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Disaster Relief and Humanitarian Logistics: Three Essays

Peter H. Imbriale
Bentley University

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Signature

Internal Committee Member: Jeffrey Livingston

Signature

Internal Committee Member: Ian Walsh

Signature

External Reviewer: Chirag Surti

Signature

Date all Signature Received: Date 8-26-2023

Disaster Relief and Humanitarian Logistics: Three Essays

Peter H. Imbriale

A dissertation
submitted in partial fulfillment of the
requirements for the degree of

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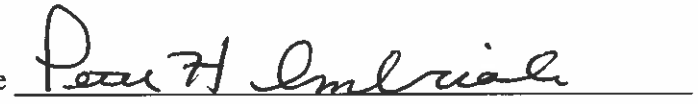
Signature 

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DEDICATION

To my loving wife, Heather, and our wonderful children: Elyse, Jade, Zoe, and Oliver.

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ABSTRACT

Disaster Relief and Humanitarian Logistics: Three Essays

Peter H. Imbriale

Chair of the Supervisory Committee:
Associate Professor of Management, Euthemia Stavrulaki
Department of Management

The increased frequency and impact of natural disasters and other humanitarian crises—including events such as the COVID-19 pandemic—makes studying disaster relief and recovery particularly important. One relevant area of research in this space is humanitarian logistics. This dissertation provides insights into disaster relief logistics by exploring the government's role in humanitarian logistics, examining the government's efforts to address COVID-19 medical supply chain challenges, and determining how to lessen the impact of supply chain bottlenecks from unwanted post-disaster donations.

Chapter one (sole-authored) is a literature review of the role of governments in humanitarian logistics. Although governments are vital stakeholders in nearly every humanitarian disaster, there is an incomplete understanding of the role of government in such events. The findings suggest that governments assume three key roles: host, funder, and coordinator. A theoretical framework is presented that illustrates these roles in the context of a humanitarian disaster.

Chapter two (co-authored) is an empirical study of the U.S. federal government's efforts to address medical supply chain challenges resulting from COVID-19. Using a qualitative case study and the lens of attribution theory, we explain how a key U.S. public health agency responded to COVID-19 medical supply challenges and how its revised

strategies are attributed to specific factors experienced during the COVID-19 pandemic. We identify four such critical factors: mission complexity and uncertainty, partner incentives, domestic manufacturing capabilities, and funding uncertainty. These factors inform and affect three main strategic priorities for the agency's medical supply chain—supply chain coordination, supply chain collaboration, and stockpiling.

Chapter three (co-authored) is an empirical study of post-disaster donations to lessen the supply chain impacts from unwanted donations. Following a disaster that results in a humanitarian crisis, media coverage of the event is frequently followed by surplus donations of goods to charitable organizations, many of which are unwanted and unsolicited. In this study, we conduct an experiment soliciting donations for the humanitarian disaster caused by the Russian invasion of Ukraine to evaluate whether media reports on the benefits of donating cash can lessen unwanted giving. We find that such reports can significantly increase the proportion of cash donations.

TABLE OF CONTENTS

DEDICATION v

ACKNOWLEDGEMENTS vi

ABSTRACT vii

TABLE OF CONTENTS ix

LIST OF TABLES xii

LIST OF FIGURES xiii

LIST OF APPENDICES xiv

CHAPTER 1 1

ABSTRACT 1

INTRODUCTION 2

METHODOLOGY 5

Study design 5

Study search criteria and literature selection 6

Analysis and synthesis 8

DESCRIPTIVE ANALYSIS 9

Number of papers per year 9

Number of papers per methodology 10

Number of papers per journal discipline 11

THEMATIC ANALYSIS 12

The government as the host and regulator 14

The government as the funder 16

The government as the coordinator 19

Theoretical framework 22

DISCUSSION 26

Study robustness 26
Challenges and opportunities for governments 28
CONCLUSION 30
CHAPTER 2 32
ABSTRACT 32
INTRODUCTION 33
LITERATURE REVIEW 38
Inter-organizational Interactions in Supply Chains 38
Supply Chain Disruptions 39
METHODOLOGY 41
Sources of Data 41
Procedures 42
RESULTS 44
Government Strategic Priorities for the Supply Chain 44
Short-to-medium term: Strengthening supply chain coordination 52
Long-term: Building opportunities for supply chain collaboration 55
Orchestrating a stockpiling strategy 58
Attributions 62
Event uncertainty and complexity 62
Partner interests and incentives 64
Domestic manufacturing capabilities 66
Funding Uncertainty 69
Theoretical Framework for the Role of Government in the Medical Supply Chain 70
DISCUSSIONS AND CONCLUSIONS 73

ABSTRACT **81**

INTRODUCTION **82**

EXPERIMENTAL DESIGN **85**

RESULTS **90**

Effect of treatments on donation choice 92

Differences by gender 95

Mechanisms 101

Discussion 104

CONCLUSION **106**

REFERENCES **125**

VITA **139**

LIST OF TABLES

TABLE 1.1: Thematic overview of papers 13

TABLE 1.2: Summary of potential government activities in each role 22

TABLE 2.1: List of Acronyms 34

TABLE 2.2: First-Order Concept Proof Quotes 45

TABLE 3.1: Summary Statistics 91

TABLE 3.2: Effects of media articles on donation choice 96

TABLE 3.3: Effect of treatments on propensity to donate cash instead of donating in-kind, by gender 100

TABLE 3.4: Effect of treatments on attitudes towards donation types 102

LIST OF FIGURES

FIGURE 1.1: Study selection and analysis process 9

FIGURE 1.2: Number of papers per year 10

FIGURE 1.3: Number of papers per method 11

FIGURE 1.4: Number of papers per discipline 12

FIGURE 1.5: Theoretical framework for the role of government in humanitarian logistics 25

FIGURE 2.1: Data Structure 53

FIGURE 2.2: Theoretical framework for the role of government in the medical supply chain 72

FIGURE 3.1: Experiment design 88

FIGURE 3.2: Percentage of participants making each donation choice, by treatment 92

FIGURE 3.3: Percentage of participants making each donation choice, by treatment and gender 97

LIST OF APPENDICES

APPENDIX A: Interview Protocol……..……..…..78

APPENDIX B: Summary of Archival Materials…….……...80

APPENDIX C: Experiment instructions and procedures…….……...109

APPENDIX D: Analysis including subjects who failed attention checks and who did not answer demographic questions in the sample….…….……..122

CHAPTER 1

The Role of Government in Humanitarian Logistics: A Narrative Synthesis

Peter Imbriale
Bentley University
pimbriale@bentley.edu

ABSTRACT

Although governments are vital stakeholders in nearly every humanitarian disaster, there is an incomplete understanding of the role of government in humanitarian logistics. This chapter reviews the current literature to better understand the government's role in the logistics for humanitarian disasters, including its particular challenges and the unique services it can offer to assist in humanitarian relief efforts. A narrative synthesis summarizes the findings from diverse methodologies spanning multiple research disciplines. The findings propose three key government roles in humanitarian logistics: the host, the funder, and the coordinator. These roles can be assumed simultaneously, but not all are necessarily present in each disaster. A theoretical framework is presented that illustrates these three roles in the context of a humanitarian disaster. This study advances the humanitarian logistics research domain by increasing the understanding of the foundational critical success factor for humanitarian supply chains and their resilience: the role of government. The chapter concludes with a discussion of this review's robustness and limitations, in addition to suggesting opportunities for government in practice and future avenues of research.

INTRODUCTION

Natural disasters are occurring with increasing frequency and economic impact (Coronese et al., 2019; Foerster, 2021). The United States experienced twice as many billion-dollar weather and climate disasters in the 2010s, even after adjusting for inflation, as it did during the previous decade (Smith, 2020). The year 2021 was second to only 2020 in terms of the number of billion-dollar weather and climate disasters in the U.S. and third—behind 2017 and 2005—in terms of total dollar cost (Smith, 2022). The increased frequency and impact of natural disasters and other humanitarian crises—including disruptive events such as the COVID-19 pandemic—makes studying disaster relief and recovery particularly important. One relevant area of research in this space is humanitarian logistics. Despite the growth of this research stream over the past decade (Altay et al., 2021; Kovacs et al., 2019), one overlooked aspect of humanitarian logistics is the government perspective (Quarshie & Leuschner, 2020), particularly given the significant influence governments have in humanitarian supply chains (Dube et al., 2016; Quarshie & Leuschner, 2020; Singh et al., 2018; Yadav & Barve, 2015).

Although a relatively limited number of papers have comprehensively addressed the role of government in humanitarian logistics, governments play a crucial role in nearly every humanitarian disaster. These roles can include enabling or restricting external humanitarian assistance (Dube & Broekhuis, 2018; Dube et al., 2016; Fathalikhani et al., 2020; Kunz & Gold, 2015), providing relief supplies, logistics, and infrastructure (Agarwal et al., 2021; Heaslip & Kovács, 2019; Kabra & Ramesh, 2015; Singh et al., 2018), administering the logistics and relief efforts among various humanitarian organizations (Chari et al., 2021; Rodríguez-Espíndola et al., 2018; Singh et al., 2018; Yadav & Barve,

2015), and exerting various powers and authority as a regulator to impact logistics (Chari et al., 2021; Dube et al., 2016; Kunz & Gold, 2015; Quarshie & Leuschner, 2020; Singh et al., 2018). Given these varied and influential functions, it is vital to understand the government's role in humanitarian disasters, including its particular challenges and the unique services it can offer to assist in humanitarian relief efforts.

Among the range of critical success factors in humanitarian logistics, the role of government is commonly cited as the key driving factor (Singh et al., 2018; Yadav & Barve, 2015). A previous review and subsequent interpretive structural model from Yadav and Barve (2015) finds government policies and organizational structure, operationalized collectively as policies that allow or restrict any external assistance, to be the most dominating critical success factor for humanitarian supply chains. A similar study by Singh et al. (2018) finds government support and policy formulation (i.e., authorization for various stakeholders to conduct relief operations and forth policies to increase disaster preparedness) to be the main driving factor in achieving resilience in a humanitarian supply chain. The role and support of the government are foundational to humanitarian logistics activities.

This study uses a literature review to answer the following research question: *what has prior research implied and found about the role of government in humanitarian logistics*? A narrative synthesis methodology is adopted, that is, a review that provides four key elements: (1) a theoretical model, (2) a preliminary synthesis of results, (3) an exploration of relationships within and between studies, and (4) an assessment of the robustness of the synthesis (Popay et al., 2006). The findings suggest that the government

assumes three roles in humanitarian logistics: host, funder, and coordinator. These roles can be assumed simultaneously, but not all are necessarily present in each disaster.

Other literature reviews have been published in the humanitarian logistics research stream, but none have explicitly focused on the role of government. Two of those reviews are included in this study. Mora-Ochomogo et al. (2016) explore the differences between commercial and humanitarian logistics, explicitly focusing on the applicability of classical commercial inventory models. Negi (2022) reviews existing literature to explore the role of humanitarian logistics in managing relief operations and undercover challenges humanitarian organizations encounter in performing humanitarian logistics. While governments factor into several of the challenges they discuss, their review does not broadly explore the role of government in humanitarian logistics. Other relevant humanitarian logistics literature reviews, while not included in this synthesis due to the defined search criteria, include examinations of extant literature concerning humanitarian supply chain performance management and measurement (Abidi et al., 2014), the use of the military and the challenges of civil-military partnerships, (Heaslip & Barber, 2014), partnerships between humanitarian organizations and business corporations (Nurmala et al., 2017), community participation (Bealt & Mansouri, 2018), risk mitigation strategies (Jahre, 2017), and the evolution of coordination in humanitarian logistics (Grange et al., 2020). Again, although these reviews mention government involvement, none specifically explore the government's varied roles and responsibilities, despite its focal involvement in humanitarian logistics activities.

This study makes several contributions. First, it synthesizes the findings from various research disciplines and methodologies, exploring relationships between studies to

identify common themes throughout the literature. Second, the study advances the humanitarian logistics and supply chain management research domain by presenting a comprehensive framework for the role of government, the foundational critical success factor for humanitarian supply chains and their resilience. Finally, the paper concludes by presenting challenges and opportunities for governments in practical humanitarian logistics settings and opportunities for future research.

The remainder of this paper is structured as follows. Section 2 discusses the methodology of this study. Section 3 presents a descriptive analysis of the literature. Section 4 discusses the findings for the review. Section 5 discusses challenges and opportunities for governments in humanitarian logistics and proposes avenues for future research. Finally, the paper ends with summary conclusions.

METHODOLOGY

This section discusses the choice of methodology and study design, as well as the search criteria and approach to literature selection.

Study design

This paper adopts a narrative synthesis methodology. A narrative synthesis is a literature review method common in the medical field but has recently seen extension into other fields, including supply chain management (Marshall et al., 2018; Martins & Pato, 2019; Tennant & Fernie, 2014). This review method is well suited for summarizing findings from studies that utilize diverse methods, particularly when many are qualitative and lack statistical results (Popay et al., 2006; Wong et al., 2013). Using the guidance of Popay et al. (2006), the method synthesizes the extant literature with a framework or theoretical model through four main steps:

(1) developing a theoretical model;

(2) developing a preliminary synthesis of results;

(3) exploring relationships within and between studies; and

(4) assessing the robustness of the synthesis.

This method was particularly well suited because the research topic spans a variety of literature streams, including supply chain management, operations research, and disaster relief. Although the literature on the role of governments in humanitarian logistics may be relatively underexplored compared to more mature research streams, there is still over a decade of available research. Accordingly, a narrative synthesis is appropriate to reconcile the multiple research disciplines and methodologies in this extant research.

Study search criteria and literature selection

To ensure a wide range of research disciplines from various types of papers, journals, and publishers, the author utilized two widely used online databases: ProQuest and ScienceDirect. The search was limited to peer-reviewed articles published in English-speaking journals. The search was performed in February 2023 for peer-reviewed articles published during or before January 2023.

To include the full range of humanitarian logistics activities, the terms *humanitarian logistics*, *humanitarian supply chain*, *humanitarian operations and logistics*, *disaster relief supply chain*, and *disaster relief logistics* were all included in the search. These terms are all used in the literature, with "humanitarian logistics" used most regularly (Çelik et al., 2012; Kunz & Reiner, 2012). The search also included the term *government* to broadly include potential papers focusing on the role of government. The terms were combined using Boolean operators (AND, OR). Our resulting search was: ("humanitarian

logistics" OR "humanitarian supply chain" OR "humanitarian operations and logistics" OR "disaster relief supply chain" OR "disaster relief logistics") AND "government." The search parameters included using these terms in a paper's abstract, title, or keywords. The search did not include "humanitarian operations" alone, as the focus of the study is humanitarian logistics, not the entire relief operation. Non-logistics relief operation activities include search and rescue, hospital triage, risk assessment, and risk mitigation (Farahani et al., 2020; Goldschmidt & Kumar, 2016). The term "military" was also not included as a search term. While the military is a government function that often plays a critical role in humanitarian logistics, the present study focuses on the government at-large. Where research on military involvement in humanitarian logistics was included in the study, it is only through a specific mention of interaction with the government's overall role. Given the military's role in providing security for humanitarian relief activities (Heaslip & Barber, 2014), this inherently focuses the present review away from the role of government in providing security for the humanitarian supply chain.

The search, using the previously discussed keywords, returned 57 papers from ProQuest and 21 from Science Direct. After screening all abstracts for alignment with the research question and eliminating duplicate articles between the two databases, 38 relevant studies were identified for the literature review. Examples of excluded papers include a number of studies focusing on non-government organizations (NGOs) rather than governments. The complete list of papers for the review is provided in Table 1.1 in the thematic analysis section. The studies cover a wide variety of disaster types, including floods (Damoah, 2022; Negi, 2022; Rodríguez-Espíndola et al., 2018), droughts (Mushanyuri & Ngcamu, 2020), hurricanes (Quarshie & Leuschner, 2020), and COVID-

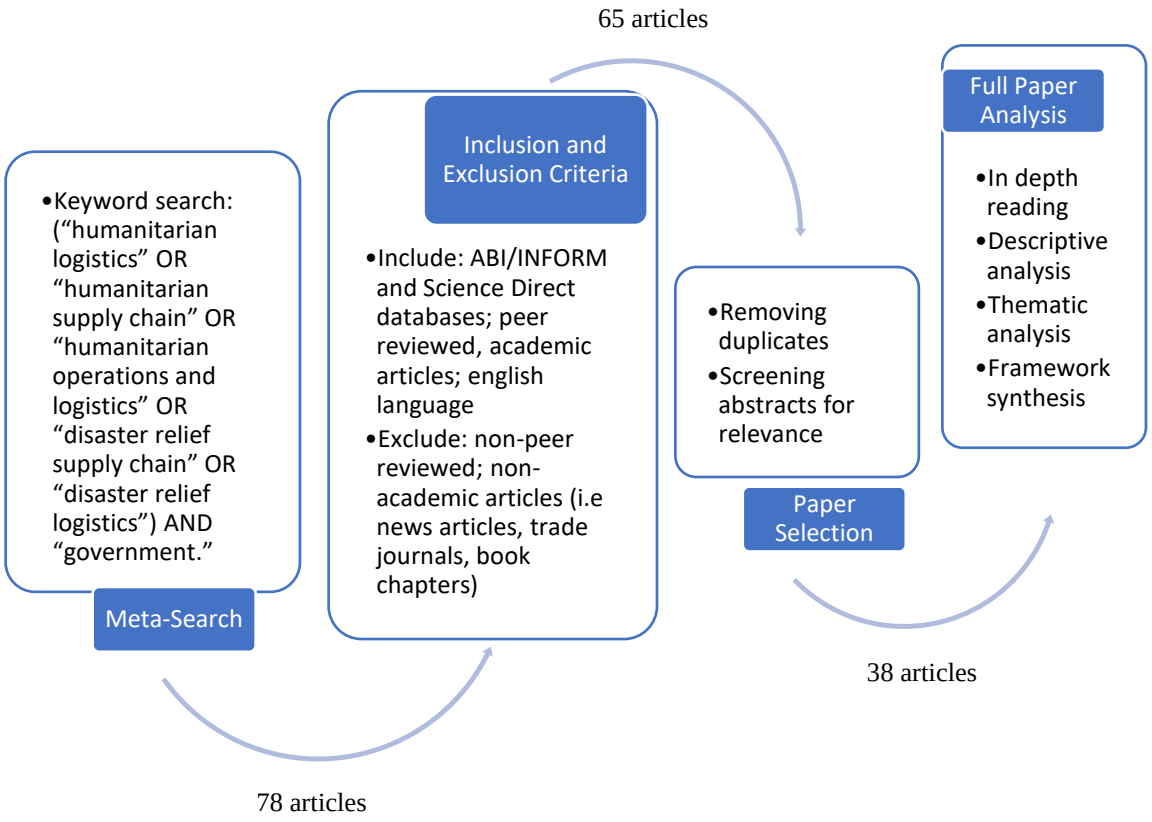
19 (Hernández Gress et al., 2021; Pacheco & Laguna, 2020). While all of the studies reference natural disasters, several also make some mention of man-made disasters (Abazari et al., 2022; Apte & Heath, 2011; Baffoe & Luo, 2020; Dube et al., 2016; Fathalikhani et al., 2020; Klumpp & Losk, 2021; Kunz & Gold, 2015; Kunz & Reiner, 2016; Lu et al., 2018; Mora-Ochomogo et al., 2016; Negi, 2022; Tasnim et al., 2022; Yadav & Barve, 2015). However, none of the included papers focus primarily on man-made disasters (e.g., wars, civil conflict, terrorism).

