research has been inconclusive and mainly associated income with positive health behavior (Baena-Díez et al., 2020; Irigoyen-Camacho et al., 2020; Lau et al., 2020; Sallam et al., 2020). Therefore, we pose the following hypothesis:

> H1a: Education is positively associated with Covid-19 knowledge.

H1b: Income is positively associated with Covid-19 knowledge.

Our era of omnipresent information technology, ubiquitous social media, and prevalent infodemics has heightened the importance of media literacy as a critical pedagogy for educating the public about media effects and information verification (De Abreu et al., 2017). A growing cohort of studies has shown that this pedagogical approach, which aims to instill critical media consumption and production skills, has been effective as an intervention strategy in multiple health situations (Halliwell et al., 2011; Jeong et al., 2012; Melki et al., 2015; Yates, 1999). Emerging research also suggests that media literacy could serve as a long-term preventive strategy for mitigating future pandemics (Melki et al., 2021, 2022; Wong et al., 2021), particularly for marginalized communities (Austin et al., 2021). Therefore, we surmise:

H1c: Media literacy is positively associated with Covid-19 knowledge.

Research about gender and Covid-19 knowledge has returned conflicting findings. While Sultana et al. (2022) reported that women scored higher on Covid-19 knowledge assessments in Bangladesh, Pinchoff et al. (2020) found the opposite in India, and Marudachalam et al. (2022) found no significant gender differences in the same country. Knowledge gap research that includes gender comparisons remains rare (Viswanath & Finnegan, 1996), and officials often fail to consider gender-sensitive content and media that effectively target women (Anhang et al., 2004; Chhetri & Lepcha, 2022). Furthermore, higher Covid-19 mortality and morbidity rates among men are attributed to economic, cultural, and lifestyle factors (Bwire, 2020; Jin et al., 2020), but could knowledge also partially explain this phenomenon? Since gender discrimination and gendered media practices, despite their global ubiquity (Byerly, 2013), vary between countries, and are quite pronounced in Lebanon and the Arab region (Melki & Hitti, 2020), it is essential to assess if gender was related to Covid-19 knowledge. Therefore, we ask:

RQ1: Is there a relationship between gender and Covid-19 knowledge?

During pandemics, the media become the main source of information for society (Ho, 2012). Initial media coverage of a disease often attracts intense public attention, which dissipates later as the disease gets under control (Ho et al., 2007). Studies have established that media exposure enhanced the public's knowledge and awareness of health issues, despite significant gaps in knowledge among various marginalized groups (Seng et al., 2004; Wong et al., 2002). Research shows that different media affect health knowledge differently. While television tends to be effective with the general public, print media are more effective with high socioeconomic groups and elite audiences, but "findings on channel influence and the knowledge gap are inconclusive and suggest needed areas of study" (Viswanath & Finnegan, 1996, p. 202).

Recent studies continue to reflect mixed findings. Gerosa et al. (2021) found that exposure to radio, print, and social media was associated with lower Covid-19 knowledge in the US, while television showed no significant relationship. Wang et al. (2021, p. 4), however, found that none of the legacy media had a relationship with knowledge, while "internet media" was positively associated with knowledge in China. In contrast, Granderath et al. (2021) found social media had a negative association, while television and newspapers had no relationship with Covid-19 knowledge in Germany. Since the amount of coverage, the news framing, and the narratives journalists employ are associated with individuals' attention and awareness of the diseases covered in the media (Ho et al., 2007; Shih et al., 2008), it is plausible that these contradictory findings are related to how Covid-19 was covered in each country. Studies show various governments and media, especially in the US, engaged in politicizing the disease, which may have led ideologized groups to adopt unscientific beliefs and conspiracy theories (Cinelli et al., 2020; Zarocostas, 2020). Since Lebanon's government, health officials, and public and private media provided a highly consistent communication strategy, we predict:

H2a: Television exposure is positively associated with Covid-19 knowledge.

H2b: Social media exposure is positively associated with Covid-19 knowledge.

In addition to facilitating information consumption, social media allow information production and dissemination, but past research has focused mainly on assessing the former media behavior. Emerging research has established a relationship between social media posting and health awareness and behavior, including those related to sun-safety measures for skin cancer protection (Nabi et al., 2019) and alcohol consumption (Alhabash et al., 2021). Although "there is some evidence that posting online affects self-concept, little is known about to what extent it influences the self: Does posting online predict future attitudes, intentions, and behaviors, or just general self-concept?" (D'Angelo et al., 2015, p. 60). Therefore, we inquire whether those more likely to post on social about Covid-19 are also more knowledgeable about the disease:

RQ2: Is social media posting associated with Covid-19 knowledge?

