ICA 年度雙語論文

新冠肺炎虛假資訊接觸對認知和態度的負面影響：探究數字媒體資訊近用性的形塑作用

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摘要

　　隨著新冠肺炎疫情的爆發和全球性傳播，相關虛假資訊在社群媒體平台滋生、流傳、誤導公眾。那麼，新冠疫情相關的虛假資訊是通過怎樣的機制危害公眾的認知與態度？本研究通過對四個文化相近、但資訊近用性不同的亞洲城市（即中國大陸的北京、香港、新加坡、台北）進行實證研究，考察了接觸疫情虛假資訊對錯誤觀念、疫苗態度、

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知識水準的負面影響。本研究的數據來自2021年8月開展的一項線上
大型問卷調查，共有4,094名受訪者參與。研究結果顯示，社群媒體
中流行的虛假資訊會使人們對於新冠疫情產生錯誤的認知、形成抵制
疫苗態度，並阻礙學習相關知識。此外，我們也發現在數字媒體資訊
近用性高的社會(如香港、新加坡)中，虛假資訊的接觸和分享較少出
現，負面影響也較低；而在對數字媒體資訊近用性受限的社會中(如北
京)，虛假資訊的接觸和分享則較為頻繁，並產生較高的負面影響。最
後，我們討論了本研究發現對虛假疫情資訊的理論與實踐意義。

關鍵詞：新冠疫情、虛假資訊、數字媒體資訊近用性、認知、抵制疫
苗態度

ICA Annual Bilingual Paper

The Role of Digital Information Accessibility in Shaping the Relationships of Exposure to COVID-19 Misinformation and Cognitive and Attitudinal Effects in Asia

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Abstract

What harms has COVID-19 misinformation circulating on social media inflicted on the general public's cognition and attitudes? We investigated this concern by linking exposure to popular COVID-19 misinformation with three adverse cognitive and attitudinal outcomes in four culturally similar Asian societies (i.e., mainland China, Hong Kong, Singapore, and Taiwan) that differ in digital information accessibility. Data collected from an online survey of

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4,094 adult respondents in August 2021 demonstrate that exposure to misinformation on popular social media platforms negatively affected respondents' misbeliefs of and incorrect knowledge of COVID-19 and anti-vaccine attitudes. Moreover, sharing misinformation was found to mediate the relationship of misinformation exposure and cognition and attitudes. When situating these relationships in the four societies, we found that exposure and sharing were less frequent in societies with free access to digital information but more frequent in societies with restricted accessibility. Implications of these findings for containing the infodemic are discussed.

Keywords: COVID-19 pandemic, misinformation, information accessibility, cognition, anti-vaccine attitudes

前言

　　曠日持久的新冠肺炎疫情不僅威脅著人類的生命和健康，也帶來了一個令人擔憂的現象：「資訊流行病」（infodemic）（見Cinelli et al., 2020）。廣義而言，資訊流行病是指，與某一特定議題相關的資訊在短時間內，受特定事件的激發，而出現快速傳播的現象（Pan American Health Organization, 2020, p. 1）；錯誤資訊、謠言、虛假資訊和假新聞等均屬資訊流行病。具有誤導性的疫情虛假資訊五花八門，從病毒起源、感染渠道、治療方法，到對疫苗的懷疑，不勝枚舉。這些虛假資訊如病毒般在社群媒體和人際網絡中大量傳播，對人們的態度和行為可能產生不良的影響。

　　因此，學術界極為關注資訊流行病及其對疫情防控的影響。相關研究發現，虛假資訊接觸會危害民眾對新冠疫情的認知和行為。例如，不分辨就盲目分享（Rossini et al., 2021）、產生焦慮不安等負面情緒（Liu & Huang, 2020）、抗拒和抵觸科學的防疫措施（Lee et al., 2020）、對接種疫苗猶豫不決（Dror et al., 2020）等。既有研究亦發現了導致虛假資訊接觸和分享的多種因素和機制，包括個人層面的差異，如科學知識水準和政治認同（Buchanan & Benson, 2019; Pennycook et al., 2020），也包括資訊本身的屬性，如負面情緒誘發性等（Kumar et al., 2021）。然而，當前研究很少探析宏觀社會因素對虛假資訊接觸的影響，而宏觀社會因素恰恰是不可忽視的。

　　為了填補現有研究之空白，本研究檢驗數字媒體資訊近用性（digital information accessibility）這一關鍵的社會因素在虛假資訊傳播及影響上的形塑作用。具體而言，我們提出的主要研究問題是，資訊近用性如何影響公眾接觸與分享虛假資訊，從而削弱或增強虛假資訊對民眾在認知和態度方面的負面影響，如形成對新冠肺炎的錯誤認知、妨礙建立正確知識、並使公眾形成抵制疫苗的態度等。

　　在社群媒體上廣泛傳播的疫情虛假資訊，無論在類型、屬性、數量、來源、話術等方面都不相同，在不同的社會環境中亦有顯著差異，這也是本研究關注數字媒體資訊近用性這一社會因素的初衷所在。生活在不同社會政治體制和媒介環境中的民眾，對於網絡資訊的

接觸有難有易，對於網絡資訊的認知和接受也會存在差異（Cho et al., 2009; Eveland, 2001）。因此，本研究選取四個在地域、文化上接近，但數字媒體資訊近用性水準相差較大的亞洲城市（即北京、香港、新加坡和台北）作為研究對象。同時，我們嘗試建立一個整合性模型，來揭示在不同的社會資訊環境之下，接觸和分享虛假疫情資訊如何影響公眾對虛假資訊的認知、對疫苗的態度、以及相關知識水準。

　　本研究將有助於進一步拓展我們對虛假資訊負面影響的了解。首先，本研究對於數字媒體資訊近用性的探討填補了既有研究對社會層面變量研究之不足。數字媒體資訊近用性作為一個至關緊要的社會因素，對新冠疫情虛假資訊的接觸程度發揮著重要的解釋性作用。而虛假資訊接觸又會進一步引發人們的後續行為，比如把虛假資訊分享給他人，或者對虛假資訊予以辯駁。其次，新冠疫情已成為全球性危機，如何有效應對資訊流行病，是一項亟待政策制定者和社群媒體運營方解決的重要問題。本研究基於亞洲四個城市的發現，可以在其他社會環境中進行進一步驗證，從而為應對數字媒體資訊流行病提供可參考的政策建議。

相關理論文獻探討

數字媒體資訊近用性

　　既有研究證實，新冠肺炎疫情相關的虛假資訊接觸頻率及分享行為與個人特質顯著相關，如收入情況、教育程度、所屬黨派等（Chadwick & Vaccari, 2019; Seo et al., 2021）。但不容忽視的是，宏觀社會因素同樣會對虛假資訊的接觸和分享造成影響。例如，在資訊自由流動、頻繁更新的社會環境中，受眾得以接觸到豐富的新冠肺炎相關資訊，這使他們更容易依靠經過證實的可靠資訊來識別虛假資訊（Gil De Zúñiga et al., 2020; Oeldorf-Hirsch, 2018）。因此，數字媒體資訊近用性在影響錯誤信息接觸及其所產生的後果方面發揮著重要的作用。

　　根據Wei和Lo（2021）的定義，「資訊近用性」是指受眾能夠自由獲取豐富、多樣新聞資訊的程度。在民主程度高的社會，資訊近用性較

高，故民眾可以享有更加豐富、即時的資訊。在本研究中，我們將「數字媒體資訊近用性」界定為公眾在數字媒體平台（例如在線新聞網站、手機新聞客戶端、社群媒體平台）獲取新冠肺炎相關資訊的自由程度，如該資訊是否來源多樣、是否數量夠大、能否即時更新。本研究主要比較北京、香港、台北、新加坡這四個亞洲城市在「在數字媒體資訊近用性」上的不同。雖然這四個城市在地域和文化上相近，但因政治制度和社會構成有所不同，造成了資訊近用性方面的顯著差別。因此我們認為，在針對以上四地新冠肺炎疫情虛假資訊的研究中，「數字媒體資訊近用性」是一個值得深入探究的社會層面宏觀變量。

根據以上定義，「數字媒體資訊近用性」是一個具有多面向的概念。它包括硬體部分（例如，網絡普及發展水準、資訊通訊基礎設施狀況）和軟體部分（例如，全球競爭力、語言多樣性、民眾自由指數等）（Biehal & Chakravarti, 1983; Kauffman & Techatassanasoontorn, 2010; Li et al., 2020; Wei & Lo, 2021）。這些因素共同構成了一個社會的數字媒體環境。

如表一所示，中國大陸、香港、台北、新加坡在以上各類指標上有不同的表現。就全球競爭力而言，中國大陸排名第四，其後分別是香港、新加坡、台北。就資訊通訊基礎設施指數而言，國際電信聯合會（ITU）在2017年發佈的排名顯示（缺台灣排名），香港位居全球第六位，新加坡列第18位，而中國大陸僅排在第80位。

網絡普及方面，四地均享有便利且普及的互聯網（Wei & Lo, 2021）。然而，需要注意的是，近年來，智慧手機的普及大幅提升了中國內地互聯網的普及程度；但另一方面，中國政府在2009年開始設置防火牆，限制民眾對境外主要網絡平台的訪問，如谷歌（Google）、臉書（Facebook）、推特（Twitter）等。儘管部分用戶使用VPN翻牆，但對大部分中國大陸網民來說，所能接觸到的資訊來源較為有限，亦沒有機會接觸並使用境外平台來獲取多元資訊。

在個人自由程度方面，美國卡托研究所及加拿大菲沙研究所（the Cato Institute and the Fraser Institute）共同發表2021年「人類自由指數」（The Human Freedom Index）報告顯示，在上述四個城市中，台灣民眾享有的自由程度最高，排在全球第19位，其後是香港（32位）、新加坡

（53位）。而中國大陸公民享有的個人自由，僅列全球第125位（Vásquez & McMahon, 2021）。

語言多樣性方面，新加坡作為一個多民族、多文化的移民城市國家，有四種官方語言，即英語、馬來語、漢語（普通話）和泰米爾語。香港市民常用的語言有粵語、普通話和英語。而在台北和中國大陸，漢語是單一官方語言。

基於以上五個面向的差異，經過綜合考量，新加坡和香港，作為國際化程度高、語言多樣、信息通訊技術發達的城市，數字媒體資訊近用性水準屬於較高。台北雖然在國際競爭力和語言多樣性方面略遜色，但較高的個人自由指數也會令民眾在接觸和獲取數字媒體資訊方面享有較高的自由。有鑒於此，我們將台北的數字媒體資訊近用性列為中等水準。而中國大陸的個人自由指數極低，互聯網使用亦受到限制，故數字媒體資訊近用性為低水準。

表一　北京、香港、台北、新加坡的數字媒體資訊近用性比較分析

	北京	香港	台北	新加坡
全球城市指數 [a]	5	6	44	9
言論自由 [b]	5.92（個人自由），中國大陸全球排名125位	8.53（個人自由），全球排名第32位	8.90（個人自由），台灣全球排名第19位	7.77（個人自由），全球排名第53位
信息通訊技術發展指數 [c]	80（中國大陸）	6	缺失	18
互聯網普及水準	普及程度高，但使用受限	普及程度高，使用不受限	普及程度高，使用不受限	普及程度高，使用不受限
政治體制	一黨制專權	有限度民主	兩黨制（亞洲民主體制的代表）	三權分立的一黨制
官方語言	中文	中文（普通話、粵語）；英文	中文	英文；中文；馬來語；泰米爾語
數字媒體資訊近用性 [d]	低（1）	高（3）	中等（2）	高（3）