The selected papers span a variety of methodologies and journals, with publication years ranging from 2009 to 2022. The start date of 2009 reflects the emergence of humanitarian logistics as a research topic following the devastating 2004 tsunami in the Indian Ocean (Banomyong et al., 2019) rather than any exclusion criteria for the start date. Figure 1.1 shows the process of locating and selecting studies.

Analysis and synthesis

The final sample of 38 papers was then analyzed utilizing a narrative synthesis methodology (Popay et al., 2006; Rousseau et al., 2008) for a thematic analysis of extant research across various quantitative and qualitative methods and research disciplines. Using the guidance of Popay et al. (2006), the author first developed a preliminary synthesis of the results of the included studies by reading and re-reading each paper while coding for concepts relevant to the research question. Next, the relationships between and within studies were examined to better understand the heterogeneity between the studies, particularly concerning research methodology and contextual factors, such as the focal country or countries in a case study. This step resulted in a theoretical framework that illustrates the connections between themes and concepts across the studies.

FIGURE 1.1: Study selection and analysis process



Sources: modified from Abidi et al. (2014) and Nurmala et al. (2017)

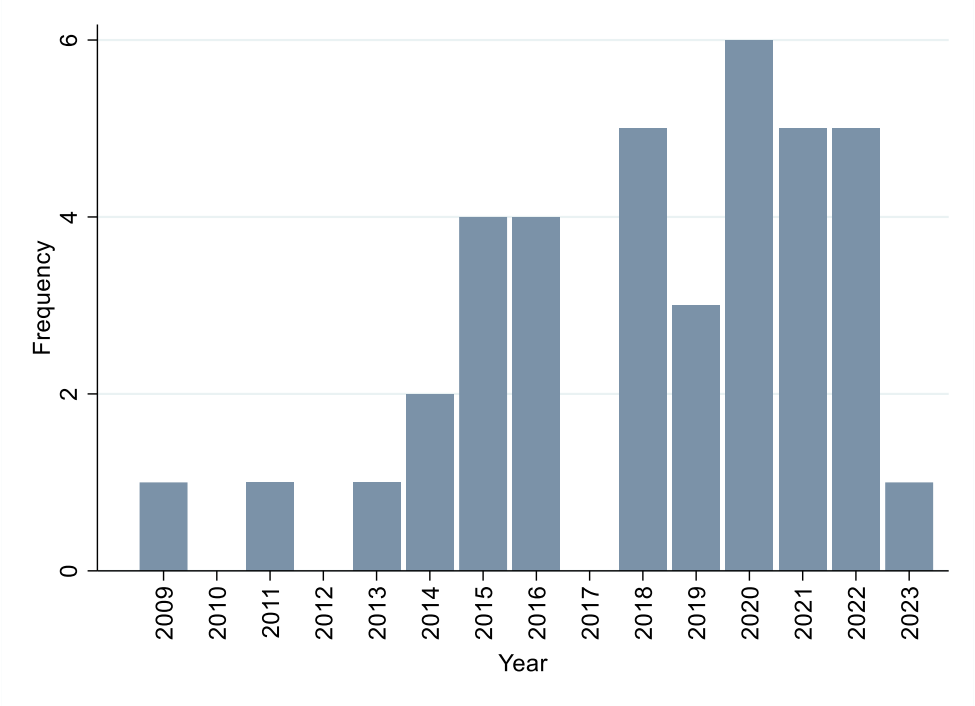
DESCRIPTIVE ANALYSIS

This section describes the number of papers published per year, the methodologies used, and specific journal publication frequency.

Number of papers per year

As discussed above, the papers selected for the review were published no earlier than 2009. This start date demonstrates the recent growth of humanitarian logistics and the government's role as a research stream. Since 2009, there has been a general upward trend of published papers each year (see Figure 1.2).

FIGURE 1.2: Number of papers per year



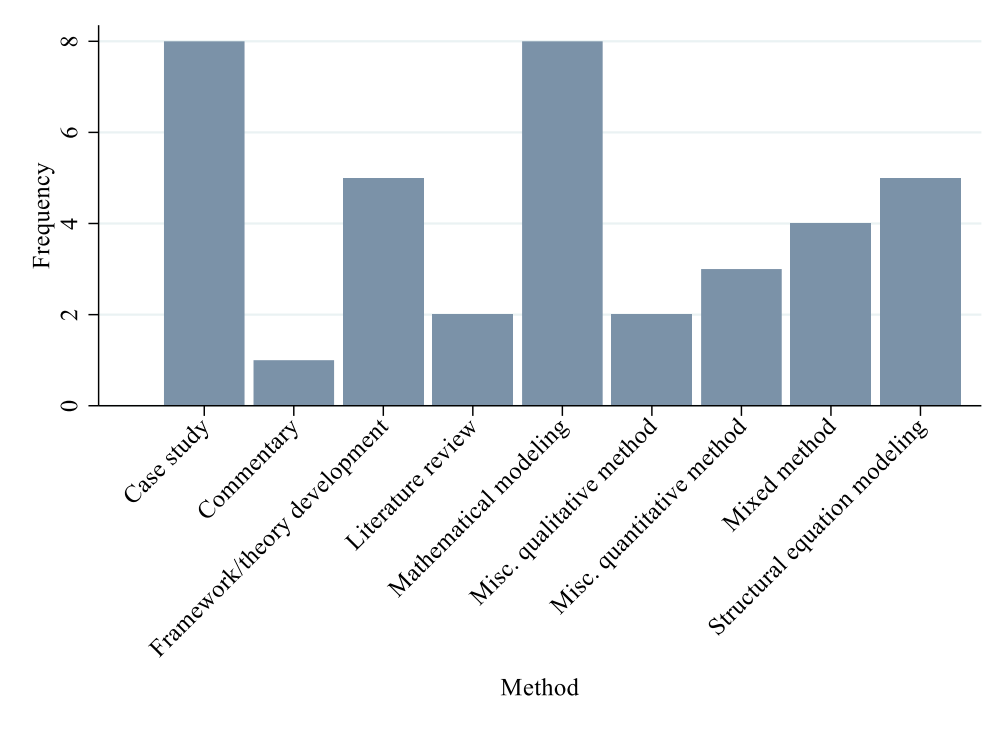
Note: the 2023 data reflects only the first month of the year, given the Feb 2023 timeframe of the search.

Number of papers per methodology

The two most frequently used methods among the 38 papers reviewed were case studies and mathematical modeling, each with eight papers (see Figure 1.3). The second most common methods, with five papers each, were framework/theory development and structural equation modeling. The miscellaneous qualitative methods included a qualitative thematic analysis (Tasnim et al., 2022) and field research (Kumar et al., 2009). The miscellaneous quantitative methods included regression (Rancourt et al., 2014), sentiment analysis (Hernández Gress et al., 2021), and a survey (Lu et al., 2018). The three mixed-method papers each also each included a survey and another method, such as a case study

or economic model (Mogotsi & Saruchera, 2023; Mushanyuri & Ngcamu, 2020; Wisetjindawat et al., 2014).

FIGURE 1.3: Number of papers per method



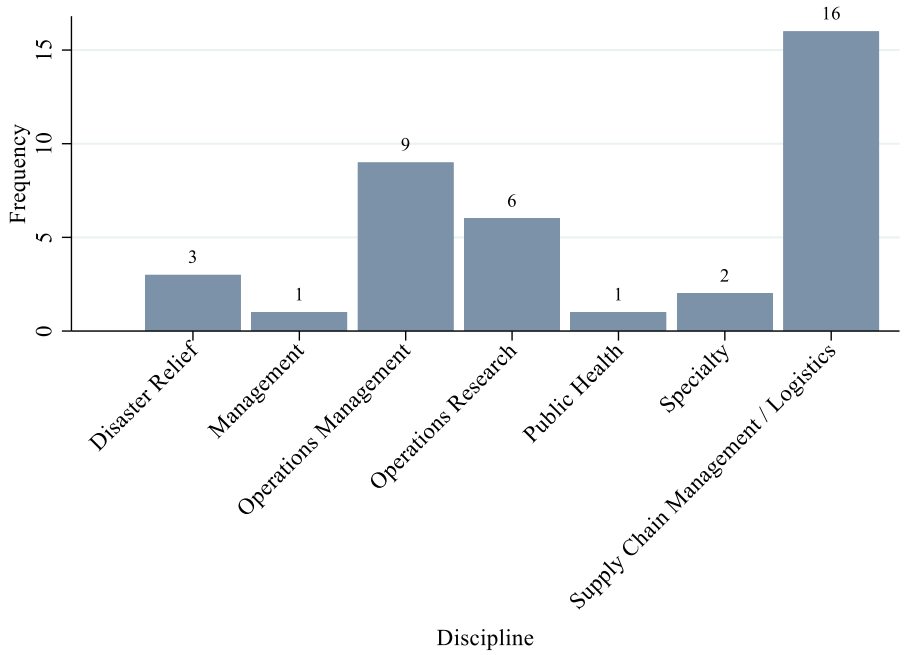
Note: the 2023 data reflects only the first month of the year, given the Feb 2023 timeframe of the search.

Number of papers per journal discipline

The 38 papers for the review are published in 27 distinct journals. These 27 journals are categorized into seven disciplines: disaster relief/emergency management, management, operations management, operations research, public health, supply chain management (SCM) / logistics, or specialty areas. The two most frequent disciplines are SCM/logistics, with 16 separate articles, and operations management, with nine (see Figure

1.4). The publication with the most articles was the Journal of Humanitarian Logistics and Supply Chain Management, with eight articles; the most for any other individual journal was two.

FIGURE 1.4: Number of papers per discipline



THEMATIC ANALYSIS

This section explores the three primary themes that emerged from the review of extant literature. Specifically, the themes outline the government's role as the host in enabling or restricting aid and external assistance, the funder in providing direct or indirect funding for relief supplies and logistics, and the coordinator of logistics efforts among various humanitarian organizations. Table 1.1 provides an overview of the themes in each reviewed paper. Of the 38 papers reviewed, 15 discussed the government's role as a host, 27 its role as a funder, and 23 its role as a coordinator.

TABLE 1.1: Thematic overview of papers

No	Papers	Role of Government		
		Host	Funder	Coordinator
1	Abazari et al. (2022)		X	X
2	Acimovic & Goentzel (2016)		X	
3	Agarwal et al. (2021)			X
4	Apte & Heath (2011)		X	X
5	Baffoe & Luo (2020)		X	
6	Chari et al. (2021)	X	X	X
7	Damoah (2022)		X	
8	Dube & Broekhuis (2018)	X		
9	Dube et al. (2016)	X		X
10	Fathalikhani et al. (2020)	X	X	
11	Heaslip & Kovács (2019)		X	
12	Hernández Gress et al. (2021)	X	X	X
13	Kabra & Ramesh (2015)		X	X
14	Klumpp (2021)		X	
15	Kumar et al. (2009)	X		
16	Kunz & Gold (2015)	X		
17	Kunz & Reiner (2016)	X		
18	Lu et al. (2018)		X	
19	Mogotsi & Saruchera (2023)			X
20	Mora-Ochomogo et al. (2016)	X	X	X
21	Mushanyuri & Ngcamu (2020)	X	X	X
22	Negi (2022)	X	X	X
23	Pacheco & Laguna (2020)			X
24	Quarshie & Leuschner (2020)		X	X
25	Rahman et al. (2022)			X
26	Rancourt et al. (2014)		X	
27	Rayawan et al. (2021)		X	X
28	Rodríguez-Espíndola et al. (2018)			X
29	Salam & Khan (2020)		X	
30	Singh et al. (2018)	X	X	X
31	Swanson & Smith (2013)	X	X	X
32	Tasnim et al. (2022)	X	X	X
33	Vega & Roussat (2015)		X	X
34	Velasquez et al. (2019)		X	
35	Wilson et al. (2018)		X	X
36	Wisetjindawat et al. (2014)		X	X
37	Yadav & Barve (2015)	X		X
38	Zhang et al. (2019)		X	

The government as the host and regulator

One of the most frequent roles governments undertake in humanitarian logistics is that of the host government for external humanitarian assistance. This role is especially prevalent in developing nations where external assistance from other nations or international nonprofit organizations is typical after a natural or man-made disaster. While a government is responsible for ensuring adequate coverage of disasters occurring within its border, it may lack the capacity, budget, expertise, or skills to accomplish this alone (Fathalikhani et al., 2020). In these cases, a host government might depend on nonprofits to provide humanitarian services when a disaster does occur, using various policies and strategies to maximize the welfare of those affected. These non-government organizations (NGOs) can be local or international organizations that work under the host government's coordination and legal framework (Fathalikhani et al., 2020).

Government policies can be used to allow or restrict external assistance (Negi, 2022; Yadav & Barve, 2015). Host government obligations (i.e., to allow free passage of international humanitarian organization supplies) differ based on the event: unarmed conflict, armed conflict, or international armed conflict (Dube et al., 2016). Using a multiple case study of a focal humanitarian organization in six countries, Dube et al. (2016) find that host governments take one of four predominant stances to external assistance: non-restrictive, opportunistic, selectively accommodating, and uncompromising—the chosen stance results from host government interests and dependency and the interaction between those two factors. Host government financial resources are not a prerequisite to a host government's chosen degree of control; instead, host governments develop ways to regulate humanitarian logistics without significant financial resources (Dube et al., 2016).

Additionally, findings from Dube et al. (2016) suggest that political motivations are not always the driver for imposing tighter regulations on humanitarian logistics efforts. This is noteworthy given that several other studies suggest political motivations are often a major factor in government decision-making (Chari et al., 2021; Dube et al., 2016; Kunz & Gold, 2015; Mora-Ochomogo et al., 2016; Mushanyuri & Ngcamu, 2020). Specifically, one of the key findings in a case study from Chari et al. (2021) indicates that:

> The results concurred with Hapeman (2012) who revealed that politics influences a natural disaster's impact and consequently the distribution of humanitarian relief aid. Government policies determine who can participate in the assistance of victims, to what extent and who the beneficiaries should be (pp. 37-38).

In their case study, Chari et al. (2021) find that response efforts in Zimbabwe were hampered by significant politicization of the relief efforts. The distribution of aid provided opportunities for discrimination against political opposition and settling grudges against political rivals. In this way, the government's role was to hamper equitable humanitarian logistics efforts due to corrupt political influences. While Chari et al. (2021) and other studies (e.g., Kunz & Gold, 2015; Mora-Ochomogo et al., 2016; Mushanyuri & Ngcamu, 2020) provide ample evidence that political influences often do impact host government decisions, the findings from Dube et al. (2016) suggest that this influence is not a necessary conclusion.

Host governments can use their significant regulatory power to either improve or hinder the efforts of logisticians. For example, host governments can declare a state of emergency and actively relax existing regulations to facilitate timely response and movement of materials (Dube et al., 2016). Alternatively, host governments can use similar strict regulations, such as banning satellite communication equipment and increasing the complexity of customs clearance procedures (Kunz & Reiner, 2016), to purposefully hinder

logistics efforts or provide a deliberately unequal response to vulnerable or marginalized segments of the population (Dube & Broekhuis, 2018; Dube et al., 2016). These are all examples of the government's role as a regulator (Quarshie & Leuschner, 2020) spilling over into humanitarian logistics. Government regulation can ease challenges, thereby improving logistics efficiency. Alternatively, regulation can increase the challenges, making operating in a country more challenging for other stakeholders. The level of cooperation from the government can differ between countries. Even the same mechanism can be used with opposite goals to create different environments for external aid. For example, factors like strict import and travel restrictions are often used to hamper the efforts of relief organizations (Kunz & Gold, 2015). These same instruments can be used to ease transportation costs through exemptions from paying duty fees, value-added taxes, toll fees, and other regulatory fees (Mushanyuri & Ngcamu, 2020) or to shorten waiting times for customs clearance on imported supplies (Kunz & Gold, 2015).

The government as the funder

In most relief scenarios, the government fills the role of the donor through financial and material contributions to humanitarian operations (Negi, 2022), in addition to subsidies on relief materials and direct support for relief activities (Damoah, 2022). According to a case study on humanitarian logistics service triads, the government as a donor

> [P]rovides funding for [international humanitarian organizations] to procure staff, relief goods, and transport them to disaster sites for relief distribution… [the donor] not only provides funding but may also provide supplies such as clothing, food or cooking oil… the donor acts like a supplier, except that the donor does not get paid (Heaslip & Kovács, 2019, p. 600).

Heaslip and Kovács (2019) make it clear that the government is not the only potential donor; other donor sources in disaster relief can include institutional and private giving. The government's specific responsibilities for direct financing of disaster relief logistics

depend on the specific country. In Indonesia, for example, the government's responsibilities entail timely disaster management, including making funds available quickly after a disaster (Rayawan et al., 2021). In India:

> Disaster management is the responsibility of the local administration, under the direction of the State Government, supported by the Government of India… local actors start the relief and rescue operations with global actors joining the relief activities at a later date (Kabra & Ramesh, 2015, p. 163).

Similarly, in the United States, formal disaster declarations by government officials are a crucial mechanism for making money available for their particular jurisdictions; each level of government can request assistance from the level above, culminating in a Presidential declaration of a disaster or emergency (Apte & Heath, 2011).