The chief argument of the knowledge gap hypothesis is that individuals from various socioeconomic segments obtain, understand and retain health information from

different communication channels differently (Tichenor et al., 1970). Previous studies suggested that television either narrows or maintains the knowledge gap between high and low socioeconomic groups, while print and online media often increase the knowledge gaps, given television's broad audience and the latter's elite orientation (Boukes & Vliegenthart, 2019; Kwak, 1999; Lind & Boomgaarden, 2019; Viswanath & Finnegan, 1996). However, research on media platform effects remains inconclusive and may be influenced by various geographic, political, and social factors (Viswanath & Finnegan, 1996). For instance, research has shown that the knowledge gap tended to decrease with intensified coverage, controversy, and topics of national concern (Kwak, 1999; McLeod & Perse, 1994; Viswanath & Finnegan, 1996), all of which are conditions that apply to the pandemic.

Covid-19 research on the knowledge gap hypothesis remains scarce (Viswanath et al., 2020), and the only two recent studies published had inconsistent findings. While Gerosa et al. (2021) found no support for legacy or online news and social media in contributing to the knowledge gap in the US, Wang et al. (2021) found that online media but not legacy media contributed to widening the knowledge gap in China. In line with previous research, our study expects that television will narrow the knowledge gap and social media will widen it. Our study excluded print and radio because Lebanese media during the past decade had major financial problems that led to the closure of most radio stations, and print media stopped distributing during that period (Melki & Kozman, 2020). Therefore, we focus on television and social media, the two main media used during the pandemic (Melki et al., 2022). We surmise:

H3a: The Covid-19 knowledge gap will be smaller for those more exposed to television.

H3b: The Covid-19 knowledge gap will be greater for those more exposed to social media.

H3c: The Covid-19 knowledge gap will be greater for those more likely to post on social media.

Finally, we ask whether media literacy had any influence on the Covid-19 knowledge gap. Media literacy education was only recently introduced to Lebanon and mainly to universities. We suspect that higher socioeconomic groups will benefit disproportionately from it. Therefore, we ask:

RQ3: Does media literacy widen the Covid-19 knowledge gap?

3. Methods

The study uses a cross-sectional researcher-administered survey of adults living in Lebanon between March 27 and April 23, 2020. Phone surveys were the only viable option, given the social distancing requirements. Although the knowledge gap hypothesis requires measuring knowledge change over time, we assume that before the pandemic Covid-19 knowledge was equally non-existent across socioeconomic groups.

3.1. Sample and Procedure

A sample of 1,536 participants was calculated based on a population of 6 million (95% CI, ±2.5%). The probability sample was based on all possible mobile numbers in the country. First, all possible number ranges were acquired from the Telecommunication Ministry. Then, a sampling frame based on the groups of numbers was developed, and the proportion for each group was developed. Finally, a proportional random sample of numbers was selected from each group of phone numbers.

Researchers contacted their designated list of mobile numbers with each being called at least five times. Numbers that did not respond after five calls and invalid numbers were replaced up to twice by adding +1. For those who answered, researchers read the consent form and conducted the survey with consenting respondents, in accordance with IRB protocol LAU.SAS.JM1.20/Mar/2020. Researchers marked those who declined as "refused." Some respondents who accepted to participate but did not complete more than 85% of the questionnaire were removed from the final dataset. The final tally was 792, a 51.6% response rate.

3.2. Instrument and Measurements

The questionnaire comprised 15 close-ended questions, required approximately 12 minutes, and generated 52 variables, 21 of which were used in this study.

Demographic data were collected, including age (1 = <18, 2 = 18–22, 3 = 23–30, 4 = 31–45, 5 = 46–65, 6 ≥65), gender (1 = male, 2 = female), education (1 = elementary school or less, 2 = middle school or less, 3 = high school or less, 4 = university or higher), and income (1 = 0, 2 ≤750,000 LBP, 3 = 750,000–1,500,000 LBP, 4 ≥1,500,000 LBP). Participants were also asked whether they received any media literacy training and answered on a 3-point response scale (1 = never, 2 = a bit, and 3 = a lot).