註：此分析基於 Wei 和 Lo（2021）研究中對資訊近用性的定義。[a] Kearney (2021). [b] Vásquez 和 McMahon（2021）. [c] 國際電信聯合會（International Telecommunication Union, 2017）. [d] 該指標排序基於對四地在全球城市指數、自由程度、信息通訊技術發展指數、互聯網接入率、語言多樣性等五個指標的綜合考量。

數字媒體資訊近用性對虛假資訊接觸的影響

根據前文對「數字媒體資訊近用性」這一概念的探討，我們認為此宏觀層面的變量可以解釋媒介環境中新冠肺炎疫情相關資訊的流行程度，亦能解釋相關虛假資訊的傳播。簡言之，數字媒體資訊近用性，可以作為虛假資訊接觸頻率的一個系統性前置條件。從媒介系統角度而言，豐富的、可接近的資訊資源能夠令民眾更便利地掌握即時資訊，加深對主要新聞議題的理解，相應提升知識水準 (Iyengar et al., 2010)。Li 等人 (2020) 曾對此觀點作出闡釋，即社會因素為個人接觸和使用媒體提供了大環境，其解釋力往往會超越個人因素，更容易影響民眾對數字資訊的獲取、使用和互動參與。

在數字媒體資訊近用性高的社會環境中，民眾更容易即時獲取新冠肺炎疫情相關的正確資訊。即使網民對此類新聞關注度不高，反思性不強，此類資訊也會在不經意中出現在公眾視野，從而提升民眾的正確認知水準。反之，在數字媒體資訊近用性低，多元資訊相對匱乏的環境，只有媒介素養很高、勤快地搜索疫情資訊，並積極對事實核查的民眾才能更有效地突破環境限制，獲取有益的資訊 (Trilling & Schoenbach, 2013)。

此外，數字媒體環境是一個用戶可以使用各種聚合性資訊的空間。因此，他應該遵循「意見自由市場」理論 (Thorson & Stohler, 2017) 的原則，該理論假設真理來自公共話語自由交流中的思想碰撞 (Ingber, 1984)。民眾如果能夠捨棄劣質信息 (例如虛假資訊或假新聞)，這些劣質信息便會輸給市場上流通的優質信息 (例如真相)。在新冠肺炎疫情的背景下，當民眾可以看到經過事實核查的資訊時，由於可以獲得正確信息，便比較不收看或聽信虛假資訊。然而，在數字媒體資訊近用性有限的環境中，意見不能自由流通，相互碰撞，將意見自由市場作為一種機制來對抗虛假資訊的基本假設可能很難成立 (Hofstetter et al., 1999)。事實上，限制民眾獲取資訊可能反而會促使民眾在網上尋找和消費更多內容，包括不實資訊，從而導致他們更容易接觸虛假資訊。Lo 等人 (2022) 的一項基於新冠肺炎疫情虛假資訊的研究表明，獲取數

字資訊的自由程度越高，民眾對虛假資訊的接觸就越少。反之，對於數字資訊獲取受限的民眾，虛假資訊的接觸頻率更高。

綜上所述，若民眾無法即時獲得豐富、源自不同渠道的新冠肺炎資訊，即資訊近用性低，鑒於他們會急於尋找相關資訊來消除對疫情的不確定感和緊張情緒（Matthes, 2006），從而令其更容易接觸到一些未經證實的、甚至是他人編造、傳播的虛假資訊。因此，我們提出第一個研究假設：

假設 1：數字媒體資訊近用性與新冠疫情虛假資訊接觸頻率成負相關，即在數字媒體資訊近用性越高的社會，民眾接觸虛假資訊的頻率越低。

在前文中，我們討論了較高的數字媒體資訊近用性可以減少該社會中民眾對虛假資訊的接觸。更進一步，數字媒體資訊近用性也有可能減少民眾對虛假資訊的分享。首先，在資訊容易獲取的社會環境中，民眾擁有必要的資源來核實似是而非的資訊。有關新冠肺炎的虛假資訊很容易被這些消息靈通的民眾揭穿和更正。過去的研究表明，在線分享新聞的主要動機是發送者和接收者能彼此互惠互利（Goh et al., 2019）。但是，如果人們已經能夠正確識別錯誤的資訊，就不太可能分享虛假資訊，因為分享虛假資訊對自己和他人都無益處（Hopp, 2022）。

Duffy 等人（2020）的一項研究進一步表明，即使線上分享是出於社會利益的考量，但如果分享的資訊被證明是虛假或誤導的，那麼此類分享會對分享者的人際關係產生負面影響。在這種情況下，資訊發佈者也會認為「不分享才是好的」（p. 1965）。因此，可以合理推論，在數字媒體資訊近用性較低的社會中，因為有關疫情發展的豐富而權威的資訊有限，虛假資訊可能會更頻繁地出現在社群網絡及民眾的日常討論中。而這些由網民生產和編造的虛假資訊會更頻繁地被分享，以填補他們相對匱乏的資訊。因此，我們提出以下研究假設：

假設 2：數字媒體資訊近用性與新冠疫情虛假資訊分享呈負相關，即在數字媒體資訊近用性越高的社會，民眾分享虛假資訊的頻率越低。

個人因素對認知及態度的影響

那麼，從個人層面而言，接觸疫情虛假資訊會對個體認知和態度產生怎樣的影響呢？不少醫學心理學者認為（Anderson et al., 2009; Laditka et al., 2009），個體的認知狀態反映了他處理資訊的能力和心理過程，例如注意力、判斷和認知。本研究更進一步探討接觸虛假資訊如何影響民眾的分享行為、認知結果（即錯誤觀念和知識水準）與相關態度（即抵制疫苗態度）。

首先，我們認為接觸新冠肺炎虛假資訊會提升民眾分享這些資訊的頻率。由於社群媒體的互動性，新聞分享成為社群媒體新聞參與最重要的行為之一（Olmstead et al., 2011）。根據Kümpel等人（2015）的定義，「新聞分享」是指分享特定內容的行為，他有別於原創性發帖、新聞評論等其他社群媒體新聞參與活動。針對本研究的關注重點，我們將「新冠肺炎虛假資訊分享」界定為民眾在線上和線下活動中，向他人推薦、轉發與新冠肺炎相關的具有誤導性資訊的行為。新聞分享是一種新聞接觸的後續行為。因此，我們可以合理假設，接觸虛假資訊越多，越容易將此類資訊分享給社群中的其他人。

此外，新冠肺炎疫情是一個關乎個人健康與生命安全、以及全社會福祉的重要議題。根據理性行動理論（Hale et al., 2002），理性人在作出某一行為前，會綜合各種資訊來考慮該行為的意義和後果。據此推論，當公眾看到新冠肺炎疫情的虛假資訊之後，考慮到疫情的緊迫性和話題的重要性，他們會希望進一步傳播和分享相關資訊，以提醒他人，或引發進一步的討論。因此，我們提出以下假設：

假設 3：接觸新冠肺炎虛假資訊與分享虛假資訊成正相關，即接觸虛假資訊的頻率越高，在社群中分享此類虛假資訊的頻率也越高。

除了導致更多虛假資訊分享行為，接觸虛假資訊還可能會導致錯誤的認知，和消極的防疫態度。根據Eveland（2001）建構的新聞學習模型，具有高度參與感並關注新聞的民眾會努力理解所接觸到的資訊，從而達到學習新知的目的。實證研究表明，新聞資訊的處理機制使人們能夠提升自己的政治知識水準（Eveland et al., 2002），也可以獲取更

多對健康有益的知識(Lo et al., 2013; Wei et al., 2011)。不過,既有研究大多關注的是接觸新聞資訊帶來的正面影響,即如何幫助人們學習新知。那麼,當民眾接觸的資訊並非真實、可信、科學的資訊,而是具有誤導性的虛假資訊,接觸這種資訊會帶來怎樣的結果呢?目前,很少研究探究接觸虛假資訊可能導致的「反向學習」效應(de-learning effects),而這正是本研究要探究的另一主題。

根據健康信念模型(Health Belief Model,即 HBM),個體對疾病(例如新冠肺炎)的認知包含多個面向,包括易感性認知、嚴重性認知以及防護措施有效性認知等(Champion & Skinner, 2008)。在本研究中,我們將「錯誤觀念」(misbeliefs)定義為接觸虛假資訊之後的一種認知結果,即對虛假資訊信以為真。例如,如果一個人認為諸如「吃大蒜可以預防新冠病毒感染」之類的虛假資訊是真實的,我們就認為,他接受了錯誤的觀念。接觸虛假資訊容易令人形成錯誤觀念,並進一步影響他們的態度和正確知識。在下文中,我們將進一步闡釋其中的道理。

當網民接觸到的虛假資訊與其記憶中存儲的其他資訊相符時,虛假資訊將更容易被認為是真實的(Petty & Cacioppo, 1986),這是由於資訊處理的流暢性(fluency)的緣故。不斷的重複可以提升資訊的可信度,即便是虛假資訊,亦是如此(Allport & Lepkin, 1945)。Pluviano 等人(2017)也認為,人們接觸虛假資訊的頻率越高,就越有可能認為這些資訊是真實的,這是一種「虛幻真相效應」(illusory effect)。因此,我們有理由提出假設,接觸新冠疫情虛假資訊的頻率越高,越容易相信這些資訊是真實的。

已往的研究探討了民眾對於不同話題新聞資訊的錯誤認知。在政治領域,Pennycook 等人(2018)發現,接觸誤導性的資訊後,人們會更傾向於相信虛假資訊。在健康傳播領域,Gerosa 等人(2021)研究了個體教育水準差異,對新冠肺炎相關知識水準、以及識別相關虛假資訊能力之間的關係。他們的發現很有趣,教育水準並不能預測人們對虛假資訊的認知,真正具有解釋力的變量是虛假資訊接觸程度。也就是説,接觸虛假資訊越多,越容易把此類真假難辨的資訊信以為真。此外,Greenspan 和 Loftus(2021)指出,當專家、記者作為訊源來討論虛

假資訊的時候，這種負面影響會變得更強。這種錯誤觀念的形成會改變人們對疾病的認知，進而導致他們採取不科學的防疫手段，甚至拒絕接種疫苗。

抵制疫苗態度是全球有效防控疫情的一種嚴重阻力（Loomba et al., 2021）。正如 Smith（2017）所說的那樣，持有抵制疫苗態度的個人不但不願意接種疫苗，甚至會勸身邊的人也不要接種疫苗。在當今的疫情之下，社群媒體上與新冠疫苗相關的虛假資訊非常多，儘管社會各界作出了許多努力，仍是屢禁不止。例如「新冠疫苗會影響生育能力」或「新冠疫苗會改變人類DNA」等虛假資訊可能會使民眾錯誤地認為接種疫苗的風險大於感染新冠病毒的風險（McKinley & Lauby, 2021）。因此，我們有理由認為，接觸新冠疫情虛假資訊可能會增強抵制疫苗的態度（anti-vaccine attitudes）。

此外，虛假資訊亦會對人們的知識水準造成負面影響。例如，有研究發現，接觸政治領域的虛假資訊會影響選民對政治議題、政黨候選人及其政策的認知（Maurer & Reinemann, 2006; Munger et al., 2022）。同樣道理，在健康危機發生後，人們對新型疾病的知識也可能受到虛假資訊的負面影響。大量流行的虛假資訊會令民眾感到迷茫、焦躁不安和不知所措。因為無法找到具有共識性的真實資訊，民眾可能會放棄對真實資訊的獲取，甚至進而不會採取適當的預防措施，或對疫情形成錯誤的知識（Chou et al., 2020）。一項基於韓國成年人的研究（Lee et al., 2020）發現，接觸新冠肺炎虛假資訊導致了錯誤觀念的形成，也造成了相關科學知識的欠缺。