When the government is providing funding, just as when coordinating physical response efforts among other actors (Negi, 2022), transparency is essential and challenging (Mushanyuri & Ngcamu, 2020; Rahman et al., 2022). Stakeholders expect to clearly understand how and where funds are being distributed, particularly in the case of public money from the government. Given the issues of politically-motivated decision-making discussed above, transparency in the use of direct funds is especially important to help ensure equity in aid across various populations. Clear communication between the government and communities on funding and repairs for the maintenance of critical infrastructure enhances community trust and can even spill over into other aspects of the response, such as greater adherence to official evacuation plans (Rayawan et al., 2021)

Lack of adequate infrastructure, particularly transportation infrastructure, is a critical challenge in humanitarian logistics (Negi, 2022; Tasnim et al., 2022). One of the government's key responsibilities is maintaining critical infrastructure during the disaster mitigation phase. In Ghana, the government bears responsibility for infrastructure

investment, including road networks, hospitals and clinics, transport systems, and communication networks (Damoah, 2022). Following the devastating earthquake in Haiti in 2010, the lack of infrastructure was one of the critical issues that emerged and the only issue with the government as the sole stakeholder (Salam & Khan, 2020). Similarly, examining the response efforts to Cyclone Idai in Zimbabwe in 2019 shows that government investments in strengthening the road, telecommunication, warehouse, and electrical infrastructure quality are essential factors in relief logistics (Chari et al., 2021). Finally, lessons learned from the 2004 tsunami response in Indonesia demonstrated the importance of the government's investment in building and maintaining adequate healthcare and transportation infrastructure to facilitate relief operations (Rayawan et al., 2021). These specific case studies collectively illustrate the responsibility and importance of government funding for infrastructure investments to help mitigate disaster impacts and facilitate post-disaster recovery.

Another area where the government's role in providing funding is critical is the provision of disaster relief materials. Government agencies and NGOs use a variety of procurement strategies to ensure that victims receive the supplies necessary to enable recovery. These strategies include active relationships with suppliers, resource-sharing agreements with various levels of government, fast-track procurement following a disaster, and the stockpiling or prepositioning of critical commodities in various locations before disasters (Wilson et al., 2018). Prepositioned supplies expedite inventory availability immediately following a disaster (Acimovic & Goentzel, 2016; Velasquez et al., 2019). Government organizations make prepositioning decisions regarding the number of storage sites, warehousing locations, distribution strategy, types and volumes of items to stock,

frequency of item turnover, and whether or how to optimally share with other agencies (Velasquez et al., 2019; Wilson et al., 2018). In most cases, when the government uses funds to procure supplies for disaster response, either before or after a disaster, government organizations act as buyers, while firms and other government organizations act as suppliers (Quarshie & Leuschner, 2020).

The government as the coordinator

Disaster relief efforts typically require coordinating private, public, local, national, and international resources toward an efficient response. In addition to government agencies, other stakeholders in humanitarian logistics include donors, logistics companies, NGOs, and victims (Wisetjindawat et al., 2014). Whether acting as a host government for external assistance or facilitating response logistics among domestic organizations, the government is responsible for coordinating, facilitating, overseeing, and directing efforts among the various actors (Chari et al., 2021; Dube et al., 2016; Rodríguez-Espíndola et al., 2018). The respective local or national government is the principal administrator for humanitarian operations (Mora-Ochomogo et al., 2016). Rodríguez-Espíndola et al. (2018) further assert that the government is often tasked with control over the preparedness plan and jurisdiction to coordinate with other organizations involved, serving as a coordinator for the response with situational awareness. Utilizing an approach that combines geographic information system data and optimization modeling, their findings demonstrate that a lack of coordination among government organizations can significantly negatively impact the outcome of disaster response.

The cooperation of NGOs and the government during an emergency enables more effective provision of relief to impacted populations (Fathalikhani et al., 2020). Without

effective government coordination, the entire relief operation and humanitarian logistics effort can suffer. Failure of the government to coordinate and collaborate with humanitarian organizations through policy and leadership support can significantly undermine the implementation of successful humanitarian supply chain management practices (Agarwal et al., 2021). The government is the party that initiates humanitarian relief by authorizing the operation and resource utilization, controlling physical assets such as warehouses or fuel depots, and helping to regulate foreign relief shipments at entry ports (Singh et al., 2018). Without the government enabling efficient logistics, it might not be possible for relief items to reach victims. In some cases, failure by the government to effectively coordinate with other actors leads to waste or duplicated effort, such as poorly coordinated relief item distribution between the government and NGOs (Abazari et al., 2022; Negi, 2022)

In their case study of the roles assumed by the government during the 2012 Hurricane Sandy response in the U.S., Quarshie and Leuschner (2020) identify several practices that demonstrate the government's significant capacity as a coordinator, including commanding government actors, orchestrating nonprofit and voluntary actors, communication, cooperation, collaboration, and managing interfaces. Regarding coordination as a practice, this specifically refers to "the [state, NGOs, nonprofit coalition, and utility firms] dividing or sharing responsibilities between them, based on their expertise areas, experience, resources, and/or pre-agreements and plans" (p. 15). This division of responsibilities often puts other organizations, not just the government agencies alone, in charge of specific logistics functions. However, these shared responsibilities do not alleviate the government of overall accountability for the success of the humanitarian relief

and logistics effort. Indeed, the lack of an integrated approach and coordination, often the government's role and responsibility, is a key barrier to success in humanitarian supply chains (Rahman et al., 2022).

One public policy priority in the disaster response space is the creation of public-private partnerships that facilitate interagency coordination (Swanson & Smith, 2013). Although many of these partnerships exist (Vega & Roussat, 2015), there is an opportunity for the government to further invest in these standing relationships to better leverage the capabilities of NGO humanitarian agencies (Wilson et al., 2018; Wisetjindawat et al., 2014). The general public often trusts community-based organizations more than state or federal government agencies. Swanson and Smith (2013) find that the private sector's logistics activities in disasters are more effective and efficient than government agencies. Often, commercial firms are unable to support disaster relief efforts, despite a desire to do so, because of the inability of governments to integrate that response (Swanson & Smith, 2013). The government can improve community communication and disaster information dissemination, in addition to testing practical mitigation elements like local evacuation plans, by building and strengthening partnerships with community-based organizations (Rayawan et al., 2021). Governmental coordination of mechanisms like third-party certification and field-oriented training activities can also build swift trust between those various humanitarian actors (Lu et al., 2018). Both communication and trust can be enhanced through government coordination with local partners. Finally, governments can enforce strict standards and regulations during the pre-disaster mitigation phase to increase the professionalization of humanitarian logistics functions (Dube & Broekhuis, 2018). The government is responsible for the policy-making process to enhance disaster preparedness

(Singh et al., 2018), which typically requires effective coordination with other stakeholders.

Theoretical framework

This section proposes a theoretical framework for the role of government in humanitarian logistics based on the extant literature. Specifically, the government fills three major roles: host, funder, and coordinator. Table 1.2 summarizes the potential government activities within these roles, as discussed above. These roles can occur simultaneously, but not all are necessarily present in every disaster situation. For example, a local government organization might handle a minor disaster alone and not necessitate higher levels of government to serve as a host to external aid. As the host, the government either accepts or rejects attempts at external assistance. When accepting assistance, the government may elect to ease regulations to enable reduced costs or less burdensome administrative procedures. Alternatively, the government may elect to tighten regulations or leave the status quo, thereby rejecting, successfully or not, attempts at external assistance.

TABLE 1.2: Summary of potential government activities in each role

Role	Summary of potential government activities
Host (and regulator)	• Relying on nonprofit agencies to provide humanitarian services • Imposing tighter regulations to limit external assistance (e.g., banning communication equipment, increasing customs clearance complexity) • Easing regulations to facilitate external assistance (e.g., shortened waiting times for customs clearance; exemptions from paying duty fees, value-added taxes, tolls, and other regulatory fees)

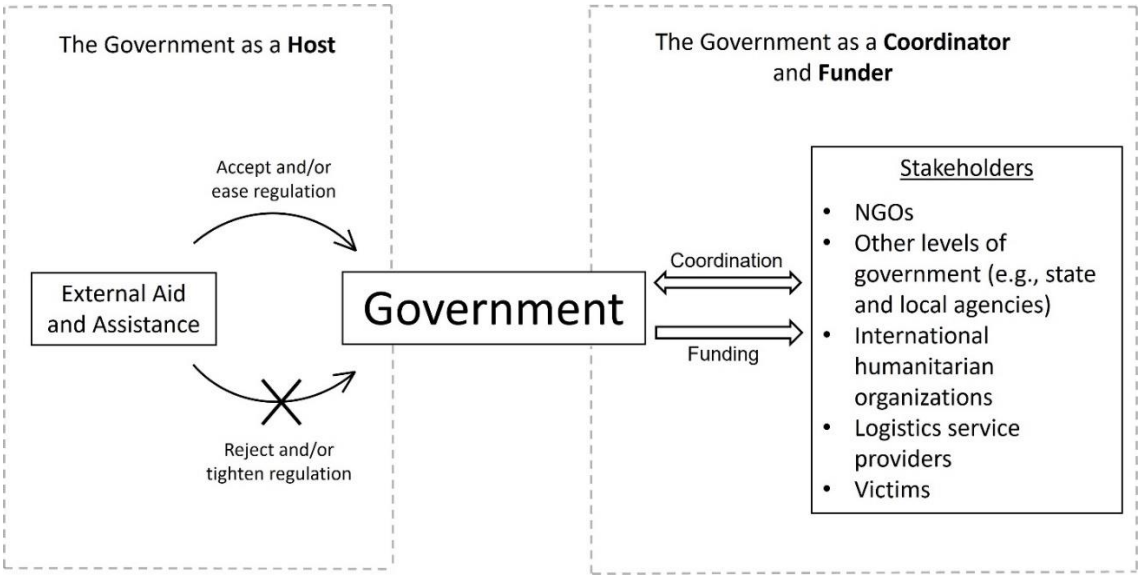
	• Structuring the distribution of aid to ensure equity across the population • Using uneven aid distribution to settle political grudges or against marginalized communities
Funder	• Providing financial and material contributions to humanitarian operations (e.g., directly providing relief supplies, subsidies on relief materials, direct cash payments to victims or NGOs) • Making funds quickly available following a disaster • Providing funding to lower levels of government (e.g., states/provinces, local jurisdictions) • Ensuring transparency in disaster funding • Investing in critical infrastructure maintenance (pre-disaster) and repairs (post-disaster), including transportation networks, hospitals and clinics, and communication networks • Developing supply provision strategies, including stockpiling, prepositioning supplies, active relationships with suppliers, resource-sharing agreements, and fast-track procurement
Coordinator	• Administering humanitarian operations and humanitarian logistics • Developing preparedness plans • Authorizing relief operations and resource utilization • Working with other stakeholders to minimize duplication of effort • Commanding government actors (e.g., local, national, and international agencies) • Orchestrating voluntary actors and NGOs • Creating public-private partnerships to facilitate interagency coordination • Building local community trust through transparency, communication, and information dissemination • Using regulation to increase the professionalization of humanitarian logisticians • Developing policies that utilize stakeholders to enhance disaster preparedness

While choosing a specific response to being a host for external assistance, the government is also serving in some capacity as the funder and coordinator for humanitarian logistics. As the funder, the government may provide funding to various other stakeholders,

including local NGOs, agencies at other levels of government, international humanitarian organizations, logistics service providers, and victims themselves. This funding can be direct, such as cash payments or stimulus, or indirect, such as infrastructure investments during the disaster mitigation phase. Particular disasters may see the government funding all or just some of these actors. Finally, as the coordinator, the government conducts activities, including administering disaster response efforts, reducing duplicated efforts among multiple actors, coordinating the stockpiling and distribution of resources, and working with community-based organizations to increase trust and transparency.

Figure 1.5 illustrates a theoretical framework for the roles discussed above. The role of the government as a host is indicated by the flow of external aid and assistance toward the government. Again, the government can either accept flow and ease regulations or reject that flow and tighten regulations. In this sense, the government's role as host also encompasses its role as regulator. The roles of the government as both a funder and coordinator are indicated by flows between the government and the various other humanitarian logistics stakeholders. The coordination flow is two-way between the government and the other stakeholders, as coordination is ideally a multilateral process. The funding flow is one-way from the government toward stakeholders to indicate the government's provision of direct or indirect humanitarian logistics funding.

FIGURE 1.5: Theoretical framework for the role of government in humanitarian logistics



Hernández Gress et al. (2021) demonstrate the interplay of the above roles through their sentiment analysis to analyze Mexico's COVID-19 vaccine distribution strategy. They found that for vaccine distribution, and similar public health campaigns, the government is "responsible for providing the necessary support to ensure financial sustainability [funder role], enforce public policy [host/regulator role], and develop a regional strategy alongside other stakeholders in the country [coordinator role]" (p. 7). Additionally, their analysis suggests that the government must orchestrate the timely distribution of information regarding vaccine security and efficacy while providing the resources necessary to manage the vaccine program (funder role). The information dissemination and physical vaccine distribution should all happen in concert with other public health stakeholders (coordinator role) (Hernández Gress et al., 2021). The government's role in vaccine distribution highlights the connection between each of the themes discussed in this section. The government bears explicit financial responsibility as

the *funder* and a responsibility to *coordinate* the regional distribution strategy with various stakeholders. Although the distribution strategy does not explicitly refer to the government as a host for external assistance, the responsibility to enforce public policy demonstrates the same regulatory-type role undertaken by a government to either enable or limit humanitarian logistics. In this case, the government's policies and actions created additional challenges for public health stakeholders, such as mixed communication on mask policies and sanctions for failure to comply with other preventative measures. The government also intended to see educators receive their immunizations first but failed to execute this plan successfully, resulting in schools remaining remote or closed. These policy decisions compare to a host government failing to use regulation to facilitate external aid and assistance effectively. These examples show how a particular government may simultaneously assume multiple roles in responding to the same humanitarian logistics need.

DISCUSSION

This section discusses the robustness of the present review and the challenges and opportunities for governments in humanitarian logistics.

Study robustness

The number of peer-reviewed papers available and the relative recency of the extant literature limits the robustness of this study. Research related to the role of government in humanitarian logistics is somewhat limited compared to more mature and established research streams, with just 38 total papers, all published after 2009. However, the articles reviewed did provide a comprehensive examination of various disaster types and utilized a variety of methodologies to arrive at their conclusions. One limitation of the present

studies was the limited number of papers discussing disasters in developed countries. For example, the current emphasis on the role of government as a host may stem from the number of studies, particularly case studies, which use developing countries as their context. Fewer papers (see Apte & Heath, 2011; Quarshie & Leuschner, 2020) focus on a developed country where the relationship between a government and external humanitarian assistance is likely to differ significantly. This focus on developing countries potentially limits the narrative framework's generalizability concerning developed country contexts. However, the government's roles as funder and coordinator are still very much, if not more, applicable in those contexts.

Although several papers discuss man-made disasters, none of the included studies focus solely on or emphasize man-made disasters over natural disasters. For this reason, the findings of this synthesis and the resulting theoretical framework are more appropriate for generalization to natural disasters. With none of the studies in this review exploring man-made disasters alone, it cannot be determined whether the results and framework directly apply to that context. This supports similar findings from other reviews that suggest the humanitarian logistics discipline has largely ignored the area of man-made disasters, such as conflicts, wars, and complex emergencies (Altay et al., 2021). Complex emergencies often result from man-made and natural causes and, until recently, accounted for the majority of humanitarian deliveries (Altay et al., 2021; Kunz & Gold, 2015). Complex disasters are generally responded to by humanitarian organizations with ongoing, long-term development projects and an existing local presence (Starr & Van Wassenhove, 2014).

Challenges and opportunities for governments

One of the primary challenges for governments in humanitarian logistics is to build trust in the government's ability to coordinate the response. The government as a coordinator has several avenues to build trust, including increased operational transparency (Rayawan et al., 2021), increased professionalization of logistics professionals through methods like additional third-party certification, and improved regulation (Dube & Broekhuis, 2018; Lu et al., 2018). Increased trust can translate to better adherence to government orders and policies (Rayawan et al., 2021), which improves the efficiency and effectiveness of the entire disaster relief program. Furthermore, increased trust in the government can empower the government to coordinate among disaster relief partners across the supply chain more successfully.

Other noteworthy barriers in humanitarian supply chains related to the role of government as a coordinator include the lack of an integrated approach and coordination among different stakeholders, a lack of multilateral information sharing, duplicated efforts among NGOs, and a lack of experienced logisticians (Rahman et al., 2022). Each of these barriers presents an opportunity for improved government involvement and leadership. Through better coordination with partners, regulation, or improved public policy, governments have opportunities to reduce the above barriers. Among the various stakeholders in humanitarian logistics, the government is uniquely positioned to affect the humanitarian supply chain.

Next, in the government's role as a funder, one of the most critical responsibilities is infrastructure investment as a disaster mitigation strategy. An ongoing challenge, particularly in developing countries, is investing efficiently during the pre-disaster phase

in transportation, public health, and communications infrastructure. Several studies in this review highlighted poor or inadequate infrastructure as contributing factors toward ineffective humanitarian logistics efforts (Chari et al., 2021; Negi, 2022; Tasnim et al., 2022). Although such investments are costly, both initial infrastructure funding and proper maintenance are crucial to facilitating relief operations and logistics (Rayawan et al., 2021). Whenever possible, governments should aim to make such investments a budgetary and public policy priority.

Finally, a key challenge for the government as both a host and funder is reducing corruption in humanitarian logistics (Chari et al., 2021; Kunz & Reiner, 2016). Whether tied to political influences or not, corruption can significantly hamper equality in the execution of the humanitarian supply chain, including the distribution of materials, infrastructure investment, and funding. Political corruption sometimes influences governments to restrict the supply chain, particularly with respect to external assistance that would otherwise benefit victims and ease suffering (Kunz & Gold, 2015). Governments should endeavor to limit these restrictions. Supplies and relief workers move more effectively with eased customs clearance, fees, and regulation. Wherever possible, governments should aim to make the movement of items and people into the country for humanitarian assistance as simple as possible.

Future research can explore applications of government operational transparency (e.g., Buell et al., 2021) in humanitarian logistics and the resulting increase in public trust. Such studies could have a broad-ranging impact on the ability of humanitarian logisticians and governments to carry out supply chain activities effectively. Additionally, multiple-case studies, such as the design employed by Dube et al. (2016), could better compare

humanitarian supply chains within countries with varying levels of government transparency or histories of government corruption. Only three of the eight case studies in this review (Dube et al., 2016; Kunz & Gold, 2015; Kunz & Reiner, 2016) utilized a multiple case study methodology. There are also opportunities to examine the comparison of multiple countries through other empirical methods, including econometric analysis and surveys.