To assess television and social media exposure, participants were asked how often they followed Covid-19 news through these media. Responses were measured on a 4-point scale (1 = *never*, 4 = *often*). Using the same response scale, participants were asked how often they posted or shared news about Covid-19 on social media.

Covid-19 knowledge was measured through two series of questions. First, participants were asked to answer "1 = yes" or "2 = no" to the question: "Are the following groups at higher risk of dying from Covid-19?'' The list included older people over 65; people with diabetes, heart, or lung diseases; immunodeficient

individuals; smokers; and the following false beliefs that circulated in social media: children younger than eight; Chinese and Iranians; and those with blood type O+. Second, participants were asked if they "can name the main symptoms of Covid-19," and interviewers were instructed to check any response that matched the following list (without spelling them out): fever, cough, shortness of breath, chest pain, bluish lips or face, and confusion. The questions resulted in 13 variables. The correct answers were added, and the false answers were subtracted, which resulted in a composite variable with a [0–10] range, distributed normally according to Figure 1, with a mean of 4.84 and (*SD* = ±1.454).

3.3. Data Analysis

The study used SPSS 26. Descriptive variables were presented as frequencies and percentages. To test the main hypotheses, we used a linear regression model to examine the direct effects of the independent variables (TV exposure, social media exposure, and social media posting) on the dependent variable *Covid-19 knowledge*. Using the "enter" method, we entered the demographic variables in block 1, the education and media literacy variables in block 2, and the media variables in block 3. Then, we entered, in block 4, the interaction variables, which were created by multiplying the education variable with each of the media variables to reduce possible multicollinearity. Results were presented as Beta (β) and their corresponding 95% CI. Finally, to assess the statistical significance of the interaction between media literacy and education on Covid-19 knowledge, we ran a two-way factorial ANOVA. Table 1 shows the distribution for gender, age, income, education, and media literacy.

3.4. Limitations

The study faced the following limitations: 27.2% (418) refused to participate, 18.2% (279) of phone numbers were not valid or did not answer despite two

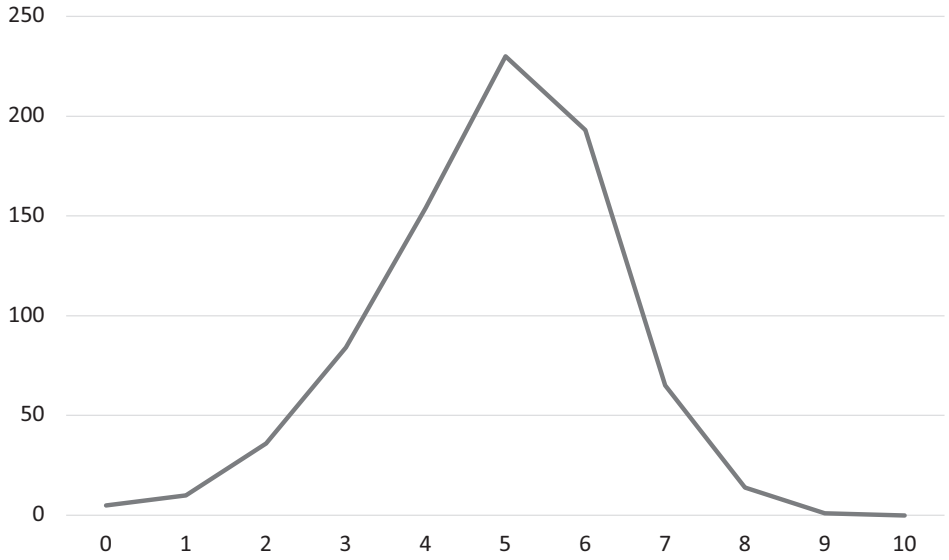

Figure 1. Distribution of Covid-19 knowledge scores (*Mean* = 4.84, *SD* = ±1.454).

Table 1. Sample demographic distribution.