基於上述文獻探討，我們提出以下一組假設，即接觸大量新冠肺炎虛假資訊會對民眾的相關認知和態度造成負面影響。具體而言，他們會更加容易形成錯誤觀念，對疫苗持抵制態度，並且欠缺足夠的疫情相關知識。

假設 4a：接觸新冠肺炎虛假資訊與對新冠肺炎的錯誤觀念呈正相關，即接觸虛假資訊的頻率越高，越容易形成錯誤的觀念。

假設 4b：接觸新冠肺炎虛假資訊與抵制疫苗態度呈正相關，即接觸虛假資訊的頻率越高，越可能抵制新冠疫苗接種。

**假設 4c：接觸新冠肺炎虛假資訊與新冠肺炎知識水準呈負相關，
即接觸虛假資訊的頻率越高，相關知識水準越低。**

虛假資訊分享的中介作用

如前文所述，新聞分享是社群網絡的重要互動性參與行為（Olmstead et al., 2011）。在社群網絡上分享的新聞可以在短時間傳開，接受者倍增。但如果資訊是虛假不實的，這種分享就可能會帶來巨大的社會負面影響，讓更多人受到虛假資訊的誤導，從而削弱科學疫情防控的成效。過去的研究（Bobkowski, 2015; Su et al., 2019）發現了許多可以預測新聞分享的變量，例如新聞重要性認知、資訊有用性、政治立場一致性等。根據Lee 和 Ma（2012）的觀點，那些積極尋找資訊、希望滿足社交互動需求、並提升自己在他人心中地位的人，更有可能與他人分享新聞。

更重要的是，以往的研究顯示，虛假資訊的分享會提升分享者自身對資訊的信任程度，從而加深錯誤觀念，並忽略科學性知識（Oyserman & Dawson, 2020）。此外，如果分享者所處社群媒介素養較低，無法識別和反駁虛假資訊，資訊分享者的錯誤觀念就難以被改變和糾正，也就更無法獲得科學資訊來更新自己的相關知識。

總之，接觸虛假資訊會導致更多的虛假資訊分享行為，從而形成錯誤觀念，影響對疫苗的態度與疫情知識。換言之，虛假資訊分享在虛假資訊接觸和負面認知及態度之間的關係上起到了中介（mediation）作用。為驗證虛假資訊分享的中介效果，我們提出了一個研究問題：
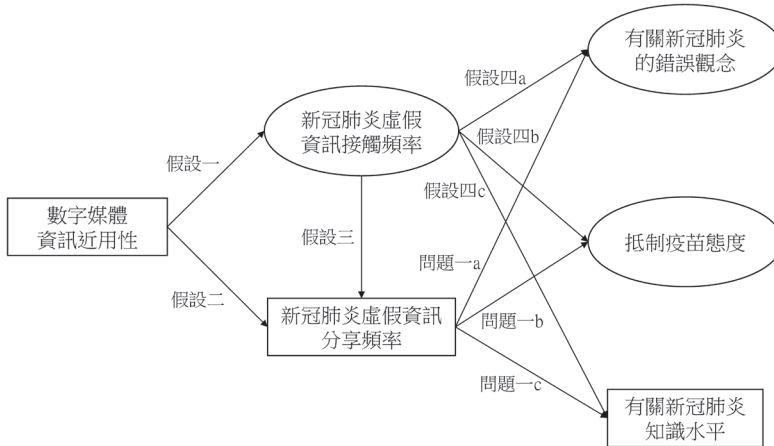
**研究問題1：分享虛假資訊是否會中介影響新冠肺炎虛假資訊接觸
與a) 錯誤觀念，b) 抵制疫苗態度，和c) 新冠肺炎相
關知識水準之間的關聯？**

最後，為了檢驗新冠肺炎虛假資訊在中國大陸、香港、新加坡和台灣地區的傳播及影響，我們進一步提出虛假資訊分享行為，是影響接觸虛假資訊與負面效果之間關係的關鍵機制。即接觸虛假資訊如何通過分享行為對錯誤觀念、抵制疫苗態度和疫情知識產生影響。如圖一所示，我們在模型中還納入了數字媒體資訊近用性這一宏觀層面的

變量，以探究不同媒介環境、社會體制對接觸、分享新冠疫情虛假資訊傳播及其後果所產生的影響。

圖一　理論模型

研究方法

抽樣程序

　　於2021年8月4日至18日的兩週時間內，我們在北京、香港、台北和新加坡四地進行網絡問卷調查。實地調查方案事先得到了大學機構審查委員會的批准。受訪者由專業調查公司Dynata招募。具體來說，Dynata從每個城市的樣本庫中隨機挑選受訪者，並通過電子郵件邀請其完成一項網絡問卷調查。為了提高研究結果的普遍性，我們採用了配額抽樣（quota sampling）來控制關鍵的人口統計變量，如年齡、性別和族裔（僅適用於新加坡），以此來保障樣本能夠反映每個城市的人口基本特徵。鑒於本研究的目標群體是18歲或以上的成年人，我們無法將樣本與當地人口普查估計的年齡範圍完全匹配。有鑒於此，我們對年配額比例進行了適當調整，以實現各城市年齡組的平均分配。在香港

和台北的訪問，問卷以繁體中文進行，在新加坡使用英文發放，而在中國大陸使用的是簡體中文。本研究共有 4,094 名受訪者完整填答問卷。

　　這 4,094 名受訪者的平均年齡為 40.36 歲（標準差 = 13.14，範圍為 18 至 84）。性別分佈大致均勻，其中 48.30% 為男性，51.70% 為女性。性別和年齡分佈與各城市的總體人口比例基本匹配。從教育背景來看，18.10% 的受訪者具有高中及以下學歷，19.20% 的人持有職業教育文憑，52.70% 的人獲得學士學位，10% 的人擁有碩士學位或更高學歷。此外，考慮到新加坡是一個多元族裔社會，我們對新加坡樣本中的族裔進行了測量。樣本包括 74% 的華人、13.70% 的馬來人、7.60% 的印度人和 4.70% 的其他族裔人。表二顯示了按研究地點劃分的樣本概況。

表二　樣本資料（樣本數 = 4,094）

因素	北京（樣本數 = 1,033）平均值（標準差）或 %	香港（樣本數 = 1,017）平均值（標準差）或 %	台北（樣本數 = 1,019）平均值（標準差）或 %	新加坡（樣本數 = 1,025）平均值（標準差）或 %
年齡	39.90 (11.80)	39.48 (12.84)	39.36 (13.08)	42.70 (14.46)
性別（男性）%	49.30	45.10	47.70	51.10
教育程度 %				
高中及以下	12.70	25.90	13.70	20.20
職業教育文憑	22.70	14.40	16	23.80
學士學位	59.40	51.60	53.50	45.90
碩士學位或更高	5.20	8.10	16.80	10.10
收入 %				
美金 $0–1,566（北京） 美金 $0–2,564（香港） 美金 $0–1,079（台北） 美金 $0–2,189（新加坡）	8.10	10.80	8.10	13.80
美金 $1,567–3,133（北京） 美金 $2,565–5,128（香港） 美金 $1,080–1,797（台北） 美金 $2,190–5,109（新加坡）	27.80	26.90	14.90	30.20

新冠肺炎虛假資訊接觸對認知和態度的負面影響

因素	北京 （樣本數 = 1,033） 平均值 （標準差）或 %	香港 （樣本數 = 1,017） 平均值 （標準差）或 %	台北 （樣本數 = 1,019） 平均值 （標準差）或 %	新加坡 （樣本數 = 1,025） 平均值（ 標準差）或 %
美金 $3,134–4,700（北京） 美金 $5,129–7,692（香港） 美金 $1,798–2,516（台北） 美金 $5,110–8,029（新加坡）	25.30	26.90	15	26.40
美金 $4,701-6,266（北京） 美金 $7,693-10,257（香港） 美金 $2,517-3,235（台北） 美金 $8,030-10,949（新加坡）	19.40	20.70	16	15.60
美金 $6,267–7,833（北京） 美金 $10,258–12,821（香港） 美金 $3,236–3,954（台北） 美金 $10,950–13,869（新加坡）	13.70	8.40	22	7.90
美金 $7,834 或以上（北京） 美金 $12,822 或以上（香港） 美金 $3,955 或以上（台北） 美金 $13,870 或以上（新加坡）	5.70	6.40	24	6.10

主要變量測量

數字媒體資訊近用性。我們使用五個廣義性的綜合指標來構建四個社會的資訊近用性指數，這些指標分別是：(1)互聯網普及和可訪問程度，(2)資訊和通信技術的發展狀況，(3)發展和競爭力方面的綜合實力，(4)民眾的個人自由程度，以及(5)語言多樣性（雙語或多語）。據此，我們將每個社會的數字媒體資訊近用性從1到3進行排名，「1」代表近用性最低，「3」代表近用性最高。如前文所述，綜合各項指標，北京＝「1」，台灣＝「2」，香港＝「3」，新加坡＝「3」。

新冠肺炎虛假資訊接觸頻率。本研究以四點量表（1 = 從不，4 = 經常）詢問受訪者在新冠肺炎疫情期間在社群媒體平台（如臉書、推特和微博等）接觸有關新冠肺炎虛假資訊的頻率。我們利用大數據方法，從網絡上廣泛流傳的虛假資訊中挑選出五條有代表性的資訊作為題

項。這五條資訊或經過事實核查被證實為假，或被權威來源（如世界衛生組織，World Health Organization）所駁斥，如「5G 移動網絡會傳播新冠病毒」和「亞洲人要比其他種族的人更容易感染新冠病毒」。我們將這五個題項取平均值，以創建一個「新冠肺炎虛假資訊接觸頻率」綜合指標（平均數 = 1.82，標準差 = .78，信度 = .88）。

新冠肺炎虛假資訊分享頻率。本研究使用四點量表（1 = 從不，4 = 經常）詢問受訪者分享有關新冠肺炎虛假資訊的頻率（平均數 = 2.23，標準差 = 1.07）。

有關新冠肺炎的錯誤觀念。本研究以五點量表（1 = 絕對錯誤，5 = 絕對正確）詢問受訪者對於以下五個題項的認知，以了解他們是否接受有關新冠肺炎的錯誤觀念：(1) 新冠病毒可以通過 5G 移動網絡傳播；(2) 飲用漂白劑可以殺死新冠病毒；(3) 吃大蒜可以預防新冠病毒感染；(4) 新冠病毒疫苗會影響生育能力；(5) 新冠病毒疫苗會改變人類 DNA。我們用以上五個題項的平均值組合成一個「有關新冠肺炎錯誤觀念」的綜合指標。分數越高，表示新冠肺炎錯誤觀念越強（平均數 = 1.82，標準差 = .96，信度 = .90）。

抵制疫苗態度。參考先前的研究（Shapiro et al., 2016），我們採用五點量表（1 = 非常不同意，5 = 非常同意）詢問受訪者對於以下三個題項的同意程度：(1) 人們在新冠病毒疫苗的有效性方面可能受到欺騙，(2) 關於新冠病毒疫苗有效性的數據很可能是虛構的；(3) 人們在新冠病毒疫苗安全性方面被瞞騙。以上三個題項的平均值組合成一個指標，建構了「抵制疫苗態度」的綜合指標。分數越高表明對疫苗接種的抵觸越高（平均數 = 2.50，標準差 = 1.10，信度 = .90）。

有關新冠肺炎的知識水準。通過調整來自權威信源（如美國疾病控制與預防中心、世界衛生組織）所發佈的新冠肺炎相關資訊，本研究構建了五個題項量表讓受訪者回答，如「世界衛生組織在抗擊新冠肺炎疫情期間的總幹事是誰？」、「新冠肺炎所造成的死亡率大致是多少？」、「新冠病毒新變種的名字是甚麼？」等。這五個題項均採用多項選擇形式，讓受訪者從四個選項中選擇一個他們認為正確的答案。選擇正確答案得一分，選擇不正確答案或「不知道」選項得零分。我們把五個題