CONCLUSION

With the expected increase in the frequency and economic impact of major natural disasters (Coronese et al., 2019; Foerster, 2021), as well as the effect of widely disruptive pandemic events such as COVID-19, the study of humanitarian relief has become progressively more important. One of the core activities within humanitarian relief is humanitarian logistics. The role of government is the key critical success factor in humanitarian supply chains (Singh et al., 2018; Yadav & Barve, 2015). Despite the foundational function of governments in humanitarian logistics, there is a relative lack of focus in the extant literature, across various research domains, on this important topic (Quarshie & Leuschner, 2020). Accordingly, this study explores the role of government in humanitarian logistics through a literature review in the form of a narrative synthesis, as outlined by Popay et al. (2006). This study illustrates the steady increase in research on the topic, starting in 2009, with peer-reviewed papers stemming from various research disciplines and methodologies.

The study finds that the government undertakes three fundamental roles in humanitarian logistics: the host, the funder, and the coordinator. Although these roles can be assumed simultaneously, not all are necessarily present in each disaster. As the host, the government uses its influence and authority to enable or restrict aid and external assistance.

As the funder, the government provides direct or indirect funding for relief supplies, logistics, and infrastructure. Finally, as the coordinator, the government takes the lead in administering and coordinating logistics efforts among various humanitarian organizations, including NGOs, various levels of government, international humanitarian organizations, logistics service providers, and victims. A theoretical model is presented based on the narrative synthesis, which illustrates these roles.

This review is limited by the timeframe of the available research, with the entirety of the papers published since 2009. Additionally, the findings might not have application beyond the context of natural disasters, with few of the articles referring explicitly to man-made disasters in addition to natural disasters and none referring to man-made disasters alone. This limitation echoes the trend noted in other reviews of a gap in the focus on man-made and complex emergencies in humanitarian logistics research (Altay et al., 2021).

Future research can explore the application of operational transparency to increase public trust in governments. Additionally, empirical studies can further compare humanitarian logistics performance for governments with varying histories of corruption, including through multiple-case study designs or econometric analysis of secondary data. Finally, the present research emphasizes developing over developed nations—perhaps one of the reasons the role of the government as a host features prominently. Future research can further explore the role of government in developed countries to understand better how those contexts compare and contrast to developing countries, which are most likely to receive external assistance.

CHAPTER 2

Government Coordination in Crisis: The Medical Supply Chain During COVID-19 and Beyond

Peter Imbriale
Bentley University
pimbriale@bentley.edu

Euthemia Stavrulaki
Bentley University
estavrulaki@bentley.edu

Ian Walsh
Bentley University
iwalsh@bentley.edu

ABSTRACT

The COVID-19 pandemic highlighted shortcomings in the medical supply chain and the government's role as a supply chain coordinator. Given the expected increase in scale and frequency of public health emergencies and related natural disasters, it is critical to understand the factors attributed to the ineffectiveness of the government's COVID-19 medical supply chain involvement and its strategy for future events. In this study, we conduct a qualitative case study of the lead U.S. federal agency responsible for public health preparedness and response. With the lens of attribution theory, we explain how this agency responded to COVID-19 medical supply challenges and how its revised strategies are attributed to specific factors experienced during the COVID-19 pandemic. We identify four such critical factors: mission complexity and uncertainty, partner incentives, domestic manufacturing capabilities, and funding uncertainty. These factors inform and affect three main strategic priorities for the agency's medical supply chain— strengthening supply chain coordination, building opportunities for supply chain collaboration, and orchestrating a stockpiling strategy. We develop a grounded framework that provides a theoretical description of the government's role in the medical supply chain for public health response. This study advances the literature on supply chain disruptions and inter-organizational relationships in supply chains, with a particular focus on the underexamined role of government.

INTRODUCTION

The COVID-19 pandemic significantly impacted the entire medical supply chain while revealing critical domestic manufacturing and public health policy shortcomings (Aeppel, 2021; Finkenstadt et al., 2021). These shortcomings include the inability of the nation's Strategic National Stockpile (SNS) to hold in inventory the volume of personal protective equipment (PPE) and vaccine ancillaries for a prolonged and nationwide pandemic, lack of federal-level market intelligence on the medical supply chain, overreliance on overseas manufacturers, and inadequate formal SNS authority or resources to communicate and coordinate with other agencies (Hanfield et al., 2020). These limitations point to gaps in the federal government's pre-COVID medical stockpiling and supply chain coordination strategies to effectively prepare for a truly national or global public health crisis. A 2022 report from the Government Accountability Office on the U.S. Department of Health and Human Services (HHS) pandemic response stated that the department is at "high risk" of mismanaging the next crisis (Diamond, 2022a). Therefore, it is imperative to understand the lessons learned from COVID-19 and how the federal government can better leverage the medical supply chain to prepare for the next widescale emergency.

The SNS is one of several vital programs within the Administration for Strategic Preparedness and Response (ASPR)[1], a branch of HHS that "leads the nation's medical and public health preparedness for, response to, and recovery from disasters and public health emergencies" (HHS ASPR, 2022a); see Table 2.1 for a list of acronyms used. The SNS began as the National Pharmaceutical Stockpile in preparation for the year 2000 to

[1] Prior to July 2022, ASPR was the Office of the Assistant Secretary for Preparedness and Response. The 2022 change elevated ASPR from a staff office to an operating division within HHS.

provide countermeasures for possible terrorist threats against the U.S. medical supply chain.

TABLE 2.1: List of Acronyms

ASPR	Administration for Strategic Preparedness and Response
BARDA	Biomedical Advanced Research and Development Authority
H-CORE	HHS Coordination Operations and Response Element
HHS	U.S. Department of Health and Human Services
IBx	Industrial Base Expansion
PPE	Personal protective equipment
SCCT	Supply Chain Control Tower
SNS	Strategic National Stockpile

In the decades since, the SNS has increased in size and scope (Burel, 2019). Today, the SNS stockpiles large quantities of certain medicines, medical supplies, and medical devices that might be required if local supplies are depleted following a public health emergency (HHS ASPR, 2022b). The SNS is not intended to be the sole source of medical supplies and equipment for public health emergencies. Instead, the stockpile is a short-term, stopgap buffer to provide continuity and relief for states and healthcare providers while regular manufacturing channels increase capacity as needed (HHS ASPR, 2022b). At the start of the COVID-19 pandemic, however, the stockpile lacked the necessary budget and inventory levels for a sustained, nationwide public health emergency. Also highlighting gaps in domestic manufacturing capacity (Klein, 2020), the pandemic illustrated the need for ASPR to improve its supply chain strategy, including better-leveraging partnerships, to achieve its public health mission.

In addition to the SNS, ASPR houses several other divisions and program offices that interact directly with the medical supply chain. These elements include the Biomedical Advanced Research and Development Authority (BARDA), the HHS Coordination Operations and Response Element (H-CORE, formerly Operation Warp Speed, the Supply Chain Control Tower (SCCT), and the Office of Industrial Base Management and Supply Chain, which includes the Industrial Base Expansion (IBx) program. Along with the SNS, these ASPR elements aim to achieve ASPR's three priorities during the pandemic: (1) Respond well and quickly emerge from the COVID-19 pandemic; (2) Restore resources and capabilities diminished during the pandemic; and (3) Prepare for future emergencies (HHS ASPR, 2022a). While ASPR plays an increasingly crucial coordinating role in the medical supply chain, the supply chain itself consists largely of private sector partners. ASPR's relationship with these private partners evolved over the COVID-19 pandemic and continues to shift from simple coordination to mutual collaboration.

Despite the documented evidence discussed above of ASPR's suboptimal response to the medical supply chain challenges that surfaced during the COVID-19 pandemic, there has been little attention to the reasons for that ineffective response. Gaps between desired and actual performance produce discrepant cues that serve as occasions for attribution. Although attribution theory is typically used to describe causal inferences about individual behavior (Heider, 2013; Weiner, 1985, 1995), it has also helped explain the assignment of responsibility and blame at the organizational level (Munyon et al., 2019). The factors to which blame for falling short of expectations are attributed will condition if and how organizations adapt their strategies and behavior. Given the expected increase in scale and frequency of public health emergencies and related natural disasters (Ghazali et al., 2018),

understanding the factors to which ASPR has attributed the ineffectiveness of its response to medical supply chain challenges during COVID-19 and the ensuing intended strategies for responding to future pandemics serve essential steps towards ensuring readiness for future pandemics or health emergencies.

To investigate these issues, we focused on the following research questions: (1) *To what factors does ASPR attribute its insufficient attempts to manage medical supply chain challenges during the COVID-19 pandemic?* and (2) *How is ASPR preparing to address medical supply chain challenges during future public health emergencies?* Specifically, we conducted a qualitative case study of the medical supply chain during COVID-19, focusing on the U.S. federal government's response to the pandemic. Our methodology involved an inductive theory-building approach (Bansal et al., 2018) utilizing the Gioia method to derive a theoretical model from empirical data (Gioia et al., 2013).

Using an inductive, theory-building case study, we find that the federal government's three strategies related to the medical supply chain during the COVID-19 pandemic—and looking ahead to future public health crises—are (a) strengthening supply chain *coordination,* (b) building opportunities for supply chain *collaboration,* and (c) orchestrating a stockpiling strategy; as we discuss in more detail within the literature review section, compared to coordination, which focuses mainly on information exchange, collaboration describes a higher level of trust, cooperation, mutual benefit, and interdependence within the supply chain. These three strategies are attributed to four external factors that impact the government's ability to mitigate supply chain challenges: (a) public health event complexity and uncertainty, (b) partner interests and incentives, (c) domestic manufacturing capabilities, and (d) funding uncertainty. ASPR's three strategic

supply chain priorities for future public health emergencies are attributed to the challenges associated with these external factors experienced during the COVID-19 pandemic.

This paper makes several key contributions. First, this study examines the government's role in supply chain networks. Despite significant government influence over supply chains (Dube et al., 2016; Quarshie & Leuschner, 2020; Singh et al., 2018; Yadav & Barve, 2015), research has neglected the government perspective in their study of supply chain networks (Quarshie & Leuschner, 2020). The limited previous literature on the government's role in supply chain coordination has focused primarily on the supply chain for sustainable or green products (Li et al., 2021; Manouchehrabadi & Yaghoubi, 2019; Sudusinghe & Seuring, 2021). This study specifically focuses on the government's role during a significant disruption in the medical supply chain when the government became increasingly involved since the start of the COVID-19 pandemic. Second, despite rapid growth and significant practitioner focus on the medical supply chain through the COVID-19 pandemic, we are unaware of any research exploring the role of coordination, collaboration, and stockpiling within the medical supply chain during the global pandemic. Finally, this study demonstrates the application of attribution theory to highlight how the government revised its strategic priorities for adapting to public health-related supply chain disruptions. Staff at ASPR attributed the divergence between expected and actual organizational performance during the pandemic to key external factors, ultimately leading to a revised organizational strategy for future public health response.

This paper is organized as follows. First, we discuss the relevant literature. The subsequent sections present our methodology, findings, and grounded theoretical model. Finally, we discuss the primary research contributions and conclusions.

LITERATURE REVIEW

The COVID-19 pandemic was a significant supply chain disruption, particularly for medical equipment and supplies. Given ASPR's unique coordinating position within the medical supply chain while lacking its own manufacturing capabilities, ASPR's offices and divisions rely almost entirely on partnerships with private partners and collaboration with other government agencies to accomplish its mission. Accordingly, this research interacts with two primary streams of literature: inter-organizational interactions in supply chains and supply chain disruptions.

Inter-organizational Interactions in Supply Chains

Several terms have been used in extant research to describe inter-organizational interactions within supply chain networks, including integration, cooperation, coordination, and collaboration. Integration occurs within and outside the organizational boundary with suppliers and customers; increasing degrees of supply chain integration can be described as 1) networking interaction, 2) synchronization, and 3) synchronization, knowledge sharing, and decision-making (Khanuja & Jain, 2019). Supply chain cooperation is a basic exchange of information and potential long-term relations (Singh & Power, 2009).

Although some practitioners and researchers use the terms collaboration and coordination interchangeably (Balcik et al., 2010; Dubey et al., 2019), we differentiate between the two terms in several important ways for this study. Coordination includes effective communication, continuous information exchange, partnering, and performance monitoring among supply chain actors (Arshinder & Deshmukh, 2008; Singh & Power, 2009). Compared to coordination, collaboration describes a higher level of trust,

cooperation, mutual benefit, and interdependence within the supply chain (Soosay & Hyland, 2015). Supply chain risk management involves "the management of supply chain risks through coordination or collaboration among the supply chain partners so as to ensure profitability and continuity" (Tang, 2006).

The government's role in supply chain relationships has been primarily explored through research on green and sustainable supply chains. This research has demonstrated the government's role in encouraging cooperation among solar cell supply chain members (Manouchehrabadi & Yaghoubi, 2019), providing subsidies to promote green investment and emission reduction (Li et al., 2021), and providing cross-functional coordination and collaboration among firms in the circular supply chains (Sudusinghe & Seuring, 2021). However, it remains unclear how these roles extend into other supply chains and whether the government serves in similar inter-organizational capacities outside the sustainability space.

Supply Chain Disruptions

Supply chain risks can be categorized as operational risks or disruption risks. Operational risks arise from problems with coordinating supply and demand, including equipment malfunctions, discontinuity of supply, and human-centered issues such as an employee strike (Kleindorfer & Saad, 2005). Disruption risks are unplanned events, either man-made or natural disasters, that restrict a supply chain (Shekarian & Mellat Parast, 2021). While supply chains typically provide data on historical demand to enable planning, anticipating a disaster's timing and location can be almost impossible (Duong & Chong, 2020). Public health outbreaks share similarities to natural disasters in the specific requirements of each event type, timing unpredictability, and demand uncertainty. This

shared unpredictability makes research in supply chain disruption an important stream of literature for understanding the medical supply chain during a public health pandemic response.

Supply chain resilience provides supply chains with capabilities to prepare for disruptions while reducing their impact and enabling faster recovery (Christopher & Peck, 2004; Duong & Chong, 2020; Jüttner & Maklan, 2011). Collaborative activities such as information-sharing, collaborative communication, and mutually created knowledge can lead to increased supply chain visibility, velocity, and flexibility, which are important constructs of risk mitigation and supply chain resilience (Scholten & Schilder, 2015). In addition to promoting high levels of visibility and flexibility, supply chain collaboration also supports higher service levels and lower cycle times, each promoting greater supply chain resilience (Cao et al., 2010). Other collaborative activities that promote resilience include sharing forecasts and demand data to enable continuous inventory adjustment (Brusset & Teller, 2017), promoting chain-wide versus company-specific practices (Altay & Ramirez, 2010), and building social capital (Johnson et al., 2013). In their review of supply chain disruption risk and resilience management, Shekarian and Mellat Parast (2021) identify four primary antecedents of supply chain resilience: flexibility, agility, collaboration, and redundancy.

Gabler et al. (2017) examine supply chain disaster resilience through short-term public-private collaboration, proposing a framework for collective response and mutual goal fulfillment in single and discrete repeat events. While their work is helpful for exploring inter-organizational relationships between public and private organizations in the

context of disruption from natural disasters, public health crises afford the ability for both short-term *and* long-term public-private partnerships to mitigate supply chain disruptions.

METHODOLOGY

To explore how ASPR addressed COVID-19 supply chain challenges, we employed a qualitative case study using inductive theory building (Bansal et al., 2018; Yin, 2018). This method is particularly useful for phenomena that cannot be readily explained with extant literature (Creswell, 2013; Denk et al., 2012). We use the Gioia method (see Gioia et al., 2013) to derive an empirically grounded theory from data collected about ASPR's COVID-19 response and its supply chain relationships. Research in supply chain management requires a methodology that allows for studying phenomena with complex behavioral dimensions at the individual and organizational levels, for which grounded theory is particularly well-suited (Randall & Mello, 2012). The COVID-19 pandemic highlighted the interconnected, global nature of numerous supply chains, with the medical supply and equipment supply chain being no exception. This inductive, theory-building case study allows us to holistically analyze this complex supply chain facing historic disruption, using data emerging directly from its members to develop a theory to better understand its behavior.

Sources of Data

Interviews. Interviews were the primary data source for this study. We interviewed 20 participants from various offices and divisions within ASPR or with private partners who worked directly with ASPR from October 2021 to June 2023. Each participant served in a role requiring interaction with the medical supply chain, including various functions with the SNS, SCCT, medical supply IBx, BARDA, and industry trade associations (see

Table 2.1 for the list of acronyms). Interviews were conducted by the first author. The interviews were semi-structured and included open-ended questions focused on understanding, through the participants' view, the challenges and keys to success in medical equipment and supply stockpiling, supply chain partnerships, and supply chain visibility throughout the COVID-19 pandemic (the final interview protocol is included in Appendix A). The questions were revised slightly after each round of initial data analysis and the initial literature review so that subsequent participants could provide evidence to confirm or deny emerging theoretical propositions (Urquhart, 2013). The interviews lasted an average of 52 minutes, varying from 38 to 74 minutes each.

Initial participants were identified using the authors' professional network and were chosen based on their personal involvement with and understanding of the medical equipment supply chain during the COVID-19 pandemic. Subsequent informants were added through the snowball sampling approach. Although all participants have spent their careers in logistics, supply chain management, or public health, they have a range of experience working directly with ASPR. However, all participants were intimately involved with the COVID-19 response for the preceding two to three years.

Archival Data. Archival data provided both background information and allowed us to triangulate and verify our interview data. Specific archival data included press articles, government reports, partner training sessions, and government presentations (see Appendix B).

Procedures

Most of the interview participants allowed their interviews to be recorded. These recordings were transcribed using a secure audio transcription service. The entirety of each

transcription was then manually checked against the audio recording for accuracy by the researcher; errors were minor and immediately corrected. Of the 20 participants, only two preferred not to be recorded; the first author took detailed interview notes in these instances. The interview transcripts and notes were then analyzed and coded at the sentence level using the NVivo 12 qualitative data analysis software package.