Sample (N = 792)		n (%)
Gender	Men	443 (56.1)
	Women	346 (43.9)
Age	≤30	288 (37.0)
	>30	491 (63.0)
Income (monthly, LBP)	0	39.4 (291)
	<750,000	21.4 (158)
	750,000–1,500,000	20.4 (151)
	>1,500,000–3,000,000	18.9 (139)
Education	< University	477 (62.1)
	University	291 (37.9)
Media Literacy	No	736 (93.0)
	Yes	55 (7.0)

replacements, and 3% (47) did not sufficiently complete the survey. Although the geographic distribution was largely proportional to the actual population, three governorates were somewhat underrepresented and the capital was slightly overrepresented, which reflects that many Lebanese from these areas work and live during the week in Beirut. In addition, men, those older than 30, and those with university degrees were overrepresented: 50.4% of Lebanese are men, 50.3% are older than 30, and 21% hold university degrees (United Nations, 2022). Given the severe economic situation and high unemployment, assessing the representativeness of the income is difficult, but the high percentage of those with no and low income accurately reflect reports that "82% of the population lives in multidimensional poverty" (Lebanon: Almost three-quarters, 2021). While the low level of media literacy poses a threat to the findings, this percentage nevertheless reflects recent studies in Lebanon (Melki & Kozman, 2020). Moreover, the measure of media literacy is admittedly rudimentary and begs the need to develop more sophisticated media literacy measures for future endeavors, particularly for survey methodology. Therefore, findings regarding media literacy should be interpreted with caution, given these limitations. Finally, the 51.6% response rate, while typical for a phone survey, creates some selection bias, which is a standard validity threat in survey methodology.

4. Results

Table 2 shows the results of the linear regression analysis predicting Covid-19 knowledge. The total model explains 16.2% of the variance in the dependent variable. When it comes to gender, age, and income, the results show no significant association with Covid-19 knowledge. Although both gender (β = 0.081, p < 0.05) and income (β = 1.77, p < 0.01) present significant positive correlations alone, they both become not significant once education and media literacy are entered. Therefore, H1b, which predicts a positive relationship between income and Covid-19 knowledge is not supported. In addition, gender (RQ1) is not associated with Covid-19 knowledge.

However, both education (β = 0.47, p < 0.01) and media literacy (β = .1, p < 0.01) return significant positive correlations with Covid-19 knowledge. Therefore, H1a, which predicts a correlation between education and Covid-19 knowledge, and H1c, which predicts the same relationship with media literacy education, are supported.

As for the media variables, social media exposure has a significant positive relationship (β = 0.274, p < 0.01), while television exposure and social media posting are not significant. Therefore, H2b, which predicts that social media exposure is associated with Covid-19 knowledge, is supported, but H2a, which predicts the same for television is not supported. Furthermore, RQ2, which asks whether social media posting is associated with Covid-19 knowledge is also not supported.

More importantly, the interaction between education and social media exposure returns a significant negative relationship (β = −434, p < 0.01), and the interaction between education and social media posting returns a significant positive value (β = 0.21, p < 0.01), but the interaction between education and television is not significant.

Figure 2 shows the interaction between television exposure and education on Covid-19 knowledge. Among those who have higher education, knowledge scores remain virtually the same for high and low television exposure. But for the low education group, the knowledge score jumps by 0.43 points between television exposure groups. However, the data cannot be generalized statistically. Therefore, H3a, which predicts the knowledge gap will be smaller for those more exposed to television, is not supported.

Figure 3 shows the interaction between social media exposure and education on Covid-19 knowledge. Among those who have higher education, knowledge scores remain virtually the same for high and low social media exposure. But for the lower education group, the knowledge score jumps by 0.17 points for the high social media exposure group. Therefore, H3b, which predicts the knowledge gap will be greater for those more exposed to social media, is not supported. In fact, the data show a statistically significant narrowing of the knowledge gap and an increase in Covid-19 knowledge for those in the lower education category.

Figure 4 shows the interaction between social media posting and education on Covid-19 knowledge. Among those with higher education, knowledge scores increase by 0.24 points between low and high social media posting categories. But for the lower education group, the increase in knowledge score between the high and low social media posting categories is only 0.16 points. Therefore, H3c, which predicts the knowledge gap will be greater for those more likely to post on social media, is supported with caution. Given that the difference (0.08) is quite small, we can also claim a maintenance rather than an increase in the knowledge gap.

Figure 5 shows the interaction between education and media literacy on Covid-19 knowledge. Among those with higher education, knowledge scores increase by 0.71 points between the no media literacy and the media literacy categories. Almost identically, the knowledge score for the lower education group increases by 0.74 points. However, as mentioned previously, findings regarding media literacy should be interpreted cautiously, given the rudimentary measurement used.