項加在一起構建了一個「有關新冠肺炎知識水準」的綜合指標。分數越高代表知識水準越高（最小值 = 0，最大值 = 5，平均數 = 2.64，標準差 = 1.53，信度 = .61）。

分析與結果

為了研究在具有不同數字媒體資訊近用性的四個社會中，接觸和分享新冠肺炎虛假資訊方面有何差異，我們首先進行了一系列方差分析（analysis of variance）。結果顯示，來自北京、香港、新加坡和台灣的受訪者在接觸虛假資訊方面存在顯著差異〔$F(3, 4,090) = 88.51, p < .001$〕。後續Scheffe測試表明，北京受訪者接觸新冠肺炎虛假資訊的頻率為最高（平均數 = 2.15，標準差 = .83），其次是香港（平均數 = 1.72，標準差 = .68）、新加坡（平均數 = 1.70, 標準差 = .81）和台北（平均數 = 1.69, 標準差 = .71）。

關於與他人分享新冠肺炎虛假資訊方面，四個社會之間也呈現顯著差異〔$F(3, 4,090) = 70.94, p < .001$〕。後續做了Scheffe檢驗，結果顯示北京受訪者分享虛假資訊的頻率為最高（平均數 = 2.61，標準差 = 1.09），其次是香港（平均數 = 2.21，標準差 = 1.01）和新加坡（平均數 = 2.11，標準差 = 1.01）。台灣受訪者分享虛假資訊頻率最低（平均數 = 1.98，標準差 = 1.04）。

假設一和假設二預測，數字媒體資訊近用性與接觸和分享新冠肺炎虛假資訊之間存在負相關關係。為了檢驗這兩個假設，我們進行了三個階層的迴歸分析。出於控制目的，人口統計變量（即年齡、性別、教育、收入）被輸入為第一階層。根據因果順序，在第二個階層中輸入數字媒體資訊近用性，在第三個階層中輸入接觸和分享新冠肺炎虛假資訊的頻率。如表三所示，數字媒體資訊近用性與接觸新冠肺炎虛假資訊呈現顯著負相關（$\beta = -.22, p < .001$）。結果還表明，數字媒體資訊近用性與分享新冠肺炎虛假資訊也呈顯著負相關（$\beta = -.09, p < .001$）。因此，假設一和假設二均得到支持。

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表三　階層迴歸分析結果（樣本數 = 4,094）

自變項	虛假資訊接觸	虛假資訊分享	錯誤觀念	抵制疫苗態度	知識水準
第一階層					
年齡	−.11***	−.07**	.03	.03	.14***
性別（男性）	.06***	−.01	−.03*	−.02	.14***
教育程度	.04*	.00	−.04**	−.01	.22***
收入	−.10***	−.08***	−.00	−.12***	.24***
Adjusted R^2	.02	.02	.01	.04	.15
第二階層					
數字媒體資訊近用性	−.22***	−.09***	.15***	.33***	.04**
Adjusted R^2 incremental	.05	.02	0	.06	0
第三階層					
虛假資訊接觸	—	.34***	.51***	.30***	−.05***
虛假資訊分享			.17***	.12***	−.13***
Adjusted R^2 incremental	—	.11	.32	.12	.02
Total adjusted R^2	—	.15	.33	.22	.17

註：上面各欄表格內的數值是標準化迴歸係數；*p < .05, **p < .01, ***p < .001。

　　這些結果與過去的研究發現（Li et al., 2020; Lo et al., 2022）一致，表明在一個接觸數字資訊受限的社會中，擔心新冠疫情的民眾會使用社群媒體來獲取最新資訊，並將其看到的內容分享給他人，其中不乏虛假資訊，以滿足他們對疫情資訊的需求。另一方面，在資訊接觸自由且不受限制的社會中，那些習慣於在線獲取各種資訊的受訪者比較可能會忽略那些錯誤和不準確的疫情資訊。

　　假設三預測，接觸新冠肺炎虛假資訊與分享之間呈現正相關。如表三中的迴歸結果所示，接觸虛假資訊與分享虛假資訊顯著地呈正相關關係（β = .34, p < .001）。假設三因此得到支持，表明受訪者在網絡上接觸新冠肺炎虛假資訊越頻繁，他們就越經常將此類資訊轉發給自己社群媒體組中的親人或朋友。

　　假設四預測，接觸新冠肺炎虛假資訊將與a) 錯誤觀念和b) 抵制疫苗態度呈正相關，但與c) 知識水準呈負相關。階層迴歸分析結果進一步顯示（如表三最後三列），在控制了人口統計變量和數字媒體資訊近用性等變量之後，接觸新冠肺炎虛假資訊與錯誤觀念（β = .51, p < .001）

和抵制疫苗態度 (β = .30, p < .001) 均呈現顯著的正相關。然而，新冠肺炎虛假資訊的接觸頻率與知識水準呈顯著的負相關 (β = –.05, p < .001)。因此，假設四得到支持。這些結果表明，接觸新冠肺炎虛假資訊的頻率越高，對受訪者的認知和態度的負面影響就越大（即對新冠肺炎之錯誤觀念的接受和對疫苗的抵制態度就越高），同時，對新冠肺炎的正確知識水準就越低。

此外，為了檢驗研究問題一所提出的，新冠肺炎虛假資訊分享在虛假資訊接觸和認知及態度之間的關係中所起的中介作用，我們採用 PROCESS Macro 中的模型四 (Hayes, 2017) 進行了一系列中介效應分析。在控制人口統計變量的基礎上，我們使用 5,000 個自舉樣本估計了經過偏差校正的 95% 置信區間 (CI)。

分析結果表明，新冠肺炎虛假資訊分享的確是接觸虛假資訊與錯誤觀念之間關係的顯著中介變量 (b = .07, SE = .01, 95% CI = [0.05, 0.08])。具體來説，接觸虛假資訊正向預測分享這些資訊 (b = .49, t = 24.38, p < .001)，這導致分享對錯誤觀念有更強的影響 (b = .14, t = 10.83, p < .001)。同時，接觸虛假資訊通過分享這些資訊對抵制疫苗態度的間接影響是顯著的 (b = .04, SE = .01, 95% CI = [0.03, 0.06])，這意味著，由虛假資訊接觸所帶來的虛假資訊分享導致了更強烈的抵制疫苗態度 (b = .09, t = 5.37, p < .001)。此外，分享虛假資訊在接觸虛假資訊和知識水準的關係中也有顯著的中介作用 (b = –.09, SE = .01, 95% CI = [–0.12, –0.07])。由接觸虛假資訊導致的分享虛假資訊頻率增強了對受訪者的知識水準所產生的負面影響 (b = –.19, t = –8.76, p < .001)。總而言之，這些結果驗證了虛假資訊分享的中介作用。

最後，為了探究接觸和分享虛假資訊如何影響四個社會中民眾對新冠肺炎疫情的觀念、態度和知識，我們用 AMOS 24 進行了結構方程模型 (SEM) 分析。模型擬合根據以下標準進行評估：對於擬合良好的模型，CFI 和 TLI 的值應大於 0.95，RMSEA 的值應小於 0.06，χ^2 的 p 值應該不顯著 (p > .05)，χ^2/df 的值應該小於 2 (Ullman, 2001)。結果顯示，雖然模型的 χ^2 值顯著 (χ^2 = 2049.76, df = 89, χ^2/df = 23.03, p < .001)，但 CFI = .95, NFI = .94, TLI = .93 和 RMSEA = .07 表明模型擬合

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是可以接受的。該模型解釋了接觸虛假資訊差異的4.20%，分享虛假資訊差異的15.70%， 抵制疫苗態度差異的9.40%， 錯誤觀念差異的41.70%，以及知識水準差異的3.80%。圖二總結了以上 SEM 的結果。

圖二　結構方程模型分析結果（樣本數 = 4,094）
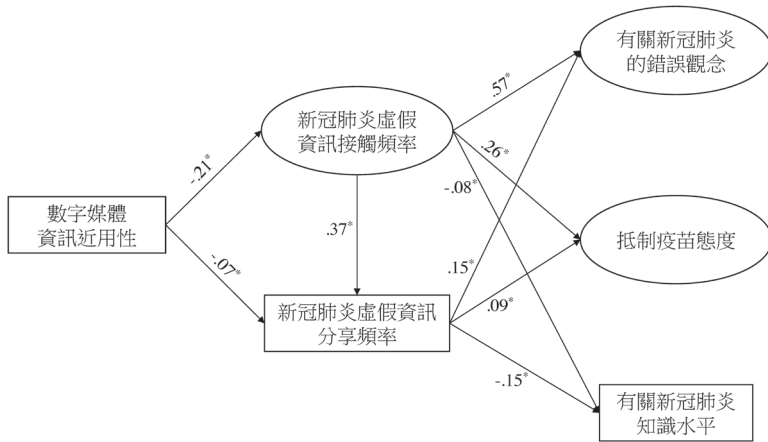
註：圖中數字為標準化係數：$^*p < .001$

結論與討論

　　隨著新冠肺炎疫情在全球的蔓延，「資訊流行病」亦成為病毒傳播的衍生品，影響對疫情的有效防控和民眾的身心健康。「資訊流行病」為何會發生？又會通過怎樣的機制產生負面的影響？探索以上問題具有相當的緊迫性和必要性 (Chou et al., 2020; Lee & Shin, 2021)。我們通過對中國大陸、香港、台灣和新加坡民眾的一項大型調查發現，接觸和分享虛假資訊對公眾的觀念、疫苗態度，和知識水準有著負面影響。具體而言，接觸虛假資訊的頻率越高，他們就越容易形成錯誤的觀念、抵制疫苗的態度，並忽略科學的知識。

　　過去的研究表明，社群媒體在民眾新聞學習方面起到了顯著的正面作用。隨時隨地可以獲取的新聞資訊，讓民眾更好地了解公共事務，

獲取健康方面的知識（例如，Cho et al., 2009; Eveland, 2001; Ghalavand et al., 2022）。然而，這些正面效應僅僅是使用社群媒體資訊的一個側面而已。在新冠肺炎相關虛假資訊在全球社群媒體平台的滋生、氾濫的情形之下，我們發現使用社群媒體其實無助於民眾獲取科學的、準確的疫情知識，反而阻礙民眾了解防疫的科學知識。這種虛假資訊的傳播，不但沒有令民眾學習到正確的知識，反而形成了一種「反向學習」效應（de-learning）。這項發現拓展了新聞資訊處理和學習模型，將為更多的後續研究指明探究的方向。

此外，本研究重點提出了分享虛假資訊的中介作用，這也進一步驗證了「資訊流行病」的傳播機制，即虛假資訊的負面影響是通過分享行為而逐步擴大的。與他人分享的人數越多，對認知、疫苗態度和知識水準的負面影響就越大，從而形成一種連鎖效應（cascading effect）。本研究提出的理論模型揭示了虛假資訊分享可以作為虛假資訊產生各類負面效應的一種重要機制。而隨時隨地、低成本甚至無成本地分享數字資訊，正是社群媒體的獨特功能。動動手指就可以輕鬆轉發，這在一定程度上加重了虛假資訊的社會危害性。因此，社群媒體虛假資訊的流行，要比其他媒體平台（如電子報紙）上虛假資訊的危害更為嚴重，也需要更有效的應對策略。有鑒於此，我們認為發現並制止虛假資訊的超級傳播者（即面向龐大社群的頻繁分享者），對切斷這類虛假資訊的傳播至關重要。