We relied on the Gioia method for data analysis and theory building (Gioia et al., 2013). This data analysis was further informed by data coding procedures recommended by Glaser (1978), Strauss and Corbin (1998), and Urquhart (2013). This initial coding resulted in a list of first-order concepts. Example evidence of these codes is given as power quotes throughout the results section and as proof quotes in Table 2.2 (Pratt, 2009). We constructed a data structure (Figure 2.1), which visually demonstrates the progression of raw data to terms and themes. This data structure serves as an important chain of evidence for external observers of the case study (Yin, 2018). The first-order concepts were then examined for similarities and differences among the categories, with the emergence of second-order theoretical themes. The second-order themes were further aggregated into aggregate dimensions. Several second-order themes and aggregate dimensions were verified with the other authors to ensure the validity and trustworthiness of the findings (see Figure 2.1). Finally, the aggregate dimensions from the data structure formed the basis for a grounded theory (see Figure 2.2), which focuses on the dynamic interrelationships between the concepts, themes, and dimensions of the empirical data (Gioia et al., 2013). We also examined the archival data to ensure it supported our concepts, themes, and theory.

During the analysis stage, we examined the extant literature on supply chain disruptions and inter-organizational relationships. Relevant insights from these literature

streams informed subsequent data collection and slight revisions to the interview protocol. Additionally, relevant literature was connected to the empirical data, where appropriate, to allow for the grounded theory to interact with extant research streams more fully.

RESULTS

In this section, we present findings and a grounded theoretical framework that emerged from our data. First, we examine the government's primary supply chain priorities in the public health space: strengthening supply chain coordination, building opportunities for supply chain collaboration, and orchestrating a stockpiling strategy. These priorities require both strategic-level preparedness and operational-level response decisions. Next, we describe four external factors to which ASPR attributes its strategic priorities. We find that the government's ability to effectively align the medical supply chain for a public health response, and its resultant strategic priorities, arepredicated on event uncertainty and complexity, partner interests and incentives, domestic manufacturing capabilities, and funding uncertainty.

Government Strategic Priorities for the Supply Chain

As Table 2.2 and Figure 2.1 illustrate, in determining how to successfully align the medical supply chain toward an effective public health response, the government manages three ongoing strategic priorities: supply chain coordination, supply chain collaboration, and stockpiling strategies. Successful public health coordination, focusing on the demands of the medical supply chain, hinges upon organizing efforts around strengthening supply chain coordination in the short-term response stage, building opportunities for supply chain collaboration in the long-term preparedness stage, and orchestrating a stockpiling strategy in both the response and preparedness stages.

TABLE 2.2: First-Order Concept Proof Quotes

Second-order theme First-order concept	**Proof Quote**
1. Strengthening supply chain coordination	
A. Improving supply chain visibility	A1. "…supply chain visibility is pulling teeth… it is a sliver of the picture provided by those who just got tired of saying no for, you know, want to help us out a little bit?" (P14) A2. "… it's very difficult for the government to engage without having a visibility on those types of supply chains. How do you perceive a shortage before it happens? The way that shortages are reported to the FDA is basically a manufacturer reaches out and they tell the FDA I'm in shortage… it's not some grander metric." (P17)
B. Information sharing to increase visibility	B1. "They can look at the overlay between the supply information and the [disease] information. So within HHS Protect, besides the control tower being in there, a lot of the [disease] information from the response within HHS is brought in… there's various efforts… PPE, testing, as it relates to the hospital reporting information." (P2) B2. "…the control tower has done a lot of stuff over the years. You know, targeted analysis, research papers, modeling… but the most incredible thing we've done… is this daily transaction level information from all the distributors. Hands down, it's never been done before.... we monitor the daily transactions, and these products for 90% of the public health, or the medical market in the U.S… that's phenomenal." (P9)
C. Use of central control/technology for information gathering and dissemination	C1. "A great challenge for everyone in supply chain is lack of clarity in what true demand is. We could use a central location to capture supply data throughout the supply chain. Investment in technology can make it less painful for partners to supply their data. The post-COVID practices need to keep in place the supply chain control tower or whatever follows it." (P4) C2. "…the most important thing is really the interoperability, the ability to have systems that are interoperable, and can be somewhat inexpensively maintained." (P7)
D. Connecting existing capacity	D1. "[Visibility] is understanding demand. It's understanding the supply chain, we've got to be more than stuff on a shelf. I mean, it has to be a calculated response really, and assume

	with the right demand	some level of risk when you're assuming what supply chain can bring… if the commercial sector can respond, what's our role in it? Are they able to capture it? I mean, just understanding what that sweet spot is, as far as where our involvement is, some of it is just coordination, basically." (P5) D2. "So I've got 4.5 billion gloves, there's been no demand on that for two years. That means the supply chain is healthy. What do want me to do with them? I mean, I can't hold that much material. And then oh, by the way, let's pretend there's… there's no pandemic at the moment. How do you envision these things entering the system to do whatever it is you're trying to do?" (P13)
E.	Communication with private partners, states, and other federal agencies	E1. "…we were able to get our hands on the data that was needed… there was really no live feed, there [were] anecdotal conversations with manufacturers and distributors, but now it's a more coordinated effort, where to get live feeds from the major medical distributors, we understand what's in the pipeline, we're able to see where the challenges are. And then that helps go into the calculations on what should be on the shelf going forward." (P1) E2. "We want to engage with every state differently… there's different relationships that exist with the states… it's been a slow process, because we're trying to have a delicate touch in how we do it. But we have had a lot of success with the jurisdictions that we have started piloting kind of more visibility into their stockpiling." (P7)
2. Building opportunities for supply chain collaboration		
F.	Developing partnerships with private partners	F1. "It was a private partnership. So they came on board, I mean, honestly, it's just good Americans who wanted to help. It's just lucky that we had all six come on board, there were six big manufacturers, now we're up to seven... what's really good is they agreed to establish that data should continue… in the post-pandemic. So it's really, the official vernacular is it's establishing a codified private, or public-private partnership with data sharing going forward. And those had to be done." (P1) F2. "…there has to be a more conscious effort for public-private partnerships going forward." (P17)

G. Building trust with partners	G1. "I think we've done a really good job at that, because we've also gained a lot of their, I mean, we've gained their trust. We haven't really, we haven't really had issues, protecting their data, they trust us with that." (P2) G2. "…you have to have the flexibility to be able to work with your partners. So having a true honest business relationship with these industry partners has just been invaluable." (P12)
H. Strengthening relationships with trade associations	H1 "We also have longstanding collaborations with trade organizations. We do table-top exercises with those partners and even done since during COVID. These table-top exercises allow us all to think differently and see the scenarios from another perspective." (P4) H2. "So if you work through a trade association, you work with all those partners…the private sector wants to work with Feds because same as we want to work with them. It's really trying to integrate as far as the supply chain goes: understanding what they do, or understanding what we do." (P5)
I. Enhancing mutual benefits	I1. "…but it was great to have that communication back and forth, because it would give us the opportunity to do some data validation and in working with them understanding maybe also what they're having challenges with that we could see what we could do to help them with that." (P2) I2. "I think largely… mutually beneficial. I mean, we have tried… in a lot of our contracting, and a lot of how we've structured these deals, have tried to meet them where they are, so that we're both, it's a win-win, and not a mighty hand of the government coming in and just exerting its rights." (P13)
3. Orchestrating a stockpiling strategy	
J. Employing a distribution strategy	J1. "The SNS was never set up to be Amazon and distribute to, you know, to drop shipments to 100 places plus in a state. We're able to do that for COVID, because we have a very large contract… we pay a lot of money to them distribute to different providers." (P7) J2. "…the methods that we can provide it…. there's everything from we can put it on a plane we can put it on a you know semi we can put it on, and we've hand carried. We've actually had people jump on an airplane, drive down to Atlanta airport, jump on an airplane, and hand deliver it to somebody on the other

	end, because there was just no way we could work to coordinate transportation." (P16)
K. Lifecycle management	K1. "So it's not just like put it on the shelf, and then let it sit there forever, then you got to rotate it. Because everything has a shelf life, especially in medical gear. Even nitrile gloves [have] five years, that may seem like a long time, but it's really not, if you've got to rotate 7 billion gloves." (P1) K2. "…one of the strategies that we use to ensure we can make the most of what we have and when stuff expires, you don't necessarily have to destroy it, is we take advantage of other programs that are in existence, like shelf-life extension." (P3)
L. Balancing stockpiling with the commercial market capability	L1."Once you start collaboratively planning like that, and you look at the whole pile of material, then you can say, Okay, if I want to have a billion of these things, industry can give me 600 million, that means potentially, the stockpile should have 400 million in it. Now I can look to industry and go what's the most efficient way to do that." (P13) L2. "So understanding how you can develop all the countermeasures, have enough to, you know, bridge that gap between the word go and running out. And, you know, in getting manufacturing ramped up, you really kind of have to marry those two things. I think you can't really think countermeasure development without having an eye on supply chain too." (P14)
M. Relying on partners to stockpile	M1. "And there's also… vendor managed inventory, there are several types... it was essentially access contracts to product, meaning on game day, within 24 hours, you will provide this. So it's not government property until that point… So it still was ours, but it was kept fresh and kept rotated." (P5) M2. "I think virtual stockpiling, putting more onus on the, on industry, to house a lot of these goods is probably one of the more efficient ways rather than saying we all need this to be government warehoused, to say, we just need the government to be able to have access to it when it is needed." (P17)
N. Strategies for what to stockpile	N1. "… I think understanding the requirements, what are the requirements that are needed for stockpiling? What are they stockpiling for, right? What is the incident or situation that they're preparing for? And, you know, therefore, what are the requirements of that situation? A hurricane is different than a pandemic." (P7)

		N2. “Does it make sense to have, you know, a truckload of masks for every single doctor in the United States standing on hand for the events that we might run out of masks again? Probably not because they don’t last forever. So I mean, any success measure needs to consider minimizing waste, but not at the expense of resilience.” (P17)
4. Event complexity and uncertainty		
O.	Constantly evolving and uncertain event types	O1. “Well, we’ve grown quite a bit. You know, bio-terror focused. 2002, It was all about anthrax, and then smallpox, and it’s grown over the years to almost an all-hazards approach. I mean, Katrina brought on hurricanes, which is another piece that was added to the portfolio.” (P5) O2. “… ASPR has been asked to respond, just in the last two years, COVID, Monkey pox, Ebola, infant formula: ASPR has jumped into the mix. There’s a lot of unpredictability out there in the world.” (P12)
P.	Understanding the specific emergency response needs	P1. “…a pandemic going on for two years, or as opposed to shorter-lived response plays… a lot into that. But I think it’s really threat specific… you’re not gonna get the… commercial supply chain to focus on [bioterror], you’re just not…” (P5) P2. “So much of it is scenario driven… if you asked me, ‘Well, how much is it going to cost to do this? Or how much time is it going to take to do that?’ I need to know the what’s, the where, the when. You know, what’s the event? What’s the medical material you need? How much do you need? When will you be ready to receive? Is transportation available?” (P16)
5. Partner interests and incentives		
Q.	Hesitancy to share information	Q1. “… I would definitely say… obviously, sharing of that information to them is very sensitive… not trusting potentially, who would get the information in their control, on their hands. I mean, we all know that information leaks all the time. And so I can, I can truly understand that concern.” (P2) Q2. “Those are the things and getting some of that insight, and sometimes they, well sometimes they don’t want to tell us because there’s, you know, competitive advantage, and they don’t trust us to keep our mouth shut.” (P11)

R.	Continuing partnerships beyond COVID-19	R1. "…our responsibility is continuing to make the make the value case, not only to those that provide us funding to do it, but to the commercial partners about why it's in their interest to continue to participate. And for us to structure it in a way and in a what I would call peace-time that is not onerous." (P4) R2. "I think when we start to get better, as far as COVID, I think when we start moving on, I think it's keeping this alive, keeping this momentum the, you know, the government and private sector working together. I think it's how we keep that how we keep feeding it." (P5)
S.	Understanding partner motivation	S1. "And we've thought about that, like, what's the incentive? Right? Because one of my, one of the things I've been very concerned about is, it's like, it's a beautiful beach house that's on stilts, right? It's kind of how I view it. And you don't, you know, if you come in with enough hot when and force. You know, all it takes is one stilt to walk away." (P2) S2. "[Partnerships] can't be one side or the other alone. Government doesn't have the capacity to do any of this on its own, even stockpiling, it doesn't. And then industry doesn't have the business incentive to do it." (P15)
	6. Domestic manufacturing capabilities	
T.	Disadvantages of overseas production	T1. "If there's any type of political unrest, or any type of environmental issue that may occur overseas… like Malaysia has an increase in cases and they're under a lockdown… these are all potential risks to being been dependent on overseas manufacturing" (P2) T2. "[Visibility] is always a challenge, because again, as we learned very heavily in COVID… a lot of the manufacturing material is not in the United States, a lot of the manufacturing processes are not in the United States. So, we are at the mercy of not only you know the availability of their production, but the transportation timeline to get it from point A to point B." (P16)
U.	Expanding and sustaining domestic manufacturing	U1. "… [the solution is] either bringing it here or creating it here. So like nitrile gloves, for example, we're not transitioning to that from Malaysia, China or Thailand, we actually have U.S. companies that are standing out to create their own nitrile gloves here in the United States." (P1)

	U2. "[T]he greatest lesson learned over the last 10 years is we need to figure out the sustainment question. You know, how do we sustain these facilities, so that they are ready, and they are prepared to respond to the next public health emergency." (P11)
V. Lack of domestic manufacturing capacity and commercial resilience	V1. "We had to broaden our lens a little bit with COVID and start to care about truly the entire lifecycle of product just based on everything coming from overseas, and also our current domestic expansion activities which resulted from our vulnerability of everything from the supply chain coming from overseas." (P3) V2. "[Hospitals] run very, very lean, a couple percent over what they're capable of doing because for them, throughput equals dollars, and they're a for-profit organization. If you hit them… with a certain amount of demand spike, they just can't, they're not gonna be able to react on a dime. And that's where, you know, something like a stockpile comes into play."
6. Funding Uncertainty	
W. ASPR funding limitations	W1. "… the number one [key to success] being funding, right? I mean, having more funding is a key to success, having less funding is not fun." (P7) W2. "Money, money makes the world go round, as you know. In the beginning of COVID, we were flush with money, that money was no object. Over the last year we've been fighting, you know, and having to do a lot of prioritization of where do we spend our dollars working with Congress to try to free up dollars."
X. Politics	X1. "The interplay of politics and financial incentives, money, the exchange of information, all of those are tensions in this very complex of a problem." (P15) X2. "Not every member of Congress has an equal perspective on what happened with COVID with preventive measures, like vaccines, and so that creates additional risks that didn't exist pre-COVID." (P18)

Short-to-medium term: Strengthening supply chain coordination

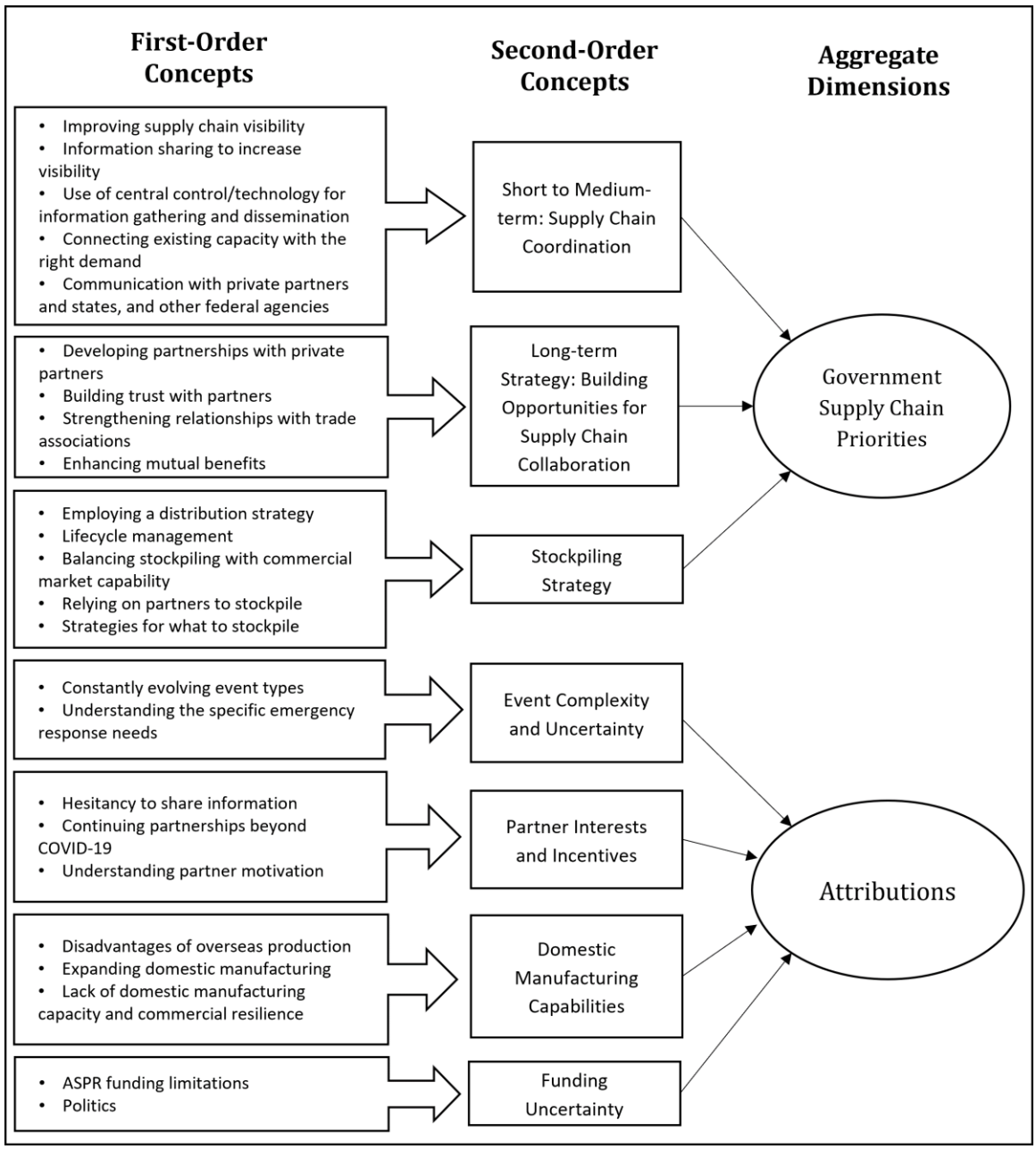
The first government priority is strengthening supply chain coordination. Our findings reveal that ASPR is increasing supply chain visibility through active partner coordination. Strengthening supply chain coordination includes practices such as "improving supply chain visibility," "information sharing to increase visibility," "use of a central control/technology for information gathering and sharing," "connecting existing capacity with the right demand," and "communication with private partners, states, and other federal agencies." These practices all relate to the concept of coordination between and among actors in the medical supply chain.