Table 3 shows the two-way factorial ANOVA assessing the statistical significance of this interaction. Education returned a significant value ($F(1)$ = 17.81, p < 0.01), and so did media literacy ($F(1)$ = 13.89, p < 0.01), which reconfirms that education and media literacy have independent effects on Covid-19 knowledge. However, the interaction between education and media literacy was not significant, which suggests that the effect of media

Table 2. Linear regression analysis to test the direct effects of the independent variables on Covid-19 knowledge.

	Zero-order	Model 1	Model 2	Model 3	Model 4
		β [95% CI]	*β* [95% CI]	*β* [95% CI]	*β* [95% CI]
Block 1: Demographics					
Gender	0.044	.081 [3.87, 4.93] *	0.057 [−0.037, 0.371]	0.049 [−0.063, 0.347]	0.051 [−0.055, 0.354]
Age	−0.043	−0.066 [−0.18, 0.008]	0.005 [−0.086, 0.099]	.01 [−0.082, 0.107]	.011 [−0.080, 0.11]
Income	0.149 **	1.77 [0.11, 0.27] **	.051 [−0.025, 1.36]	0.039 [−0.039, 0.124]	0.041 [−0.037, 0.126]
Incremental R^2 (%)		3.3			
Block 2: Education & Media Literacy					
Education	0.355 **		0.32 [0.349, 0.557] **	0.313 [0.339, 0.549] **	0.47 [0.174, 1.16] **
Media Literacy	0.174 **		0.112 [0.247, 1.037] **	0.106 [0.207, 1.001] **	0.1 [0.178, 0.969] **
Incremental R^2 (%)			11		
Block 3: Media Exposure & Uses					
Television Exposure	0.01			0.033 [−0.058, 0.164]	0.028 [−0.285, 0.375]
Social Media Exposure	0.087 **			0.021 [−0.068, 0.127]	0.274 [1.21, 6.45] **
Social Media Posting	0.146 **			0.064 [−0.011, 0.216]†	−0.063 [−0.311, 0.109]
Incremental R^2 (%)				0.6	
Block 4: Interactions					
Education × TV Exposure	0.291 **				0.023 [−0.096, 0.111]
Education × Social Media Exposure	0.282 **				−0.434 [−0.229, −0.04] *
Education × Social Media Posting	0.337 **				0.21 [0.014, 0.265] *
Incremental R^2 (%)					1.3
Total R^2 (%)					16.2

Note: † p = 0.07, * p < 0.05, ** p < 0.01.

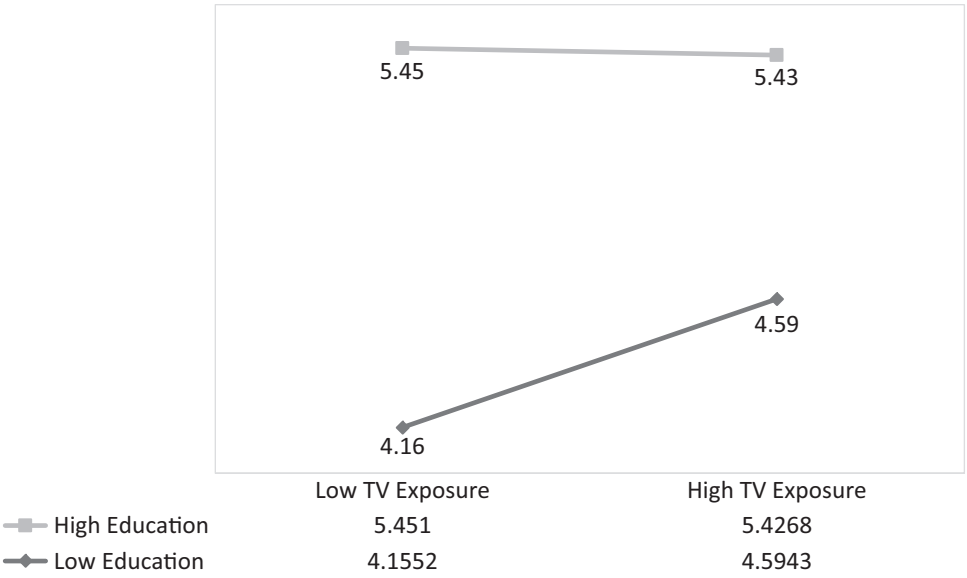

Figure 2. Interaction between education and Television exposure on Covid-19 knowledge: Covid-19 knowledge score [0–10] across education and television exposure levels.