本研究的另一個重要發現是社會層面變量對虛假資訊傳播的影響，即在數字媒體資訊近用性水準不同的社會環境之中，接觸虛假資訊和分享這些資訊的頻率有所不同，帶來的負面影響程度也不盡相同（differential effect）。在數字媒體資訊近用性越高的社會中，民眾對虛假資訊的接觸較少、分享頻率也較低，進而負面影響就越小。反之，資訊近用性越低，民眾對虛假資訊的接觸就更多、分享頻率也較高，進而產生較大的負面影響。通過對媒介環境不同的四個亞洲城市進行比較研究，本研究的重要發現是，數字媒體資訊近用性的差異是造成四地民眾虛假資訊接觸程度不同、分享頻率不同的根本性影響因素。在公共衛生危機期間，如果民眾具有較高的資訊近用性，能夠隨時獲

取可靠而且多渠道的最新疫情資訊,他們就不太可能去獲取那些社群媒體上的虛假資訊,更沒有動力去分享。這是因為較高的數字媒體資訊近用性會給民眾帶來豐富、多元的資訊。然而,在資訊獲取受到限制的社會,及時和多渠道的資訊通常稀缺,民眾為了緩解由公共健康危機而產生的焦慮情緒和不確定性,便傾向於利用社群媒體中一切可獲得的資訊來了解最新疫情。也就是說,在有限且缺乏多元性的數字媒體環境中,民眾無法有效識別社群媒體上疫情資訊的真假,因此常常會將含有虛假資訊的消息分享給他人。

我們的深入分析還發現,在數字媒體資訊近用性高的社會中,民眾可以獲取充分的資訊資源以應對公共衛生危機,他們受到虛假的負面影響較小。我們常言,「知識就是力量」,那麼,對正確的新冠肺炎知識的掌握,便是對公眾的有效賦能。相比之下,在數字媒體資訊近用性低的社會環境下,民眾無法獲取足夠的疫情資訊,無從建立正確的疫情知識,虛假資訊的負面影響就較大。

以上發現對抗疫有何啟示?在實踐上,我們認為,數字媒體資訊的近用性、以及公開、透明的資訊,是抵消社群媒體上虛假資訊傳播危害的必要的社會條件。隨著新冠肺炎疫情防控進入常態化,政府、公共衛生部門、醫學專家應當與公眾保持公開、透明的溝通。特別是要利用好社群媒體平台的資訊發佈優勢,一旦虛假資訊出現在社群媒體平台上,就應迅速反應、即時提供基於事實的科學資訊,以便公眾更有效、便利地進行事實核查,從而削弱虛假資訊對公眾認知、疫苗態度和知識水準的負面影響。

在理論上,我們通過將宏觀層面的社會因素（即數字媒體資訊近用性、媒介環境）與微觀層面的個人心理變量相結合,來解釋虛假資訊的傳播與危害,這是對既有研究一項重要理論創新。也就是說,通過探索數字媒體資訊近用性、新冠肺炎虛假資訊接觸、分享,以及認知和態度影響之間的關係,我們的理論模型為四個亞洲社會中,虛假資訊傳播和影響的差異找到了具有解釋力的社會因素 —— 即數字資訊的自由流動。這些發現將有助於我們從社會和個體兩個層面,更加全面地建構虛假資訊的傳播和影響機制。

　　當然，本研究也存在著不足和可改進之處。首先，我們提出的中介模型雖然擬合度和顯著性得到了支持，但鑒於這是一次性的調查數據（one-shot），在推斷因果關係方面，仍需要進一步通過多點數據等長期調查方法才能予以驗證。此外，我們提出了數字媒體資訊近用性的概念，其概念界定及操作化還需要進一步通過比較研究方法進行完善和修正。例如，在差異較大的社會之間（譬如華人社會與伊斯蘭社會），數字媒體資訊近用性是如何影響虛假資訊的傳播及其後果？同樣，在相似性較高的社會（譬如東亞的幾個儒家文化社會），數字媒體資訊近用性的形塑作用又是如何？以上問題都需要進一步探究，以達到數字媒體資訊近用性這一概念的效度和普世性。我們相信，這樣的多元文化和跨社會比較研究對建構虛假資訊傳播與影響的理論是不可或缺的。

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The Role of Digital Information Accessibility in Shaping the Relationships of Exposure to COVID-19 Misinformation and Cognitive and Attitudinal Effects in Asia

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Introduction

It has been widely observed (Cinelli et al., 2020) that an information epidemic known as "infodemic" has been a hallmark of the on-going COVID-19 pandemic. Infodemic refers to an overabundance of "information associated with a specific topic and whose growth can occur exponentially in a short period of time due to a specific incident" (Pan American Health Organization, 2020, p. 1), such as rumours, misinformation, and fake news. In the context of the raging COVID-19 pandemic, inaccurate and false information concerning various aspects of the virus, ranging from its origin, infection mechanisms, treatments to doubts about the vaccines, has been spreading like a wildfire on social media platforms and interpersonal social networks.

The "infodemic" phenomenon has caught scholarly attention. The detrimental effects of misinformation exposure on individuals' perceptions and behaviors include dysfunctional sharing (Rossini et al., 2021), negative emotions (Liu & Huang, 2020), reluctance in adopting preventive measures (Lee et al., 2020), and vaccine hesitancy (Dror et al., 2020). Other researchers have examined the antecedents of misinformation exposure and sharing to understand the contributing factors to the widespread of misinformation on social media platforms. These factors are diverse, ranging from individual-level variables, such as scientific knowledge and political identity (Buchanan & Benson, 2019; Pennycook et al., 2020), to message factors, such as negative sentiments (Kumar et al., 2021). However, few studies have explored societal-level factors that may accelerate or mitigate the spread of the COVID-19 misinformation that amplifies or lowers the negative effects of exposure to such misinformation.

The present study aims to fill the gap by investigating the role of a key societal factor—information accessibility—in shaping the context of exposure to and sharing of popular COVID-19 misinformation on social

media that lead to harmful effects on cognitive and attitudinal outcomes (i.e., misinformation beliefs, anti-vaccine attitudes, knowledge of COVID-19).

The inclusion of information accessibility on digital media in the present study was based on the consideration that the widely diffused COVID-19 misinformation on social media differs in types, attributes, quantity, sources, and false claims across societies. Individuals living in societies with different social-political systems and media environments have either restricted or free access to such information online. As such, their cognitive processes and reflections of digital content would also differ (Cho et al., 2009; Eveland, 2001). Specifically, we situated the present study in four Asian societies (i.e., mainland China, Hong Kong, Singapore, and Taiwan) to explore if digital information accessibility makes a difference in viewing and sharing COVID-19 misinformation, which then weigh on the people's cognition and attitudes in these societies. To do so, we developed an integrated model to uncover the underlying process of how exposure and sharing affected people's beliefs, attitudes, and knowledge of the pandemic across the four societies.

The findings of this study will enrich the understanding of the harms of COVID-19 misinformation in several ways: First, the focus on the role of information accessibility in Asian societies contributes to literature on misinformation; accessibility as a social context holds the key to understand reception and viewing of such information, which then trigger follow-up behaviors such as sharing and counter-arguing. Second, the on-going COVID-19 pandemic is a global crisis and how to contain the infodemic is an urgent task for policymakers and social media platform operators around the world. Our findings will lead to some generalizations that may be applicable to a wider context beyond the four studied societies. Practically, the findings will provide valuable insights for developing strategies to contain the "infodemic" on digital media.

Literature Review

Information Accessibility on Digital Media

Recent research about COVID-19 misinformation (Chadwick & Vaccari, 2019; Seo et al., 2021) shows that the frequency of misinformation

exposure and sharing is subject to individual differences, such as income, education, and partisanship. However, it is equally important to consider the effects of macro-level social contexts. To illustrate, in an environment where access to updated COVID-19 information, factual, scientific types as well as inaccurate and misleading ones, is free and timely, scholars (Gil De Zúñiga et al., 2020; Oeldorf-Hirsch, 2018) have suggested that citizens are more likely to debunk misinformation as they find it easier to seek factual information, gain COVID-19 knowledge through incidental exposure to fact-checking sheets, and benefit from the Internet-enabled high-choice media environment (Gil De Zúñiga et al., 2020, p. 1605). Therefore, access to an abundance of digital information is a necessary condition for individual-level factors to play out in affecting the exposure to misinformation and producing effects following exposing to such misinformation.

Wei and Lo (2021) defined information accessibility as the extent to which citizens can freely get access to various news sources online; this sort of access is an integral dimension of personal freedom enjoyed by citizens in open and democratic societies. In the context of this study, information accessibility in digital media refers to how freely respondents in the four societies in our study can have access to a wide range of COVID-19-related information, such as news updates from digital media (i.e., online news websites, news Apps, and social media platforms).

The four societies chosen for this study share similar cultural roots but feature different social-political systems and different levels of information accessibility, making them an ideal set of populations for investigating the influence of information accessibility on digital media as a societal factor on the exposure and sharing of COVID-19 misinformation.

As a multi-dimensional construct, information accessibility consists of the hardware component (e.g., Internet accessibility, information and communication technology (ICT) infrastructure), and the software component (e.g., global competitiveness, language diversity, and personal freedoms) (Biehal & Chakravarti, 1983; Kauffman & Techatassanasoontorn, 2010; Li et al., 2020; Wei & Lo, 2021). Jointly, they make up the digital media environment of a society. Table 1 depicts the level of each component in the four societies. With regard to ICT development, the ICT Development Index (IDI) published by the International Telecommunication Union (ITU) (2017) combines 11 indicators to measure each country's ICT development stage, including ICT readiness, intensity, and effective use. In the most

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recent 2017 report, while Taiwan was not included in the IDI ranking, Hong Kong took the lead, ranking 6th globally, followed by Singapore (18th) and China (80th). In the 2020 rankings of global competitiveness, China topped the four societies, followed by Hong Kong, Singapore, and Taipei.

As for Internet accessibility, Hong Kong, Taipei, and Singapore residents all enjoy widely available and unrestricted access to the Internet (Wei & Lo, 2021). However, the situation is different in China. Despite China's growing Internet penetration rate thanks to the diffusion of the smartphone, since 2009 the Chinese government has employed a great firewall to restrict its citizens from using global social media platforms. As such, residents in China were unable to get access to *Google, Facebook, Twitter, YouTube*, and international media outlets unless using virtual private networks (VPNs). In such an environment, access to different types of media and diversified information sources is highly controlled.

Personal freedom is highly intertwined with a city's political system. The Human Freedom Index (Vásquez & McMahon, 2021) measuring citizens' personal freedom with dimensions like expression and information access rated China at the bottom (125th globally), while Hong Kong ranked 32nd and Singapore ranked 53rd, among the middle level of the four societies. Taiwan was considered the freest society among the four societies, ranking 19th globally. Finally, in terms of linguistic diversity, with four official languages, Singapore is considered the most diverse, and Hong Kong, which is bilingual, ranked second. In comparison, Taipei and China have a single official language.

Based on the five indicators, Singapore and Hong Kong were rated as the most information accessible societies with high global competitiveness, promising ICT development, multilingual media, high levels of personal freedom, and unrestricted Internet access, followed by Taiwan (medium). China was at the bottom (low) as personal freedom and restricted Internet access largely hindered the information accessibility enjoyed by its residents.