As discussed above, supply chain coordination refers to communication, information exchange, and partnering between parties in the supply chain (Arshinder & Deshmukh, 2008). One of the primary efforts in supply chain coordination at ASPR is increased information sharing through the development and growth of the SSCT:

> [ASPR has] much better coordination with the private sector, with distributors. Now, through the Supply Chain Control Tower, we're getting visibility into their daily orders, right, what they're receiving, what they're building, what they're making, what they're sending out to hospitals or states. We're able to see that now through the supply chain control tower, and that's a level of visibility we never had before. (P7)

The increased information sharing between partners enables a higher degree of supply chain visibility, which was fundamentally lacking before the COVID-19 pandemic. An ongoing goal is to lessen the burden on partners sharing information with ASPR by using interoperable platforms and technologies to the degree possible. Several participants spoke of the benefits of automating the information collection process, particularly when so much of the current data-sharing is voluntary.

FIGURE 2.1: Data Structure



Supply chain coordination mainly occurs at the short- and medium-term operational level, as opposed to the longer-term, strategic one. In ASPR terms, this makes coordination a *response* priority rather than a *preparedness* priority, although there is significant overlap within ASPR between the two mission sets. As an operational-level activity, supply chain coordination requires daily and weekly communication with partners (i.e., private partners, states, and other agencies) to ensure information sharing continues and to enable supply chain visibility. One participant described these frequent interactions with PPE distributors as being critical to information sharing during COVID-19:

> [The Supply Chain Control Tower] have a collection of the distributor orders and fills from major PPE distributors within the U.S. We don't have all of them, but we have a good portion of them, kind of like the big six, in addition to some manufacturers [who] started to contribute to the supply chain control tower… We get their feeds almost daily; depending upon the contributor, it could be daily, it could be weekly. (P2)

The overarching purpose of supply chain coordination is to understand better the true state of the end-to-end medical supply chain. This picture creates visibility that connects existing supply chain capacity with the appropriate market demand. Participants frequently used the term *end-to-end* visibility:

> [W]ith the control tower… we'd like to have this end-to-end visibility. We've fully focused in more so on the distributor to point-of-care flow, and also upstream from there, manufacturer to distributor. Where we're really trying to focus in now… as we really dive into manufacturing capacity, and surge capacity, [is] upstream from that point, our raw materials. So we really want to be able to have visibility as much as possible to understand where there are potential bottlenecks and challenges within the medical supply chain. And if we can have that visibility and potentially capture any type of early indicators, be able to… minimize those challenges as much as possible or at least alert as early, as fast as possible. (P2)

Although the goal of coordination is full visibility of the entire, end-to-end supply chain, the pandemic highlighted the government's lack of true visibility over the supply chain for medical supplies and equipment. This is particularly true for supplies that are

manufactured overseas, which is certainly the case for much of the PPE market. At the start of the COVID-19 pandemic, China was the world's largest producer of PPE finished products and many of the raw materials for these products (UNICEF, 2020). Several participants spoke of the lack of visibility for products manufactured overseas:

> In terms of looking at the supply chain… it's not just us, it's everybody, and anybody who tells you different is lying: the further you get away from the United States, the harder it is to get to ground truth. And there is no data source available that looks into China and really gets a really good sense of what's going on. Not only on the manufacturing side, but on the raw material side, you can make some very, fairly accurate deductive reasoning on what's going on… But the further you go back on that end, the harder it is to get that same level of fidelity and that competence. (P13)

ASPR's recent coordination efforts attempt to solve the problem of poor visibility for future public health crises by establishing a platform for information sharing and commitments from supply chain members to share data with ASPR. However, attaining full end-to-end visibility remains difficult, given the global nature of the supply chain. With this difficulty, coordination alone is insufficient to address supply chain challenges such as those experienced during the COVID-19 pandemic. Accordingly, ASPR also balances two other priorities: building opportunities for supply chain collaboration and orchestrating a stockpiling strategy.

Long-term: Building opportunities for supply chain collaboration

Another key priority for ASPR is building opportunities for supply chain collaboration; (as mentioned earlier, our study specifically differentiates between supply chain coordination and collaboration with coordination including communication, information exchange, and performance monitoring and collaboration requiring higher levels of trust, cooperation, and interdependence among supply chain members). The collaboration theme encompasses activities related to ASPR's efforts to build mutual

benefits among its partners while working collaboratively, contributing to shared goals and objectives. Building opportunities for supply chain collaboration includes practices such as "developing partnerships with private partners," "building trust with partners," "strengthening relationships with trade associations," and "enhancing mutual benefits."

Supply chain collaboration involves more than information-sharing and partnering. It requires goal congruence, decision synchronization, incentive alignment, resource-sharing, collaborative communication, and joint knowledge creation (Cao et al., 2010; Scholten & Schilder, 2015). Collaboration also involves trust and commitment between parties (Soosay & Hyland, 2015). With supply chain collaboration, partners are co-contributing to some shared deliverable with shared responsibility for the outcomes. ASPR's efforts towards collaboration within the medical supply chain manifest in their desire to create mutual benefits for their partners while preparing for future health events. ASPR's long-term goal is to not simply aggregate supply chain information as a supply chain coordinator. Although such aggregation is a necessary and important function during a crisis, ASPR also wants to provide value to distributors and manufacturers to strengthen the supply chain in the long term. Much of the information gathered for the SCCT is not kept secret by ASPR; they also, where possible, try to share information with partners to help them improve their own supply chain visibility. Several participants described the shift towards synergy and mutual benefits:

> I think there was a lot of synergy [during COVID-19], and I think that they saw it. We're continuing to listen to them and what things would be helpful. We aggregate a lot of market views back to them to the degree we can, and we think we're going to continue to try to do that. (P9)

ASPR's partners benefit from data analysis and visualizations about their respective markets, just as ASPR benefits from understanding the manufacturer and distributor

capabilities for particular medical supplies, devices, and pharmaceuticals. This mutual benefit encourages partner participation in ASPR's programs, including the SCCT and table-top exercises for specific public health event planning (e.g., bio-terror attacks and pandemic disease), so its partners can better understand how to position themselves for potential future events. The planning exercises give ASPR a better understanding of what the commercial market can readily provide for specific public health threats versus what might be necessary to stockpile at the state or federal level. From the private partner perspective, these exercises give them a better understanding of the potential medical equipment and supply demands for those specific threat scenarios. However, multiple participants spoke about the need to expand those efforts:

> [Collaborative planning] to me is the next, again, part of the next frontier. It's collaboratively working together, outside of a response, to try to figure out some of these harder problems that I think will benefit us during response (P13).

While collaborative planning is part of the current strategy, expanding it has opportunities and benefits, particularly looking beyond the COVID-19 response. However, the nature of government contracting often requires that ASPR collaborate with industry trade associations rather than manufacturers or distributors directly unless a contractual agreement is in place. Therefore, much of the long-term inter-organizational relationship development occurs between ASPR and trade associations versus directly with supply chain members.

In addition to providing mutual benefits, supply chain collaboration includes building trust among partners. According to one participant, "the trust between [the industry trade association] and the SNS has been absolutely critical" (P6). Trust allows for longer-term relationships, which are especially important in public health, where there can be years between significant event responses. One of the key concerns expressed by

multiple participants is the fear that existing partnerships might end after the pandemic is over and partner priorities shift:

> I think when we start to get better, as far as COVID, I think when we start moving on…[the key is] keeping this alive, keeping this momentum… the government and private sector working together. I think [the key is] how we keep that, how we keep feeding it. (P5)

This concern over sustaining collaboration beyond COVID-19 makes building trust an especially critical element of the collaboration priority. In this way, supply chain *collaboration* is a key element of both ASPR's planning and long-term preparedness strategy, while *coordination* occupies a space within the short and medium-term response phase.

Orchestrating a stockpiling strategy

The final priority for ASPR is orchestrating a stockpiling strategy. This piece of ASPR's strategy involves bridging the gap when commercial partners cannot meet supply chain demands during a public health crisis. The reasoning for this buffer inventory could be an unexpected surge in demand for particular products (i.e., PPE during the COVID-19 pandemic) or the desire to maintain inventory of a medical countermeasure that lacks a typical commercial market (i.e., the anthrax vaccine). Orchestrating a stockpiling strategy includes practices such as "employing a distribution strategy," "lifecycle management," "balancing stockpiling with commercial market capability," "relying on partners to stockpile," and "strategies for what to stockpile."

Stockpiling is an essential and imperfect element of public health planning. Public health preparedness for the medical supply chain involves a balance of manufacturing capacity and stockpiling. The stockpile at the SNS provides a buffer when existing local resources cannot meet surge demand. The key challenges in stockpiling are what exactly

to stockpile and lifecycle management for items in the stockpile. Larger inventories provide greater resilience to potential emergencies but also cost more. These costs can compound when items in the inventory expire and need to be restocked. Such was the case for the SNS at the start of COVID-19, as the stockpile's PPE inventory was significantly depleted after the 2009 swine flu (H1N) pandemic. Much of the remaining PPE at the SNS was expired, and funding was inadequate to reorder new supplies, despite repeated concerns expressed by public health experts regarding the state of masks and ventilators in the stockpile (Klein, 2020). Several participants discussed experiencing this challenge during COVID-19:

> Within the first few weeks of COVID, we were getting requests for hundreds of thousands of ventilators from states, and we just didn't have that. We could purchase 300,000 ventilators and I don't remember the exact amount, but we purchased a lot, far more than we actually ended up needing. And now those ventilators are just sitting on a shelf. They're sitting on shelves… either in our state stockpiles or within the Strategic National Stockpile. And they may be needed, they may not be, and then of course, just with any stockpiling, there's lifecycle management, right? (P7)

The SNS uses a variety of strategies to mitigate the challenges associated with stockpiling. These include relying on partners to stockpile through practices similar to commercial vendor-managed inventory, reliance on contracted third-party logistics partners for distribution and warehouse management, and a well-established shelf-life extension program administered through the Federal Drug Administration (FDA). The shelf-life extension program allows the SNS to send samples of particular batches of expired pharmaceuticals or medical countermeasures to the FDA for testing. If the FDA finds that sample still viable, the entire batch can see its shelf-life extended. While the shelf-life extension program certainly offers benefits and helps alleviate some of the waste associated

with stockpiling, it is not without its issues. Another participant discussed the practical reality of clinicians receiving items with extended expiration dates:

> [The shelf-life extension program] is a great conceptually, because… you've got the material, you're not going to throw it away. Testing proves it's still safe and efficacious. That's great. But I tell you, when I tried to hand an N95, to a doc in a hospital… that had an expiration date on it with a little note that said 'don't believe the expiration date, it's really good.' They wouldn't use them. Right? So there's a challenge there that we need to overcome in terms of the education of clinicians. And I don't know how you do that. Because again, you're talking about them trusting someone they don't know, and the government, right, with their lives… So that is a big challenge. (P18)

Even if shelf-life mitigation programs like this are successful, stockpiling perishable materials remains an expensive and challenging endeavor:

> In most cases, the packaging was not meant to be long-term stored. It wasn't meant to be stockpiled, it wasn't developed for that purpose. So that's the enemy of the stockpile, [it is] perishable fruit… so when you invest all this money, and then you go back to the planning factors we have to mitigate against, that's an extraordinary expenditure, calculated every X number of years. Now, the SNS has done phenomenal work and shelf-life extension program, and getting [Emergency Use Authorizations] and all sorts of things. But, you know, is that the most effective way? I don't know. (P9).

Stockpiling alone is not meant to—and cannot—meet the needs of every public health emergency. The COVID-19 pandemic illustrated the limitations of the SNS during a worldwide, prolonged pandemic health event. Therefore, ASPR must continually balance its strategy to stockpile resources with its efforts to build partnerships in the manufacturing sector. Numerous participants echoed this need for balancing:

> Once you start collaboratively planning like that, and you look at the whole pile of material, then you can say: Okay, if I want to have a billion of these things, industry can give me 600 million, that means potentially, the stockpile should have 400 million in it. Now I can look to industry and go, what's the most efficient way to do that? (P13)

This type of collaborative planning requires strategic decisions regarding what to stockpile, in addition to strategic communication with ASPR's supply chain partners regarding their capabilities and limitations.

Another major decision for the SNS is the physical distribution strategy for materials in the stockpile. Traditionally, the SNS housed materials in warehouses operated by third-party logistics providers and relied on those providers to transport and distribute materials when necessary. During COVID, the SNS utilized alternative distribution strategies to meet the massive increase in demand for materials while also reducing order lead times:

> [During] early stages of the [COVID] response, we found that if distributors… that can take [supplies] directly to the point-of-need, to that hospital, it takes all the other pieces out and makes that more efficient… we call that alternative modes of distribution for SNS. And we're still framing that out, how that looks, but also looking at a possibility for beyond COVID. (P5)

SNS and ASPR continue to explore ways of using existing distribution networks (i.e., better utilizing the medical distributors that already make daily deliveries to healthcare providers) to improve their distribution of materials. This strategy connects directly to the partnerships with private partners and collaborative efforts discussed above.

Stockpiling exists as both a short-term response decision and a long-term preparedness decision. On the response side, stockpiling decisions include the physical distribution strategy for a particular medical countermeasure, utilizing programs like the FDA shelf-life extension program for expiring materials, and the acquisition decisions for stockpiled materials during a crisis. On the preparedness side, the decisions include long-term questions of what materials are most appropriate to stockpile, improved collaboration with states to align overall public health stockpiling strategies (e.g., a better understanding of what states have in their own stockpiles), and collaboration with private partners for a

vendor-managed inventory of critical materials. Both short-term response and long-term preparedness decisions are necessary to orchestrate a stockpiling strategy successfully.

Attributions

Reflecting on the challenges ASPR faced in responding to the pandemic, four external factors were identified as critical to the COVID-19 response and future pandemic preparedness. These are ongoing situational factorsthat are a constant backdrop under which the government's decisions are made. The external factors are event uncertainty and complexity, partner interests and incentives, domestic manufacturing capabilities, and funding uncertainty. The findings suggest that ASPR attributes—or blames—the response to COVID-19 on hindrances caused by these four factors. As a result, ASPR used these attributions to develop the above strategic priorities for future public health events.

Event uncertainty and complexity

One of the primary challenges in public health preparedness is uncertainty surrounding the timing and specific demands of the next public health event. Event uncertainty and complexity include concepts such as "constantly evolving and uncertain event types" and "understanding the specific emergency response needs." Each crisis uniquely stresses the public health system and its supply chain, and predicting future events is challenging. The unique stress of specific events requires ASPR to develop contingency plans around events that might never occur or events they do not yet know about:

> [T]here's no one size fits all… So all of your public health emergencies that we are a part of don't evolve the same way: Ebola wasn't the same as Zika, which isn't the same as COVID. So we have to understand that and be flexible enough to ensure we get the public health interventions that are needed to save lives. (P3)

Uncertainty requires flexibility and agility within the supply chain (Prater et al., 2001; Sharma et al., 2017; Vickery et al., 1999). It also requires a supply chain resilient to

disruption (Duong & Chong, 2020). The same applies to ASPR in coordinating and collaborating among its partners; flexibility and agility build resilience to disruption.

Uncertainty also complicates stockpiling requirements because the next event's specific demands are often unknown. Even with sufficient funding, which is a different challenge, the SNS could stockpile for events that might never occur or could be forced to respond to a new pandemic with supply requirements not currently in the stockpile. Similarly, ASPR could plan and prepare for events that never occur or respond to events previously unexpected. In 2021, no one at ASPR assumed they would respond to an infant formula shortage. However, in 2022 they were heavily involved with coordinating "Operation Fly Formula," an effort to quickly ship formula from overseas to address the domestic shortage (Diamond, 2022b). The challenge of threat assessment is significant:

> [O]ne area we haven't touched on is threat assessment and trying to understand what the threats are, [and what] you need to be prepared for… you can't be prepared for everything all the time. So how do you rack and stack the threats that we need to be prepared for? And I think that's, that's an open challenge for government. (P15)

Because ASPR does not have an unlimited budget, it must assess and prioritize the critical public health threats and stockpile for those potential events. This challenge reiterates the need to develop a comprehensive stockpiling strategy *and* a robust partnership with industry partners to provide flexibility and agility for emerging threats.

Different event types put different demands on the supply chain. Several participants shared the importance of understanding the specific emergency response needs of specific events. There is no one-size-fits-all solution to every public health crisis. Understanding specific event demands requires collaborative planning and coordination among stakeholders. Accordingly, event complexity is one of the primary driving forces for supply chain coordination and collaboration. The SNS was established initially with

the primary purpose of responding to bio-terror events. As the program's needs have grown to include "all-hazards" events like the COVID-19 pandemic, ASPR is reevaluating how it meets healthcare stakeholders' demands. The reevaluation includes solutions such as better distribution of stockpiled resources using existing commercial networks and collaborative partnerships:

> We found with COVID, [distribution] was a big challenge for us getting down to individual hospitals across the country at the same time. You know, you don't expect to have an anthrax event in every state across the nation, so you don't build your system to have to go to every place across the nation. But COVID was different in that sense that you needed to get everything across the nation when you had it, consistently. So there are companies that do that every day, like your major distributors, so we need to leverage them to do that on our behalf. (P3)

Complex, large-scale events like the COVID-19 pandemic require creative solutions outside of routine operating procedures. In this case, one solution is to leverage the existing distribution networks of the major distributors to push supplies more quickly and in greater volume than the SNS's third-party logistics structure allows. Such collaboration might not be necessary for events with less complexity or uncertainty.

Partner interests and incentives

Partner interests and incentives include concepts such as "hesitancy to share information," "continuing partnerships beyond COVID-19," and "understanding partner motivation." Both supply chain coordination and collaboration require partner engagement and willingness to share information. State public health officials have hesitated to share information on their respective stockpiles, fearing that the federal government might try to take control of those supplies. Some private partners have also hesitated to share information that might somehow be revealed to their competitors:

> [A] distributor might be like, oh, well we're not going to share that with you, because it might get out, and that might hurt our business, it might hurt the

> hospital's business. So you've got to always take that into account when you're working with the private sector, that this is all a business for them. (P7)

Given that information sharing is a core component of supply chain coordination, partner hesitancy to share information makes supply chain coordination, in particular, more challenging—programs such as the SCCT hinge upon partner cooperation in sharing data with ASPR. In addition to general fears regarding data privacy and security, hesitancy to share information might also indicate a lack of trust, which is one of the critical elements of supply chain collaboration.