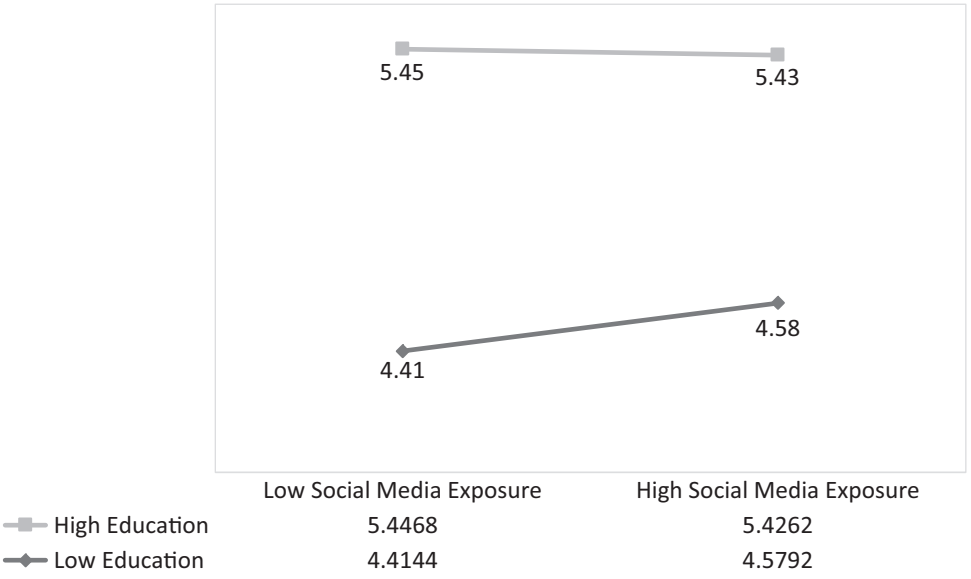

Figure 3. Interaction between education and social media exposure on Covid-19 knowledge: Covid-19 knowledge score [0–10] across education and social media exposure levels.

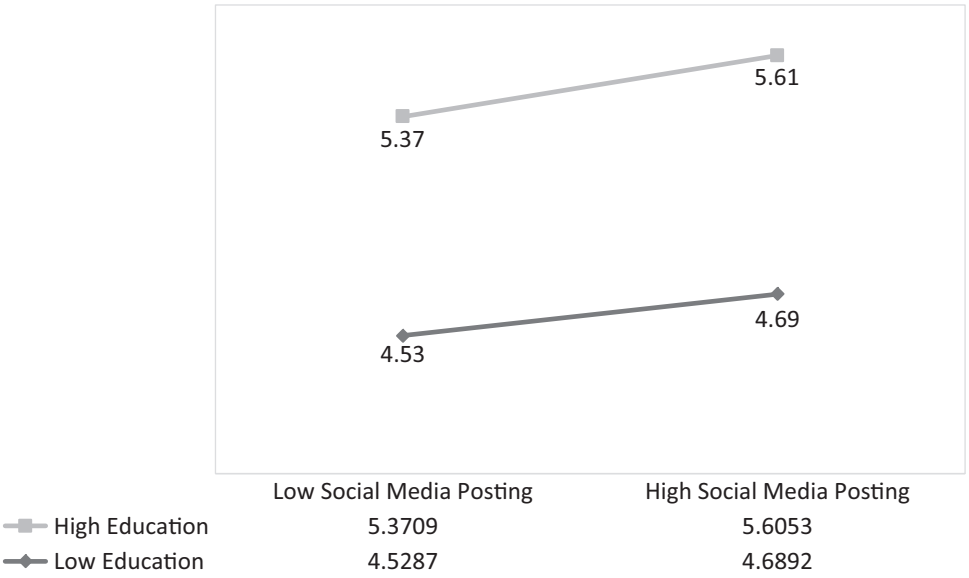

Figure 4. Interaction between education and social media posting on Covid-19 knowledge: Covid-19 knowledge score [0–10] across education and social media posting levels.