Table 1 Information Accessibility in Beijing, Hong Kong, Taiwan, and Singapore

	Beijing	**Hong Kong**	**Taipei**	**Singapore**
Global City Index [a]	5	6	44	9
Freedom of expression [b]	5.92 (personal freedom), ranked #125 for China	8.53 (personal freedom), ranked #32	8.90 (personal freedom), ranked #19 for Taiwan	7.77 (personal freedom), ranked #53
ICT Development Index [c] rankings	80 for China	6	NA	18
Internet accessibility	Widely available but restricted access	Widely available and unrestricted access	Widely available and unrestricted access	Widely available and unrestricted access
Political systems	Authoritarian one-party rule	Limited democracy	Asia's leading democracy with a two-party system	Viable democracy
Official languages: bilingual or multilingual	Chinese	Chinese (Mandarin and Cantonese) and English	Chinese	English, Chinese, Malay, and Tamil
Information accessibility [d]	Low (1)	High (3)	Medium (2)	High (3)

Notes. This table is adapted and updated from Wei and Lo (2021). [a] Kearney (2021). [b] Vásquez and McMahon (2021). [c] International Telecommunication Union (2017). [d] The index was created by an overall evaluation on the indices of a, b, and c, as well as Internet accessibility and linguistic diversity.

Information Accessibility as Condition of Exposure to Disinformation

Given the differences in digital information accessibility across the four societies with different media environments, we expected that accessibility as a macro factor would account for differences in viewing and COVID-19 information circulating online. That is, it would provide a system-level antecedent that affects the exposure to such misinformation. From a media systems perceptive, as Iyengar et al. (2010) suggested, widely accessible information resources help the public acquire fresh information, understand major news topics, and gain knowledge. Li et al. (2020) also argued that societal influences would likely prevail over individual differences in affecting citizens' consumption and engagement with digital information,

largely because they provide the necessary social conditions in which individuals' information-seeking and consumption take place.

Thus, a free and information-rich environment is structurally conducive for citizens to learn factual and accurate information about COVID-19 in a timely manner, even for those who engaged in limited cognitive processing of such information. On the other hand, in a restricted and information scarce environment, the role of individual-level cognitive ability would be more prominent. Only people with enthusiasm for fact-checking, ability to reflect, and access to multiple information sources can keep up with updated and accurate information concerning COVID-19 and acquire sufficient knowledge about the disease (Trilling & Schoenbach, 2013).

Furthermore, the digital media environment functions as space where aggregated messages of all sorts are available to users. As such, it should follow the principles of classic marketplace of ideas theory (Thorson & Stohler, 2017), which assumes that the truth will emerge from the competition of ideas in free exchanges of public discourses (Ingber,1984). Individuals are able to discard inferior information (e.g., misinformation or fake news), which loses out to superior information (e.g., truth) circulated in the marketplace. In the context of COVID-19 pandemic, when citizens can access a mixture of fact-checked content and misinformation, they are less likely to consume misinformation to stay informed because of the availability of fact checked accurate information. However, in environments with limited information accessibility, the fundamental assumption of the marketplace of ideas as a mechanism to weed out falsehood for the benefit of an informed citizenry may not hold (Hofstetter et al., 1999). In fact, restricted access to digital information may be counter-productive, motivating people to seek and consume more content online no matter whether it's true or not, resulting in greater likelihood of exposure to misinformation. Empirically, Lo et al. (2022) have provided preliminary evidence to support the possibility that free access to digital information reduces exposure to misinformation; whereas restricted access leads to increased viewing of such misinformation.

Therefore, in a society where COVID-19 information is not widely available to the public in a timely manner, citizens who are unable to seek a full range of information on the pandemic may feel anxious and their need for orientation to cope with uncertainty would increase (Matthes,

2006). It is unsurprising that they might rely on unverified information from user-generated content on social media, thus increasing the possibility of exposing themselves to misinformation. That is, scarcity of information concerning the pandemic due to limited access will likely result in vulnerability of consuming misinformation. Therefore, we anticipated that the level of information accessibility in society would be negatively related to the level of exposure to COVID-19 misinformation. Our first hypothesis:

H1: Information accessibility will be negatively associated with exposure to COVID-19 misinformation.

As we argued above, high information accessibility could decrease the chances of exposure to misinformation circulated on various social media platforms. It is also plausible that it could decrease the possibility of sharing misinformation on COVID-19. First, in highly information-accessible societies, citizens have the needed resources to fact-check and verify information that seems suspicious or misleading. Any such information concerning COVID-19 can be easily debunked by the well-informed public. Sharing information online such as news has social utility in generating mutual benefit between the sender and receiver (Goh et al., 2019). When it comes to sharing information based on user-generated content, previous research (Hopp, 2022) has shown that if people can correctly identify misinformation, they are less likely to share it with people in their social circles.

A study by Duffy et al. (2020) further showed that even though sharing online represents a social good, if the shared information turns out to be false or misleading, sharing negatively impacts the sender's interpersonal relationships. Under such a circumstance, the information is what they characterized "too good not to share" (p. 1965). Therefore, it is logical to assume that in societies with higher information accessibility, where digital information is freely accessible and sharing can be socially beneficial, sharing misinformation on COVID-19 would probably happen less frequently. Conversely, in societies with restricted information accessibility, misinformation sharing would likely to happen more frequently largely because diverse authoritative information is limited whereas user-generated content fills the void. The second hypothesis was raised accordingly:

H2: Information accessibility will be negatively associated with sharing COVID-19 misinformation.

Individual-level Factors Affecting Cognition and Attitudes

Next, the effects of individual-level factors on cognitive and attitudinal outcomes are analyzed. In medical psychology (Anderson et al., 2009; Laditka et al., 2009), the state of an individual's healthy cognition implies his/her ability to perform all necessary cognitive or mental processes of acquiring knowledge and understanding, e.g., attention, judgment, and perception. We were interested in examining how exposure to COVID-19 misinformation would affect sharing behavior as well as cognitive outcomes (i.e., misinformation beliefs, knowledge of COVID-19) and attitudes (i.e., anti-vaccine attitudes). The effect of exposure to COVID-19 misinformation on sharing the misinformation was elaborated first because scholars (Olmstead et al., 2011) have long argued that sharing news has become the most important dimension of social media engagement. According to the definition by Kümpel et al. (2015), sharing refers to the "act of distributing a specific kind of content instead of describing a general social media activity that can involve posting personal pictures, anecdotes, or simply talking about one's feelings" (p. 2).

Accordingly, we defined COVID-19 misinformation sharing as the practice of talking, posting, or recommending to people in their online and offline social networks seemingly true, but actually false information about COVID-19. Considering news sharing is a post-exposure practice, it is appropriate to assume that higher exposure to COVID-19 misinformation will increase the possibility of sharing the misinformation. In addition, COVID-19 is an issue with high individual relevance and societal significance. According to the theory of reasoned action (Hale et al., 2002), people will be likely to share related misinformation after exposure since they consider the information as very important to themselves and others (Kim et al., 2020). Therefore, we hypothesized the relationship between exposure to COVID-19 misinformation and sharing behavior in the next hypothesis:

H3: Exposure to COVID-19 misinformation will be positively associated with misinformation sharing behavior.

In addition to sharing behavior that facilitates the spread of misinformation, misinformation exposure could result in some negative cognitive and attitudinal consequences. Our expectation was based on the news learning model (Eveland, 2001) which proposes that a highly involved individual exposed to news will likely process the information and learn from it. Research has indicated that information processing mechanisms enable people to enhance their political knowledge (Eveland et al., 2002) and to stay informed of accurate health knowledge following exposure to relevant information (Lo et al., 2013; Wei et al., 2011). While these findings have acknowledged the positive effects of information processing, few studies have explored whether exposure to misinformation leads to any "de-learning" effects.

Furthermore, the Health Belief Model (HBM) proposes people's beliefs as their perception about a disease (e.g., COVID-19), including their susceptibility to infection, the disease's severity, and benefits of preventive behaviors (Champion & Skinner, 2008). The exposure to COVID-19 can alter an individual's beliefs and further influence their attitudes and knowledge. In this study, misinformation beliefs refer to the acceptance of misinformation on COVID-19 as true. For example, if a person thinks that a piece of misinformation like "eating garlics can prevent COVID-19 infection" is likely or definitely to be true, the person is considered to have misinformation beliefs.

Misinformation is more likely to be accepted as true when it is compatible with other information one stores in his or her memory (Petty & Cacioppo, 1986). In addition, repetition can also make the statement appear more credible in the eyes of the beholder (Allport & Lepkin, 1945). The phenomenon is known as "processing fluency." As Pluviano et al. (2017) argued, the more often people are exposed to false claims, the more likely they are to find the claims to be true (aka the *illusory truth effect*). Therefore, we anticipated that increased exposure to COVID-19 misinformation would produce belief in the credibility of the misinformation.

The misinformation false belief has been observed in a variety of contexts. Studies of fake news (e.g., the U.S. 2020 election) found that prior exposure to misleading information increased the perceived accuracy of fake news (Pennycook et al., 2018). Gerosa et al. (2021) examined how people's education levels relate to their knowledge about COVID-19 and susceptibility to fake news. Interestingly, they found that education level

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did not play a role in misinformation beliefs, but higher news consumption was associated with lower levels of knowledge and more false beliefs. Lee et al. (2020) found that COVID-19 misinformation exposure was positively associated with misinformation beliefs about COVID-19. As Greenspan and Loftus (2021) suggested, when the misinformation is discussed among experts, journalists, and the general public, the negative effect of misinformation exposure on people's knowledge and beliefs will be stronger. The altered perceptions and beliefs regarding COVID-19 due to acceptance of COVID-19 misinformation as true could result in reluctance to adopt recommended preventive measures and vaccination.

To be specific, as Smith (2017) reported, individuals holding anti-vaccine attitudes are reluctant or even refuse to be vaccinated. The anti-vaccine attitudes are one of the false perceptions that have hindered the collective efforts to control the global pandemic (Loomba et al., 2021). Misinformation prevailing on social media such as "COVID-19 vaccines will affect fertility" or "COVID-19 vaccines will alter human DNA" will likely make people falsely believe that the risk of vaccination is greater than getting infected with the COVID-19 virus (McKinley & Lauby, 2021). Thus, exposure to COVID-19 misinformation will likely enhance anti-vaccine attitudes.

Moreover, the negative effects of misinformation on knowledge were examined in a different context, including in politics and public health. Being exposed to misinformation in the form of fake news about political campaigns resulted in voters knowing less about political issues, candidates, and policies (Maurer & Reinemann, 2006; Munger et al., 2022). Similarly, during an unexpected health crisis, people's learning outcomes could also be negatively affected by popular misinformation due to the impression created by the misinformation that no consensus existed on the topic, which could generate confusion and mistrust. Then, individuals might further disengage from health information seeking, avoid appropriate preventive measures, or form wrong perceptions about pandemic control (Chou et al., 2020). A study of South Korean adults (Lee et al., 2020) found that exposure to COVID-19 misinformation was positively associated with misinformation beliefs, which in turn were positively associated with poor knowledge about COVID-19.

Based on the above review, we proposed that a higher level of misinformation exposure would exert negative effects on people's cognition and attitudes—that it will make them more likely to believe in the misinformation about the COVID-19 pandemic, form an anti-vaccine attitude, and know less about COVID-19. The hypotheses were proposed as follows:

H4a: Exposure to COVID-19 misinformation will be positively associated with misinformation beliefs about the disease.

H4b: Exposure to COVID-19 misinformation will be positively associated with anti-vaccine attitudes.

H4c: Exposure to COVID-19 misinformation will be negatively associated with knowledge on COVID-19.

Modeling the Mediation Effects of Sharing

As we discussed, sharing digital information is the hallmark of engagement on social media (Olmstead et al., 2011). Sharing, for instance, may extend the reach of a message to a large group of people. If the message is false, sharing it with others will lead to greater harms in confusing or misleading more people who receive it. Past research (Bobkowski, 2015; Su et al., 2019) has tested a number of predictors of news sharing behavior, such as perceived issue importance, information utility, and ideological congruence. According to Lee and Ma (2012), those who were driven by gratifications of information seeking, socializing, and status-seeking will be more likely to share news with others.