There is a concern at ASPR over the existing partnerships, cultivated throughout the COVID-19 response, ending once distributors and manufacturer priorities shift during the post-COVID environment. Despite some worry, many participants also expressed confidence that the majority of partners will stay engaged because they genuinely see the benefits of their involvement:

> I think they'll be good for a while, I really do… We do get a lot of feedback. I mean, we're working with multiple trade associations now. And a lot of it, it's still the same… they want to learn more, and then how can we become involved… I think it will continue on. (P5)

Right now, partners seem incentivized by the mutual benefits and the relationships established during COVID-19 to continue working closely with ASPR. However, questions remain about whether there needs to be a financial incentive or compensation for partner participation or whether there needs to be some legally mandated participation:

> [A] lot of the collaboration, a lot of the involvement of manufacturers and distributors has been goodwill and personality… not really a quid pro quo beyond that. That only goes so far, especially for something that becomes onerous and far outside of a public health emergency when companies are going to care a lot less. So like financial incentives, or at least reducing burden of participation, making providing data easier, providing insight into the company easier. And Control Tower, to my knowledge is doing this really well, but I'm sure there's room for improvement. (P15)

Asymmetry in the distribution of information is often solved in commercial supply chains through sharing contracts (Vosooghidizaji et al., 2020). While typical profit-sharing contracts are not applicable in this case, there are alternative incentives that the government can explore. Monetary or legally mandated incentives would become critical factors in long-term supply chain coordination and collaboration between ASPR and its partners. Such incentives could be contractual or data sharing from the SCCT to improve situational awareness of the supply chain for ASPR's partners (i.e., alerting partners to supply chain trends or emerging threats to the supply chain). In any case, a lack of partner incentive or requirement to participate with ASPR effectively eliminates its ability to coordinate the supply chain.

Domestic manufacturing capabilities

Domestic manufacturing capabilities include concepts such as "disadvantages of overseas production," "lack of domestic manufacturing capacity and commercial resilience," and "expanding and sustaining domestic manufacturing," One of the key challenges highlighted during the pandemic was the inability of domestic manufacturing to meet the medical supply demands of a nationwide or global pandemic. While stockpiling is an essential aspect of the public health strategy, the federal stockpile is neither intended nor funded to provide enough supplies for the entire nation through the complete timeline of a public health event. As one participant stated:

> The SNS is not meant to be the CVS to the nation, but instead, [it's] the backstop. SNS provides surge capacity if the commercial market cannot meet unexpected demand or there is interrupted supply, like we've seen recently. (P4)

This strategy relies on a capable and flexible domestic manufacturing sector for medical supplies. Certain products, because they lack any commercial viability (i.e., Anthrax or Ebola vaccines), need to be stockpiled because the government has decided they should be

readily available at the start of an emergency. However, another factor in stockpiling is whether a product lacks robust domestic manufacturing capacity:

> You know, in some things, you probably shouldn't stock, because they're readily available, and they're going to be readily available during a pandemic. But there's some things that you can't wait for manufacturing to increase or expand production of, or you don't produce in the United States. So you need to stockpile it. (P1)

The lack of domestic manufacturing capacity for specific items necessitates a stockpiling solution, assuming it is determined necessary for public health preparedness. Of course, this requires an adequately funded stockpile.

There is an ongoing effort within ASPR to satisfy a major government initiative to strengthen domestic manufacturing capabilities across critical sectors. The Industrial Base Expansion (IBx) project is a significant part of this initiative. The specific details of IBx include targeted government investment in products that lack regular commercial viability (i.e., medical countermeasures for diseases like Anthrax and Ebola), warm-base manufacturing, and keeping a trained medical supply workforce for future needs. Each of these efforts is balanced against the need to stockpile items that cannot be quickly manufactured. There is also the ongoing question of how to *sustain* manufacturing capability for products lacking sustained demand but likely needed for a public health emergency:

> [H]ere's a problem, though, too, because if we do… expand production, but you can't expand your demand. And that is a problem; that's a challenge. I mean, now that we've got this capability, we have these employees, then who's going to buy our product now that the demand is gone? And we see that in product lines now, especially with respirators like N95s and other things. So you've got to figure out where that balance is because the government can't be the answer to everything. (P5)

Without sustained demand, domestic manufacturers may shift priorities away from PPE and other medical supplies again, putting the supply chain back at the same point it was to

start the COVID-19 pandemic. As another participant put it: “The greatest lesson learned over the last ten years is we need to figure out the sustainment question… how do we sustain these facilities, so that they are ready, and they are prepared to respond to the next public health emergency” (P11)? Some of the suggestions for future investment to counter this problem under IBx include stimulated and sustained demand “through U.S. Government partnerships, increasing stockpile inventory, and establishing a revolving fund for SNS with Buy American provisions” (HHS, 2022, p. 22).

The theme of domestic manufacturing also encompasses the need for greater overall supply chain resilience in the healthcare industry. Several participants discussed concern over resilience. The decades prior to the onset of COVID-19 saw most hospitals and healthcare providers shifting to just-in-time inventory systems with frequent deliveries of supplies from healthcare distributors. This shift was a cost-saving initiative for hospitals; however, the result was minimal supply chain resilience during significant supply chain disruptions. While state and federal stockpiles exist to provide this buffer capacity, some level of responsibility rests on providers to build internal resilience to public health emergencies:

> [I]f hospitals go back to keeping three days of supply on hand, we’re broken day one, if there’s a daughter of COVID, or a son of COVID… because, look, if I live in Florida, I’ve got a hurricane go bag, I’ve got water for me and the dog, you know, I’ve got some food… Our healthcare system has to have that same perspective, that they need to understand that they are responsible for ensuring that they can operate not just their generators for seven days but their supply chains for any number of days… until everything else kicks in to be able to support them. (P18)

The goal for increasing supply chain resilience at the industry level is to shift some of the burden for emergency stockpiling, even just in small part, back to healthcare providers. While state and federal stockpiles will still play a critical role, providers themselves will be able to withstand supply chain disruptions without an immediate impact on service. By

combining this resilience with a more robust domestic manufacturing capability, the healthcare industry will be better positioned for future public health crises.

Funding Uncertainty

Funding uncertainty includes concepts such as "ASPR's funding limitations" and "politics." Each of the challenges discussed is further exacerbated by the limitations and uncertainty of funding at ASPR:

> And then, from a money perspective, we've got to find a better way. This idea that every time there's a crisis, we got to go ask Congress for a supplemental and depending upon where the political environment is, where they are in their cycle of, whether they're even in session, is not effective in terms from a public health perspective. (P12)

Funding for most federal government agencies is inherently tied to the agenda of the political party in power. In the U.S., Congress determines appropriations for HHS and ASPR. The lack of long-term funding makes strategic preparedness decisions more challenging and limits the ability of ASPR and its programs to contract effectively, a frustration expressed by multiple participants.

An additional funding constraint comes from the strict and often limiting government contracting requirements. For example, several ASPR programs were initially funded using appropriations from COVID-19 spending bills. This funding subsequently limits the use of those programs to only the COVID-19 response. It restricts their use in subsequent public health events (i.e., the following public health emergency, Monkeypox) without modification of contracts or additional funding, despite the active ability of those systems to support additional events:

> But we had contracting limitations, funding limitations. A lot of the funding we had, some of these systems were COVID-specific, so we had to kind of find additional funds, modify some contracts. We would have been able to do some of this even sooner if we hadn't had those limitations. (P7)

The limitations of government contracting and funding make preparedness, response, and stockpiling decisions each more difficult. Sustained long-term funding would enable ASPR to invest fully in long-term partnerships. Such funding would also allow ASPR to grow programs such as the SCCT and fully invest properly in flexible and warm-base manufacturing strategies that synergize with existing stockpiling strategies. Funding uncertainty at ASPR necessitates strong partnerships and collaboration with industry so that the private sector can meet supply chain demands regardless of the public health funding situation.

Theoretical Framework for the Role of Government in the Medical Supply Chain

In this section, we propose a grounded theoretical framework using attribution theory that explains the government's role in the medical supply chain during COVID-19 (see Figure 2.2). The framework incorporates three government strategic priorities managed during the preparedness and response phases of a public health crisis and the underlying environmental attributions for those priorities. Specifically, the process model in the framework begins with the emergence of medical supply chain challenges, such as those present during the COVID-19 pandemic. The challenges lead to a construal of a suboptimal or negative performance gap, which triggers the attribution process. Importantly, this attribution process begins with the construal—or recognition—of a gap between the organization's performance and expectations for meeting a particular supply chain challenge rather than the actual subpar performance itself.

The four attributions are external factors that determine ASPR's success in meeting supply chain demands, as demonstrated by the challenges and inefficiencies of the COVID-19 response; each of these attributions factors into ASPR's strategy for addressing medical

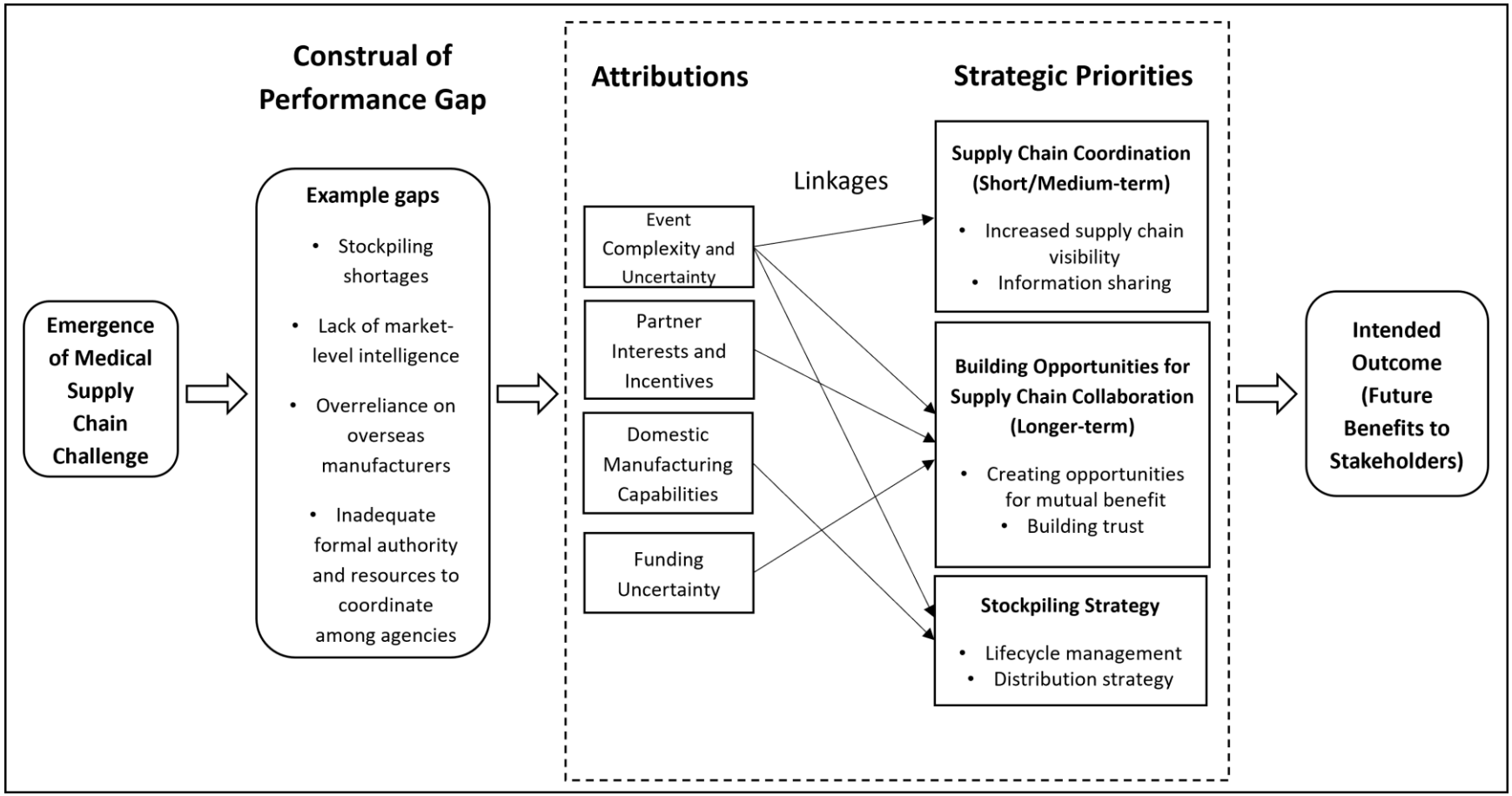
supply chain challenges during future public health emergencies. First, as the findings demonstrate, complexity and uncertainty in public health events necessitate a supply chain strategy involving all three priorities: coordination, collaboration, and stockpiling. Second, an appreciation of partner interests and incentives leads to building opportunities for collaboration, given the emphasis on activities like enhancing mutual benefits and building trust with partners. Third, the shortcomings in domestic manufacturing capabilities experienced during COVID-19 have a clear causal link to the emphasis on a continued stockpiling strategy for future events. Finally, funding uncertainty necessitates opportunities for collaboration so that private industry can meet supply chain demands despite the ebbs and flows in government funding.

The attributions collectively determine the government's three strategic priorities for the supply chain. The following quote from a participant illustrates the balancing and interplay between stockpiling, coordination, and collaboration priorities:

> [The key to success in stockpiling] is understanding demand. It's understanding the supply chain; we've got to be more than stuff on a shelf. I mean, it has to be a calculated response, really, and assume some level of risk when you're assuming what [the] supply chain can bring… if the commercial sector can respond, what's our role in it? Are they able to capture it? I mean, just understanding what that sweet spot is, as far as where our involvement is, some of it is just coordination, basically. (P5)

The government's goal with medical equipment and supplies during a public health crisis is for the commercial sector to meet demand. The stockpile exists to bridge the gap before that occurs. These processes require coordination (i.e., knowing what the commercial sector can do and identifying areas of concern along the supply chain) and collaboration (i.e., ASPR and its partners working together to meet the public health demand). These strategic priorities aim to deliver future benefits to public health stakeholders.

FIGURE 2.2: Theoretical framework for the role of government in the medical supply chain



DISCUSSIONS AND CONCLUSIONS

Our study aims to examine the government's role and perspective in supply chain networks by exploring the medical supply chain during the COVID-19 pandemic. Through a case study of the U.S. federal government's chief public health preparedness and response agency, we examined the factors attributed to the insufficient attempts to manage medical supply chain challenges during COVID-19 and how the agency is preparing to address supply chain challenges during future events. In summary, we found that this agency identified several gaps in its supply chain response to the pandemic and aimed to balance three strategic priorities during and post the pandemic to improve responses to public health emergencies: strengthening supply chain coordination, building opportunities for supply chain collaboration, and orchestrating a stockpiling strategy. These priorities are attributed to external factors in mission complexity and uncertainty, partner interests and incentives, domestic manufacturing capabilities, and funding uncertainty. We develop a theoretical model that explains the government's role in moving from the emergence of medical supply chain challenges, such as those experienced during the COVID-19 pandemic, to providing future benefits to healthcare stakeholders. We also discuss the linkages between the attributions and the strategic supply chain priorities for future public health events.

The COVID-19 pandemic provided critical lessons learned for public health officials to prepare for future public health emergencies. Despite numerous documented challenges within the medical supply chain throughout COVID-19 and warranted criticism of the government's response (Tyson & Funk, 2022), the evidence presented in this study points to a genuine desire by ASPR personnel to work closely with members of the medical supply chain to improve visibility, flexibility, and responsiveness to public health

emergencies. As one participant stated regarding getting materials to people and populations in need: “So if we learn[ed] one thing during COVID, we need to have different strategies to ensure access for different types of material. And there’s no one size fits all. The response is going to drive how we ensure access” (P3). The pandemic reiterated the understanding at ASPR that stockpiling alone is not the solution to public health response. The preferred solution involves a balance of stockpiling and partnerships that enable medical supplies, pharmaceuticals, and medical devices to be broadly and quickly distributed when needed. COVID-19 also demonstrated the value of leveraging existing networks that exist for routine distribution to provide surge capacity beyond the limitations of the SNS third-party logistics contracts. While the SNS may still need to use its internal system for products without commercial viability (i.e., bioterrorism countermeasures), COVID-19 illustrated the value of using medical distributors who already distribute to healthcare facilities daily for surge public health emergency distribution.

In discussing the theoretical model with several of the study’s participants after data collection, there was some consideration as to whether the internal priorities and external factors could be ranked. While future research could attempt to rank the factors comprehensively, some participants suggested that their rankings are highly dependent on the scenario ASPR is facing at that time. For example, during the preparedness stage (i.e., between responses), stockpiling might take the forefront from a strategic perspective. During the onset of a response, as occurred during COVID-19, supply chain coordination to enable supply chain visibility might become the top priority. In the external factors, funding uncertainty was frequently cited as a top concern; however, this was not the case for much of the COVID-19 pandemic when public health spending was significantly higher

than usual. As overall government spending priorities shift away from the COVID response, ASPR is again facing a scenario when funding uncertainty is a major challenge. Even here, the scenario and context drive the ranking of these factors.

This study makes several contributions. First, it addresses the mostly ignored role of the government in supply chain networks (Quarshie & Leuschner, 2020) by examining the government's increasingly important role and perspective within the medical supply chain. The proposed theoretical framework establishes the government's priorities and external challenges when providing benefits to public health stakeholders in the face of increasingly common supply chain challenges. The limited extant literature on government involvement in supply chains has focused primarily on sustainable or green products (Li et al., 2021; Manouchehrabadi & Yaghoubi, 2019; Sudusinghe & Seuring, 2021); this study extends that work into a major supply chain that recently faced significant disruption. Notably, two of the priorities undertaken by the government in the medical supply chain, collaboration and coordination, mirror roles assumed by the government in achieving sustainability in circular supply chains (Sudusinghe & Seuring, 2021). Second, while the COVID-19 pandemic placed practitioners and press focus on the medical supply chain, this is the first study we are aware of that examines government collaboration and coordination within the medical supply chain during the global pandemic, which saw unprecedented growth of demand and new facets for collaboration.

Finally, this study demonstrates how attribution theory can be used to explain how the factors responsible for falling short of expectations are attributed to specific *organizational*-level decisions and strategies. Previous literature extending attribution theory to macro-level data looked instead at consumer response to firm-level phenomena—

firm-level product recall decisions (Munyon et al., 2019)—rather than firm- or organizational-level responses to attributions of blame. This study shows how gaps between expectations and actual performance at ASPR led to attributions of blame based on external factors, ultimately leading to revised strategy (i.e., strategic priorities).