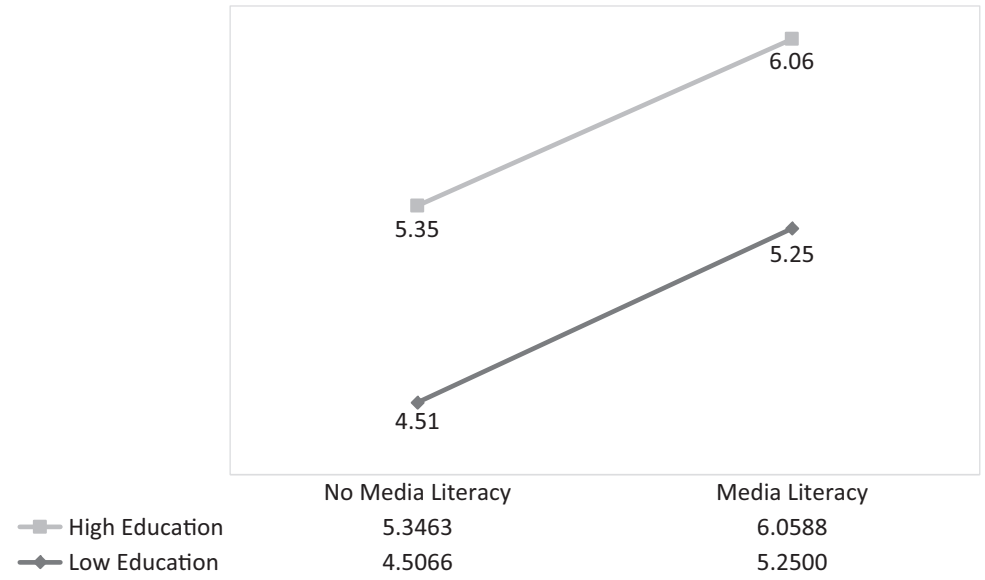

Figure 5. Interaction between education and media literacy on Covid-19 knowledge: Covid-19 knowledge score [0–10] across education and media literacy.

Table 3. Two-way factorial ANOVA for testing the significance of the interaction between education and media literacy on Covid-19 knowledge score.

Predictor	Sum of Squares	df	Mean Square	F	p
Corrected Model	169.442[a]	3	56.481	31.64	0.00
Intercept	5,237.893	1	5,237.893	2,934.74	0.00
Education	31.788	1	31.788	17.81	0.00
Media Literacy	24.794	1	24.794	13.89	0.00
Education x Media Literacy	0.011	1	0.011	0.006	0.94
Error	1,361.792	763	1.785		

literacy and education is the same for low and high socioeconomic groups, as reflected in the almost identical increase in Covid-19 knowledge scores. In other words, while education and media literacy both independently increase the knowledge scores, media literacy does not necessarily help close the knowledge gap, since the increase for both high and low-education groups is identical. Therefore, the answer to RQ3 is that media literacy maintains the knowledge gap while increasing the knowledge level for both low and high socioeconomic groups, a finding that should be cautiously interpreted, given the limitations in measuring media literacy.

5. Discussion and Conclusion

This study examined the knowledge gap hypothesis during the height of the Covid-19 pandemic in Lebanon, a country that was experiencing multiple crises. The findings show a positive relationship between Covid-19 knowledge and education, media literacy, and social media exposure, but no relationship between Covid-19 knowledge and income, gender, television exposure, and social media posting. The evidence supports a widening of the knowledge gap for those more likely to post on social media, but the observed narrowing of the knowledge gap for high television exposure was not statistically generalizable. In addition, data show that social media exposure led to a narrowing of the knowledge gap. Finally, media literacy seems to maintain the knowledge gap, while significantly increasing the knowledge level for both low and high socioeconomic groups, although future research on media literacy should use more sophisticated measures.

These findings continue to add inconsistency to the knowledge gap hypothesis. When it comes to legacy media, our findings are consistent with both Gerosa et al. (2021) and Wang et al. (2021), who found no evidence that legacy media widen the Covid-19 knowledge gap. However, our finding that social media exposure narrows the Covid-19 knowledge gap contradicts Wang et al. (2021), who found that online media contributed to widening the gap, and Gerosa et al. (2021), who found no support for social media contributing to the knowledge gap. Nevertheless, consistent with previous research, education remains a potent indicator for identifying the knowledge gap (Lind & Boomgaarden, 2019; Viswanath & Finnegan, 1996).