What is more, sharing with the purpose of convincing others that the information may be true will be more likely to accumulate misinformation beliefs and make the information senders further ignore updated factual knowledge (Oyserman & Dawson, 2020). In addition, the social networks in which senders share misinformation also account for a great deal of the possible consequences—when misinformation is shared with people who lack sophisticated media literacy and Internet skills, sharing is likely to consolidate their false beliefs about COVID-19 and prevent them from learning scientific knowledge from media outlets.

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In sum, misinformation exposure results in misinformation sharing behavior, which affects false beliefs and correct knowledge. That is, sharing mediates the relationship between misinformation exposure and negative cognitive and attitudinal outcomes. To further explore the indirect effects of misinformation exposure on cognitive outcomes (i.e., misinformation belief, knowledge) and anti-vaccine attitudes through misinformation sharing, we raised a research question:

RQ1: To what extent will sharing misinformation mediate the relationship between exposure to COVID-19 misinformation and a) misinformation beliefs, b) anti-vaccine attitudes and c) knowledge of COVID-19?

Finally, to examine the exposure and effects of COVID-19 misinformation in mainland China, Hong Kong, Singapore, and Taiwan, we further proposed sharing misinformation as the underlying the mechanisms of how exposure affects people's beliefs, attitudes, and knowledge towards the pandemic. As Figure 1 shows, we also incorporated information accessibility in the four societies in the model to investigate how different accessibility under different socio-political systems makes a difference to misinformation exposure, sharing, and cognitive outcomes.

Figure 1   The Hypothesized Model
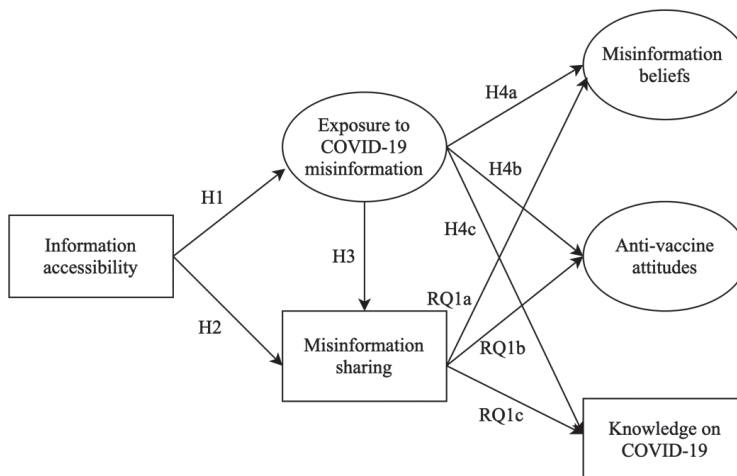
Method

Online parallel surveys were conducted to collect data in Beijing, China, Hong Kong, Taipei, and Singapore in a two-week period from August 4 to 18, 2021. The fieldwork protocol was approved by Institutional Review Board. Panel members for the sample were recruited by a professional survey company, Dynata. Specifically, respondents were randomly selected from a national panel with an invitation via email to complete a web-based survey. To increase the generalizability of the findings, we employed quota sampling to control for key demographics (age, gender, and ethnicity, only for Singapore) in order to reflect the population characteristics in each city. Given that the target group for this study was adults aged 18 years or older, we could not match the sample exactly to the age range estimated by the local census. Hence, some adjustments were made to the quota ratio to achieve even distribution of age groups in each city. The questionnaire was administered in traditional Chinese in Hong Kong and Taipei, in English in Singapore, and in simplified Chinese in China. Two bilingual researchers translated the complete questionnaire from Chinese to English. A total of 4,094 respondents successfully completed the surveys.

Among the 4,094 respondents, the average age was 40.36 ($SD = 13.14$, ranging from 18 to 84). Of the sample, gender was evenly distributed, consisting of 48.30% males and 51.70% females. The distribution of gender and age basically matched the general populations of each city. In terms of education background, 18.10% of respondents received high-school level education or lower, 19.20% held a diploma in vocational education, 52.70% obtained a Bachelor's degree, and 10% had a Master's degree or higher. Considering that Singapore is a multi-ethnic society, ethnicity in the Singapore sample was measured. The sample included 74% Chinese, 13.70% Malay, 7.60% Indian, and 4.70% other. Table 2 presents the sample profile by site of study.

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Table 2   Sample Profile (N = 4,094)

Factors	Beijing (*N* = 1,033) *M* (*SD*) or %	Hong Kong (*N* = 1,017) *M* (*SD*) or %	Taipei (*N* = 1,019) *M* (*SD*) or %	Singapore (*N* = 1,025) *M* (*SD*) or %
Age, years	39.90 (11.80)	39.48 (12.84)	39.36 (13.08)	42.70 (14.46)
Gender (male) in %	49.30	45.10	47.70	51.10
Education in %				
High school or lower	12.70	25.90	13.70	20.20
Vocational school or non-degree program	22.70	14.40	16	23.80
Bachelor's degree	59.40	51.60	53.50	45.90
Master's degree or higher	5.20	8.10	16.80	10.10
Income in %				
US$0–1,566 (Beijing) US$0–2,564 (Hong Kong) US$0–1,079 (Taipei) US$0–2,189 (Singapore)	8.10	10.80	8.10	13.80
US$1,567–3,133 (Beijing) US$2,565–5,128 (Hong Kong) US$1,080–1,797 (Taipei) US$2,190–5,109 (Singapore)	27.80	26.90	14.90	30.20
US$3,134–4,700 (Beijing) US$5,129–7,692 (Hong Kong) US$1,798–2,516 (Taipei) US$5,110–8,029 (Singapore)	25.30	26.90	15	26.40
US$4,701–6,266 (Beijing) US$7,693–10,257 (Hong Kong) US$2,517–3,235 (Taipei) US$8,030-10,949 (Singapore)	19.40	20.70	16	15.60
US$6,267–7,833 (Beijing) US$10,258–12,821 (Hong Kong) US$3,236–3,954 (Taipei) US$10,950–13,869 (Singapore)	13.70	8.40	22	7.90
US$7,834 or above (Beijing) US$12,822 or above (Hong Kong) US$3,955 or above (Taipei) US$13,870 or above (Singapore)	5.70	6.40	24	6.10

Measures and Scales

Information accessibility

To construct the index of the information accessibility scale concerning the four societies in our study, five broad indices were used to build a

digital information accessibility index in each society. They were (1) Internet accessibility, (2) the state of development in information and communication technology, (3) the global outlook in terms of development and competitiveness, (4) degree of personal freedoms, and (5) linguistic diversity (e.g., whether bilingual or multilingual).

Based on the constructed information accessibility index, the level of information accessibility in each society was ranked on a scale of 1 to 3, with "1" representing the least accessibility and "3" indicating the most accessibility.

Exposure to COVID-19 misinformation

Five items were used to measure how often the respondents were exposed to COVID-19 misinformation on popular social media platforms (e.g., Facebook, Twitter, and Weibo). A 4-point Likert scale (1 = never, 4 = often) was used. The items were selected from a pool of false messages or posts that circulated online during the pandemic; they were either fact-checked or refuted by established sources (e.g., World Health Organization, 2021). For example, 5G mobile networks can transmit the COVID-19 virus; Asians are more likely to be infected with COVID-19 virus than others; and non-inactivated COVID-19 vaccines will alter human DNA. Responses were averaged to create a combined measure of exposure to COVID-19 misinformation (M = 1.82, SD = .78, Cronbach's α = .88).

COVID-19 misinformation sharing

Using the same 4-point scale (1 = never, 4 = often), respondents were then asked to indicate how often they shared some of the COVID-19 misinformation that was used in the exposure measure (M = 2.23, SD = 1.07).

Misinformation beliefs

Respondents rated the extent to which they believed five statements concerning COVID-19 were true on a 4-point scale (1 = definitely false, 4 = definitely true). The statements were: (1) COVID-19 virus can spread through 5G mobile networks; (2) drinking bleach can kill COVID-19 virus; (3) eating garlic can prevent COVID-19 infection; (4) COVID-19 vaccines will affect fertility; and (5) COVID-19 vaccines will alter human DNA.

Responses were averaged to form an index of misinformation beliefs. The higher score represents a stronger belief in COVID-19 misinformation ($M =$ 1.82, $SD = .96$, Cronbach's α = .90).

Anti-vaccine attitudes

Adapted from Shapiro et al. (2016), respondents answered three items on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree): (1) People are deceived about the effectiveness of COVID-19 vaccines, (2) Data about COVID-19 vaccine effectiveness is fabricated, and (3) People are deceived about COVID-19 vaccine safety. Responses were averaged to create a measure of anti-vaccine attitudes. A higher score indicates a more negative evaluation of COVID-19 vaccines ($M = 2.50$, $SD = 1.10$, Cronbach's α = .90).

Knowledge of COVID-19

Respondents' knowledge on COVID-19 was assessed using another five questions adapted from established sources (Centers for Disease Control and Prevention, 2021; World Health Organization, 2021). The factual questions include who the Director-General is of WHO (World Health Organization) in fighting COVID pandemic, the approximate death rate of COVID-19, and what is the new variant of COVID-19 virus, to list a few. Using the multiple-choice format, respondents were requested to choose one answer that they thought was correct from four options. They received one point from each correct answer and zero points for selecting the incorrect answer or "don't know" option. The total score for five questions yielded an index of knowledge about COVID-19. The higher the score, the more knowledgeable (Min = 0, Max = 5, $M = 2.64$, $SD = 1.53$, Cronbach's α = .61).

Results

To examine how exposure to and sharing of COVID-19 misinformation differed across the four societies with different levels of digital information accessibility, a series of one-way analyses of variance (ANOVA) was performed. Results revealed that respondents from Beijing, Hong Kong,

Singapore, and Taiwan differed significantly in exposure to COVID-19 misinformation [$F(3, 4090) = 88.51$, $p < .001$]. The post-hoc Scheffe test indicated that Beijing respondents were most likely to view COVID-19 misinformation ($M = 2.15$, $SD = .83$), followed by respondents in Hong Kong ($M = 1.72$, $SD = .68$), Singapore ($M = 1.70$, $SD = .81$) and Taipei ($M = 1.69$, $SD = .71$).

Regarding sharing of COVID-19 misinformation with others, the differences among the four societies were also found to be significant [$F(3, 4090) = 70.94$, $p < .001$]. Results of the post-hoc Scheffe test showed that the Beijing respondents also shared more misinformation ($M = 2.61$, $SD = 1.09$) than did their counterparts in Hong Kong ($M = 2.21$, $SD = 1.01$) and Singapore ($M = 2.11$, $SD = 1.01$). Respondents in Taiwan shared misinformation the least ($M = 1.98$, $SD = 1.04$).

H1 and H2 hypothesized a negative relationship between information accessibility and exposure to/sharing COVID-19 misinformation. To test them, a series of hierarchical regression analyses were performed. For control purposes, the influences of demographic variables (i.e., age, gender, education, income) were entered as the first block. Based on causal order, information accessibility was entered in the second block, followed by exposure to and sharing COVID-19 misinformation in the third block. As shown in Table 3, information accessibility was significantly but negatively associated with exposure to COVID-19 misinformation ($\beta = -.22$, $p < .001$). The results also showed that information accessibility was negatively related to sharing COVID-19 misinformation ($\beta = -.09$, $p < .001$). H1 and H2 were both supported.

Consistent with past research (Li et al., 2020; Lo et al. 2022), these results suggest that in a society where access to digital information is limited or restricted, people who are worried about the pandemic use the social media to obtain updated information about the COVID-19 pandemic will view and share all sorts of information about the pandemic, including misinformation, to meet their needs for information. On the other hand, in societies where information access is free and unrestricted, respondents who are used to exposing themselves to all sorts of information online will ignore faulty and inaccurate information.

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Table 3　Results of Hierarchical Regression Analyses (N = 4,094)

Predictors	EM	SM	MB	AVA	KN
Block 1					
Age	−.11***	−.07**	.03	.03	.14***
Male	.06***	−.01	−.03*	−.02	.14***
Education	.04*	.003	−.04**	−.01	.22***
Income	−.10***	−.08***	−.00	−.12***	.24***
Adjusted R²	.02	.02	.01	.04	.15
Block 2					
Information accessibility	−.22***	−.09***	.15***	.33***	.04**
Adjusted R² incremental	.05	.02	0	.06	0
Block 3					
Misinformation exposure	—	.34***	.51***	.30***	−.05***
Misinformation sharing			.17***	.12***	−.13***
Adjusted R² incremental	—	.11	.32	.12	.02
Total adjusted *R²*	—	.15	.33	.22	.17

Notes. EM: Exposure to misinformation; SM: Sharing misinformation; MB: Misinformation beliefs; AVA: Anti-vaccine attitudes; KN: Knowledge of COVID-19; All values are standardized regression coefficients. *$p < .05$, **$p < .01$, ***$p < .001$

H3 stated that the relationship between COVID-19 misinformation exposure and sharing behavior would be positive. As regression results in Table 3 show, exposure to COVID-19 misinformation was positively associated with COVID-19 misinformation sharing ($\beta = .34$, $p < .001$), thereby supporting H3. The result indicates that the more respondents viewed COVID-19 misinformation online, the more they were inclined to share such information with others by virtue of forwarding or reposting it to people in their social media groups.

With regard to the harmful effects of exposure to COVID-19 misinformation on cognitive and attitudinal outcomes, we predicted in H4 that exposure would be positively associated with a) misinformation beliefs, and b) anti-vaccine attitudes, but c) negatively associated with knowledge about COVID-19. To test H4, more regression analyses were performed. As shown in Table 3 (the last three columns), after controlling for demographics and information accessibility, exposure to COVID-19 misinformation was significantly associated with misinformation beliefs ($\beta = .51$, $p < .001$) and anti-vaccine attitudes ($\beta = .30$, $p < .001$). As expected, it was significantly

but negatively associated with knowledge of COVID-19 ($\beta = -.05$, $p < .001$). H4 was supported. These results indicate that the higher the level of exposure to COVID-19 misinformation, the greater harms on respondents' cognition and attitudes in terms of having misbeliefs about the pandemic, being anti-vaccine attitudinally, and have less correct knowledge about COVID-19.

Further, to test the mediation effect of COVID-19 misinformation sharing on the relationship between misinformation exposure and cognitive and attitudinal outcomes, the concerns of RQ1, a series of mediation analyses were conducted using PROCESS macro Model 4 (Hayes, 2017), while controlling for demographics. We estimated bias-corrected 95% confidence intervals (CIs) with 5,000 bootstrap samples.

The results showed that misinformation sharing was a significant mediator of the relationship between misinformation exposure and misinformation beliefs ($b = .07$, $SE = .01$, 95% $CI = [0.05, 0.08]$). Specifically, misinformation exposure positively predicted misinformation sharing ($b = .49$, $t = 24.38$, $p < .001$), which in turn enhanced misinformation beliefs ($b = .14$, $t = 10.83$, $p < .001$). Moreover, the indirect effect of misinformation exposure on anti-vaccine attitudes through misinformation sharing was significant ($b = .04$, $SE = .01$, 95% $CI = [0.03, 0.06]$), which means, the increased exposure to misinformation caused by misinformation sharing led to stronger anti-vaccine attitudes ($b = .09$, $t = 5.37$, $p < .001$). Additionally, misinformation sharing significantly mediated the effect of misinformation exposure on knowledge ($b = -.09$, $SE = .01$, 95% $CI = [-0.12, -0.07]$). The increased level of misinformation exposure resulting from misinformation sharing had a negative impact on respondents' correct knowledge on COVID-19 ($b = -.19$, $t = -8.76$, $p < .001$). Together, these results validated the mediating role of misinformation sharing.

Finally, to uncover the underlying process of how exposure and sharing affected people's beliefs, attitudes, and knowledge of the pandemic across the four societies that differ in information accessibility on digital media, the structural equation modelling (SEM) in Amos 24 was conducted. The model fit was evaluated on the following criteria: For a good model fit, the values for the comparative fit index (CFI) and Tucker-Lewis Index (TLI) should be greater than .95, the value for the root mean square error of approximation (RMSEA) should be less than .06 (Hu & Bentler, 1999), the p-value of chi-square (χ^2) value obtained should be non-significant ($p >$

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.05), and the relative chi-square (χ^2/df) should be less than 2 (Ullman, 2001).

Figure 2 summarizes the SEM results, which showed that although the chi-square for the model was significant, ($\chi^2 = 2049.76$, *df* =89, $\chi^2/df=$ 23.03, *p* < .001), the comparative fit index (CFI = .95), the normal fit index (NFI = .94), the Tucker Lewis index (TLI = .93), and the root mean square error of approximation (RMSEA = .073) indicated that the model fit was acceptable. The model explained 4.20% of the variance in exposure to misinformation, 15.70% of the variance in sharing misinformation, 9.40% of the variance in anti-vaccine attitudes, 41.70% of misinformation beliefs, and 3.80% of knowledge of COVID-19.

Figure 2 Structural Equation Model with Standardized Coefficients (N = 4,094)
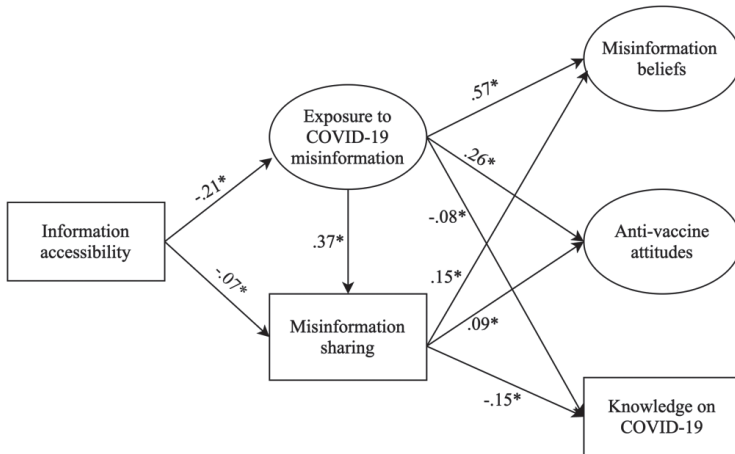
*Note. *p* < .001*

Conclusion and Discussion

In responding to the pressing need to understand multi-level factors that influence the diffusion and harm of the widespread infodemic during the COVID-19 pandemic (Chou et al., 2020; Lee & Shin, 2021), this large-scale cross-societal analysis of misinformation on COVID-19 in China, Hong Kong, Taiwan, and Singapore shows that from a stimulus-response perspective, viewing and sharing of misinformation imposed a harmful or

negative impact on citizens' beliefs, vaccine attitudes, and knowledge—the greater their exposure to and sharing of misinformation, the stronger were their beliefs about the misinformation and their anti-vaccine attitudes, and the less knowledgeable they were about COVID-19.

These findings expand past research (e.g., Cho et al., 2009; Eveland, 2001) on the positive role of media for citizens to learn about public affairs, especially the facilitating role of social media in gaining health knowledge (Ghalavand et al., 2022). In the context of the global pandemic, widely circulated misinformation about COVID-19 on social media platforms seemed to impede the public's acquisition of factual and accurate knowledge that would help it build the necessary literacy to cope with the disease. Instead of empowering citizens with correct knowledge, misinformation on COVID-19 appears to have a *delearning effect*, a new ground that points the direction for more follow-up research.

Further, more insight is gained from the finding that sharing misinformation on COVID-19 mediates the relationship between exposure and negative cognitive and attitudinal effects. That is, the harm of exposure to COVID-19 misinformation is transmitted through sharing it. The more people shared with others, the greater the harmful effects on misbeliefs, anti-vaccine attitudes, and incorrect knowledge, creating a sort of cascading effect. These patterns reveal the underlying process of how sharing functions as a critical link between encountering misinformation on social media and the negative effects on cognition and attitude. As sharing is a characteristic of social media communication, this finding suggests that the harm of consuming misinformation on COVID-19 diffused on social media platforms was greater than on other media outlets such as e-newspapers. Also, the finding has implications for containing the circulation of misinformation on social media; spotting the super spreader is critical to stopping the spread.

More importantly, the negative effects of misinformation on COVID-19 in society appear to be *differential*, subject to the larger societal context—the greater information accessibility, the less exposure and sharing as well as fewer negative cognitive and attitudinal effects. Conversely, restricted access leads to greater exposure to infodemic. Furthermore, the less information accessibility, the greater exposure and sharing, which in turn is associated with stronger negative cognitive and attitudinal effects. This key finding from the four societies with markedly different media environments underscores the shaping role of digital information accessibility. We

conclude that during the on-going public health crisis, the negative effects of misinformation about COVID-19 were less in societies with free access because citizens can access a diverse range of information to stay informed. They are also less likely to share misinformation. On the other hand, in societies with restricted access to digital information, timely and accurate information about COVID-19 outbreaks was scarce. Under the circumstance of information scarcity, citizens tended to seek all the information that they can find and share the limited information to those around them, including misinformation.

Taken together, these findings suggest that societies with free access to digital information provide their citizens with rich information resources to cope with a public health crisis, and they tend to be harmed less by misinformation. Thus, the mantra that "knowledge is power" applies. In comparison, the benefit of online information is less when accessibility is restricted. As our findings show, the harmful effects of misinformation can be greater on citizens in information-poor societies.

What, then, have we learned from this cross-societal study? Access and transparency turned out to be the necessary social condition for understanding the diffusion and consequences of encountering misinformation about COVID-19 on social media. The results of this study strongly support the idea that public health authorities and medical experts should maintain open and transparent communication with the public, especially on digital media platforms. As soon as misinformation about COVID-19 appears on social media platforms, factual and evidence-based information should be presented quickly so that the general public can fact-check user-generated content to sort out inaccurate or false information. Timely and accurate information published from authoritative sources, such as health agencies, should reduce the chance of misinformation that affects the public's beliefs, vaccine attitudes and knowledge.

Theoretically, these key findings contribute to the growing research on the impact of the infodemic in the four societies by integrating environmental social factors (e.g., access to digital information, and media environment) with individual-level social-psychological variables in accounting for the differential harms of misinformation on COVID-19. That is, by situating the relationships of information accessibility, exposure and sharing of COVID-19 misinformation, and cognitive and attitudinal outcomes in the four societies,

our findings provide a comprehensive understanding of the underlying societal factors—free flow of digital information—that account for the differential harms of misinformation on citizens' cognition and attitudes in the four societies.

Nevertheless, the links and relationships tested in our SEM model should not be interpreted as causal due to the one-shot design. Hence, a limitation of the study. Future research should attempt a longitudinal design to collect tracking data, which would demonstrate the causal relationships among societal factors, exposure, sharing and the impact of pandemic misinformation. Another limitation concerns the index of information accessibility, which needs to be further tested in societies with greater differences (e.g., Chinese societies vs. Islamic societies) or similarities (e.g., Confucian societies in East Asia) in information accessibility to fully demonstrate its validity and applicability. More multi-cultural and cross-societal comparative studies involving a greater number of societies will be desirable in future research to theorize the role of digital information accessibility in shaping the relationships of exposure to misinformation and its impact on cognition and attitude.

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