Our two potentially unique findings that social media posting widens and media literacy maintains the knowledge gap between high and low socioeconomic groups merit attention and caution. Both improve the knowledge score for low and high socioeconomic groups, and both seem to be related to each other. Media literacy promotes critical thinking, effective access to information, and analysis of media content; it also empowers individuals with competencies that help to verify Covid-19 misinformation and disinformation (Melki et al., 2021). The growing evidence that media literacy effectively helps in various health issues behooves health communication scholars and public health officials to seriously consider it as a long-term society-wide health intervention strategy (Halliwell et al., 2011; Jeong et al., 2012; Melki et al., 2015; Yates, 1999), particularly for mitigating future pandemics (Melki et al., 2021, 2022; Wong et al., 2021), and countering communication inequality among marginalized communities (Austin et al., 2021). However, scholars should further investigate these claims with more robust media literacy measures and larger media literacy samples. As for social media posting, further examination of individuals who prolifically post on social media is required to discern trends for this understudied media behavior (D'Angelo et al., 2015), particularly given the potential role these individuals may have in spreading false information and conspiracy theories. Emerging research shows that instilling media literacy competencies among such prolific posters may help spread quality information and reduce the uncritical spreading of false posts during health campaigns (Melki et al., 2021). Future research should also confirm the relationship between such high social media engagement and health awareness and behavior for different health issues (Alhabash et al., 2021; Nabi et al., 2019).

Despite rampant gender discrimination in Lebanese laws and social and political institutions and widespread sexism in its media (Melki & Hitti, 2020), our study did not find a significant difference between men's and women's Covid-19 knowledge. This may be explained by the high education rate among women in Lebanon. Across the higher education sector, the majority of students are women, although this does not translate

into the workforce, which is dominated by men, especially at the upper levels of management (Melki & Mallat, 2016). Still, Covid-19 knowledge is not the only concern when it comes to gender, since other studies in Lebanon found that women are more likely than men to believe in Covid-19 misinformation (Melki et al., 2021), which points to a gender gap in news consumption, particularly because women are more likely to avoid news perceived to be created for men (Hart et al., 2009). The unequal domestic burdens for women and exclusion from political and social life also contribute to distracting them from the news (Melki & Hitti, 2020), which is largely political in Lebanon. This gender gap requires further investigation and more sophisticated intersectional gender assessment. Although our study assessed gender within a larger model that incorporated income, age, media literacy, and education, a limitation of this study was its inability to capture intersectional marginalization within racial, sectarian, and geographic subgroups, due to the difficulty of pinpointing these overlapping groups in Lebanon. Future research should adopt an intersectional framework that accounts for multiple overlapping identity lenses beyond gender, including ability, nationality, sexuality, ethnicity, employment status, religious sect, and refugee status, among others (Crenshaw, 1991; Okolosie, 2014). In addition, future research should adopt non-binary measures of gender to capture other gender identities. However, several studies we have recently conducted in Lebanon that include three options for gender (men, women, other) consistently return no values for *other*. This may be due to participants' fear of selecting non-confirmatory options but may also reflect dominant social norms that continue to subscribe to the binary gender division—another matter that media literacy pedagogies can help address.

As for why income also did not relate to Covid-19 knowledge, it is plausible that the severe economic crisis the Lebanese people were facing contributed to this finding (Melki & Kozman, 2020). By the time Covid-19 hit Lebanon, the Lebanese currency had devalued by over 90% and Lebanese people faced sudden hyperinflation. Although the cost of fuel and staples skyrocketed, most media-related costs—including mobile and internet fees—remained constant because the government continued to subsidize them. Perhaps in countries where education is widely and deeply diffused and the cost of access to legacy and new media is low, income does not contribute to the knowledge gap. Still, the finding could be a byproduct of the severe economic crisis, where even those we considered as middle- and upper-income groups were actually reduced to one lower-income group due to the drastic currency devaluation and hyperinflation.

Aside from income, the multiple Lebanese crises, during which this study was conducted, provide an extreme context of social heterogeneity. Various sectarian, political, and ideological divides characterized that country and period.

Research has shown that heterogeneous societies exhibit larger knowledge gaps than homogenous societies (Viswanath & Finnegan, 1996). In complex pluralistic societies, multiple power centers compete for influence, often publicly through media and political institutions. These may lead to differential knowledge centers and communication inequalities. The low mean score for Covid-19 knowledge (4.84/10) may confirm this situation, although Covid-19 unified that society, its media, and its fighting policies, for a short period. A recent study from another conflict zone in Cameroon also pointed to low Covid-19 knowledge levels (Nicholas et al., 2020). Further research in societies undergoing tumultuous change may help pinpoint specific knowledge gaps and help target them with specific communication to improve knowledge.

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Conflict of Interests

The author declares no conflict of interests.

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