We conclude by offering several short and long-term recommendations for ASPR. First, ASPR should continue to build partnerships that enable supply chain collaboration. Collaboration can lead to resilient supply chains (Shekarian & Mellat Parast, 2021). Although public health officials might not know the specific details of the next major crisis, they do know that infectious diseases and climate-related emergencies will continue to create demand surges and potentially limit supply (as the COVID-19 pandemic did), so supply chain resilience is paramount. Second, ASPR needs to hire proper supply chain and logistics professionals. While some of the participants interviewed for this study are logisticians or supply chain professionals, many are simply public health experts with increased exposure to supply chain issues due to the challenges associated with COVID-19. Several participants spoke about ASPR's shortcomings in hiring dedicated supply chain professionals over the previous decades. As COVID-19 illustrated, disruptive public health crises require personnel with knowledge of supply chains and whose understanding of the medical supply chain is not simply ad hoc but built on years of experience working in the logistics space.

Finally, ASPR should better communicate to the American public and stakeholders that the solution to medical supply chain problems, such as PPE shortages, experienced during public health events is not the SNS alone. Much of the criticism of the SNS during COVID-19 was due to a public misperception of the SNS's purpose. The SNS, as it stands

now, is not resourced to be the nation's storehouse for medical supplies during a crisis. Therefore, the solution to medical supply chain challenges during a crisis is not in the SNS alone. This reality needs to be better communicated to stakeholders and the public so that sustained funding, even years after COVID-19, is appropriately put into projects and initiatives that strengthen domestic manufacturing and build public-private partnerships. Additionally, the healthcare industry needs to take responsibility for building its own resilience by stockpiling reserve supplies and equipment in the event of disruption rather than relying entirely on a just-in-time inventory strategy. These recommendations will better position ASPR to handle the next public health crisis.

APPENDIX A: Interview Protocol

Overview

1. Describe the project and research objective as an exploration of the medical supply chain and medical supply stockpiling during COVID-19.

Interviewee's background

2. Tell me a bit about your professional experience.
3. How would you describe your current role?
    a. How long have you been in your current role?
4. What is the role of your agency/organization in disasters and emergencies?

Stockpiling

5. What are the keys to success in medical equipment and supply stockpiling?
6. What are the key challenges in stockpiling?
    a. Strategies to overcome those challenges?

Partnerships

7. How do private-public partnerships fit into stockpiling efforts?
    a. What type of information is typically exchanged?
    b. Can you give me an example of how that was a challenge (if it was)?
    c. How were you able to meet that challenge?
    d. What is the ideal solution to that challenge?
    e. Can you give me another example of challenges related to public-private partnerships?

8. What interdependencies exist in the current public-private partnerships?
    a. Is there mutual dependence, or does one group rely on the other?
    b. What type of relationship is realistic or feasible moving forward?

Supply Chain

9. What does supply chain visibility mean?

    a. Is supply chain visibility a problem?
    b. Can you give me an example of how that was a challenge?
    c. How were you able to meet that challenge?
    d. What is the ideal solution to that challenge?
    e. Can you give me another example of challenges related to visibility?

10. Where would you invest in technology for the future that can help your stockpiling and supply chain efforts?

11. How has COVID-19 changed the strategies or practices you use?
    a. Why?

12. How does the recent shift to become the Administration for Strategic Preparedness and Response change things for your office?

13. How has the monkeypox response differed from the COVID-19 response?

Wrap up

14. Is there anything else you'd like to share that you think might be pertinent to my research?
15. What else should I have asked you but didn't?
16. Is there anyone else you would recommend I interview?

APPENDIX B: Summary of Archival Materials

Data Type	Description	Number of Documents/ Videos	How Materials Were Used
Press articles	Relevant press and media articles related to the government's COVID-19 response and subsequent changes	15	These materials allowed us to corroborate the information shared by interview participants. Given the highly public nature of the COVID-19 pandemic, there was significant media attention paid to government response. By examining various sources, these resources provided perspectives on the case external to ASPR. These materials also provided additional contextual/ background information for the case.
ASPR multimedia	ASPR online courses, partner webinars, industry-targeted materials	21	These materials provided rich information about the information ASPR provides to its partners. Within the supply chain coordination and collaboration themes, these materials provided a first-hand view of the information ASPR shares with its partners and stakeholders. Similarly, materials specific to the SNS provide a first-hand view of the stockpiling strategy theme.
Government reports	Federal government reports and documents	7	These materials helped us to understand public health and supply chain policies, particularly with respect to changes made in response to the COVID-19 pandemic.

CHAPTER 3

Unintended Consequences of In-kind Humanitarian Donations: The Problem of Material Convergence

Peter Imbriale
Bentley University
pimbriale@bentley.edu

Jeffrey A. Livingston
Bentley University
jlivingston@bentley.edu

Euthemia Stavrulaki
Bentley University
estavrulaki@bentley.edu

ABSTRACT

Following a disaster that results in a humanitarian crisis, media coverage of the event is frequently followed by surplus donations of goods to charitable organizations. This flow of donations, a post-disaster phenomenon termed *material convergence,* often consists of large quantities of unsolicited and unwanted items that disrupt the distribution of more urgently needed goods. In this study, we conduct an experiment to evaluate whether this problem can be mitigated by media reports on the benefits of donating cash instead of goods. We find that such reports can significantly increase the proportion of cash donations, potentially reducing the material convergence problem.

INTRODUCTION

Natural and humanitarian disasters often elicit an outpouring of support for victims. Bergdoll et al. (2019) note that approximately 30 percent of U.S. households made disaster-related donations in 2017 and 2018. Donations of items are extremely common. Of these donating households, 61 percent made both financial and in-kind gifts, while 65 percent made in-kind donations for disaster relief in at least one of the two years.

However, such in-kind donations to a disaster site can result in *material convergence*, which Holguín-Veras et al. (2022) define as "the sudden and mostly uncoordinated arrival of physical donations in the aftermath of large disasters and catastrophic events." While in-kind donations may be well-intentioned, an estimated 50 to 70 percent of supplies donated following a disaster are unsolicited, non-priority items (Holguín-Veras et al., 2014). Holguín-Veras et al. (2022) describe the resulting problems as follows:

> The chief issue is that because of the magnitude of material convergence, disaster responders must allocate significant portions of scarce resources—staff, space, and equipment—to deal with the flow of non-priority supplies or run the risk of a collapse in the supply chains. The massive amount of non-priority supplies drastically increases congestion at critical logistical facilities—airports, ports, distribution centers, warehouses—which slows down and even blocks the flow of high-priority supplies. (p. 2)

The nature and extent of problems caused by material convergence have been thoroughly documented[2], but solutions to these difficulties have proven elusive. As Holguín-Veras et al. (2022) further note, "The lack of progress in reducing the flows of non-priority items in

[2] See, e.g., Fritz and Mathewson (1957), Destro and Holguín-Veras (2011), Holguín-Veras et al. (2012), Holguín-Veras et al. (2014), Mejia et al. (2019), Ülkü et al. (2015), Wachtendorf et al. (2013), and Ye et al. (2020).

the more than six decades that have elapsed since the seminal work of Fritz and Mathewson (1957) can only be considered a global failure of disaster response policy."

Media coverage can raise awareness of disasters, facilitate donations, and increase the volume and type of donations (Ogie et al., 2022; Waters & Tindall, 2011). However, media coverage often contributes to material convergence by encouraging in-kind donations. Stories referencing or requesting specific items are frequent after major natural or humanitarian disasters and can significantly influence what materials flow into the disaster areas (Holguín-Veras et al., 2012; Wachtendorf et al., 2010; Wachtendorf et al., 2014). Donors also may hesitate to donate cash for various reasons, including that cash donations may feel impersonal or out of concern that cash may never reach a person in need (Schiffling & Piotrowicz, 2022).

In this study, we conduct an experiment to examine whether media coverage of a disaster might instead be used to encourage cash donations instead of in-kind donations, helping to mitigate material convergence. Our experiment explores how exposure to actual news articles of different types influences a donor's choice to donate cash, goods, or nothing at all. Past experiments have explored how charitable giving is affected by factors such as choice architecture (Zarghamee et al., 2017), crowding-out (Ottoni-Wilhelm et al., 2017), direct asks and anchoring (Edwards & List, 2014), deadline effects (Damgaard & Gravert, 2017), donor identity priming (Kessler & Milkman, 2018), immediacy bias (Huber et al., 2011), group identity (Sánchez, 2022), nudging (Schulz et al., 2018), or solicitation by volunteers or paid workers (Rau et al., 2022). These works, however, do not directly consider major disaster giving and the influence of types of media coverage on donations.

Our experiment gave subjects the chance to donate to charity drives organized in response to the humanitarian crisis caused by the Russia-Ukraine conflict, which commenced on February 24th, 2022. Subjects were given a $6.00 endowment which they could choose to keep, donate as cash, or use to purchase an item that would be donated (either an item referenced in the Treatment In-kind article, a first-aid kit, or an item not mentioned in the article, batteries). All subjects read one neutral article that simply provided information regarding the conflict. Subjects were randomized into one of four groups in a 2x2 design: (a) a control group that read only the neutral article; (b) Treatment Cash Education, which read an article that described the negative supply chain impact of in-kind donations and the benefits of donating cash in addition to the neutral article; (c) Treatment In-kind, which read an article that described needed items such as medical supplies in addition to the neutral article; and (d) Treatment Both, which read all three articles.

We find evidence that exposure to the article that explains the benefits of donating cash significantly increases cash donations. Compared to the control, subjects who are exposed to the article that discusses the benefits of donating cash and the problems with donating goods are 4.25 times more likely to donate cash instead of goods. Similarly, subjects who read both the cash education article and the article describing specific goods that are being collected are 1.97 times more likely to donate cash instead of donating goods relative to those who only viewed the neutral article. We find no significant evidence that the in-kind donation article changes donor behavior, however. Subjects who read this article are less likely (0.57 times as likely) to donate cash instead of goods, but the estimate is not significant. These results highlight that even brief education articles regarding the

adverse effects of material convergence can significantly influence donor choice, making them more likely to donate cash in lieu of items that may not be needed.

EXPERIMENTAL DESIGN

Our experiment is designed to study the behavior of potential donors to disaster relief in a situation that could lead to material convergence that is as realistic as possible. Accordingly, our goal was to give subjects a chance to donate to relief efforts in response to a well-known, real humanitarian crisis where a) there were charitable organizations that actively sought to deliver in-kind goods to the region, b) available media reports discussed the apparent need for these goods, c) other organizations sought cash donations, and d) other available media reports noted the desirability of cash donations in lieu of donations of goods.

The Russian invasion of Ukraine that began in February 2022 resulted in a situation that matched all these characteristics. First, the crisis resulted in a distinct need for help that was (and remains) well-known. From the first weeks of the conflict, it was clear that a massive humanitarian crisis was occurring due to the number of people fleeing Ukraine to neighboring countries.

Second, there were organizations seeking in-kind donations to Ukraine as well as media articles reporting donation requests for specific items. News articles advertising both cash and in-kind donation drives around the world were common, given the widespread public support for the people of Ukraine. We contacted the coordinator for one of the donation drives (Christ the King Ukrainian Church in Boston, MA), and we agreed to use our experiment to collect items to donate to their drive. In our treatments, we used an article

from The Boston Globe that discussed the need for medical supplies and other goods, highlighting local donation drives collecting such items.

Finally, there were also large non-profit organizations conducting specific cash donation drives for the crisis in Ukraine and related news articles discussing the logistical challenges associated with material convergence occurring because of in-kind donations. We selected the International Committee of the Red Cross as the recipient of any cash donations made by our subjects and used an article from theconversation.com[3] that explains how organizations conducting relief efforts for Ukraine were being overwhelmed with donations of goods.

We recruited 377 subjects from the undergraduate student body at Bentley University. The Russia-Ukraine crisis commenced in February 2022, and the experiment was conducted approximately two weeks after the start of the crisis. The experimental sessions took place at the beginning or end of regularly scheduled course sessions[4] and lasted approximately 10 minutes.

The subjects were randomized into one of four treatment groups in a 2x2, between-subject design: control, Treatment Cash Education, Treatment In-kind, or Treatment Both.[5] All subjects, including those in the control group, were asked to read a straightforward,

[3] theconversation.com is a nonprofit, independent news organization with articles written by academic experts for the general public and edited by a team of journalists.
[4] Courses were all undergraduate business courses, including subjects such as General Business, Management, Marketing, and Supply Chain Management.
[5] Each subject was randomized into a treatment group individually via Qualtrics, which randomly selected a particular treatment's question block when the subject began the survey.

factual article (henceforth the "neutral article") about the recent Russian invasion of Ukraine and the associated humanitarian crisis.[6] Subjects in control read only this article.

Subjects in Treatment Cash Education were asked to read an additional article from theconversation.com that describes how donated materials to Ukraine were already piling up and why cash donations were more useful as a result. This article (henceforth the "cash education article") specifically outlined why cash is preferred by disaster relief organizations and the logistical challenges associated with in-kind donations.

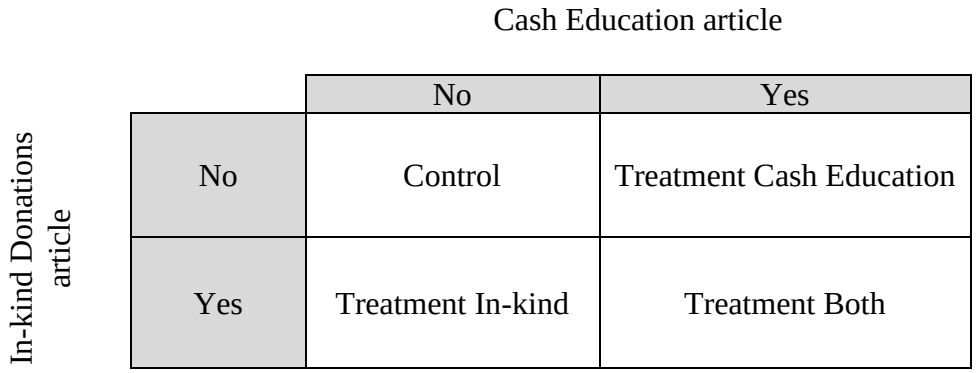
Subjects in Treatment In-kind were asked to read an additional article from the Boston Globe that discussed several Boston-area groups that were collecting donations of goods to be sent to Ukraine (henceforth the "in-kind donations article"). The text of this article promoted in-kind giving with mention of local residents who have already "stepped up" to donate in-kind to charities and by providing a list of local charities and their solicited items. The article also included pictures of first aid supplies, one of the in-kind options the subjects could choose to donate in our experiment, and specifically mentions "medical supplies" in the text of the article. Thus, the education and in-kind articles were symmetrical in that they each promoted their respective donation mode while maintaining the realism of typical media solicitations.

Finally, subjects in Treatment Both were asked to read both the cash education and the in-kind donations articles corresponding to the Treatment Cash and Treatment In-kind groups, respectively.[7] Each article was reduced from its original published version to

[6] This article was taken from Politico.com, but the source was not listed for any of the articles provided to reduce any bias caused by particular sources of news.
[7] The order of the cash education article and the in-kind donations article was randomized for each subject in Treatment Both.

reduce the overall length of the experiment. After each article was presented, we asked an attention check question to verify that the subject read the article. The content of the reduced articles and the questions for respective attention checks were consistent across each treatment. Figure 3.1 provides a summary of our experimental design. Appendix C presents the instructions, articles, and interface subjects encountered in each of the treatments.

FIGURE 3.1: Experiment design



The task subjects were asked to do was simple. Each subject was paid a $1 participation fee and given an additional $6 endowment. Subjects could choose one of four options: (1) donate $6 to the International Committee of the Red Cross charity for their Ukraine crisis fund; (2) use the full amount to purchase a 10-pack of AA batteries (a $6 value) and have it sent to Christ the King Church; (3) use the full amount to purchase a first aid kit (a $6 value) and have it sent to Christ the King Church; or (4) do not donate and keep the full $6. The first aid kit was chosen due to the explicit mention of medical supplies in the in-kind donations article. Since most donors giving in-kind will not be limited to just one specific item, the AA batteries were chosen to provide the subjects

another option for an in-kind donation. This also allowed us to test whether the article encourages donations of the specific item mentioned or in-kind donations more generally. Both items were also on the church's list[8] of desired items on their donation drive website (the church followed the increasingly common practice of using both an Amazon wish-list[9] and their own desired items list for in-kind donations). The experiment instructions made clear that the crisis in Ukraine was a real event, and the donation choices were real donations that would be carried out on the subjects' behalf by the research team.

The experiment instructions clearly stated that subjects should treat the $6 endowment as their own money and that any donation choice was a real choice; cash would be donated to the charity, and items would be sent to the donation drive. The choices of the subjects resulted in a total donation of $1,506 to the International Committee of the Red Cross, and the donation of 16 packs of AA batteries and 81 first aid kits to Christ the King Church for shipment to Ukraine.

To ensure subject anonymity, we generated random ID numbers for each subject at the beginning of the experiment, which subjects were asked to record. After the experiment, a person from the research team placed subjects' earnings in envelopes marked with the random ID numbers. This occurred in a separate room away from all subjects. The envelopes were then dropped off with each course section and left with the course instructor; students then collected their envelopes after the researcher left the room. Each student had an envelope regardless of their donation choice because of the participation

[8] See https://ukraineforward.notion.site/Donate-Supplies-b43ef9591ae14bc686de5258d1a7ec60
[9] See https://money.cnn.com/2017/11/29/technology/amazon-wish-lists/index.html

fee. This anonymous procedure ensured that no one was able to match subjects' responses to identities; subjects were ensured of this anonymity at the start of the experiment.

Following their donation choice, subjects were asked to answer three questions about their donation decision and provide some demographic information. Subjects were asked to answer three 5-point Likert-scale questions with options spanning from strongly disagree to strongly agree: (1) I trust that a donation of cash will truly help disaster victims; (2) I think donating cash gives organizations the most flexibility to make an impact when helping disaster victims; (3) I like knowing what specific item will reach a disaster victim.

RESULTS

Of the 377 subjects who participated in the experiment, 21 failed various attention checks throughout the survey. Another three subjects completed part of the survey but failed to answer the demographic questions. Excluding these students brings the final sample size to 353 subjects.[10]

Summary statistics by treatment for the main variables of interest and for the demographic variables across each treatment are presented in Table 3.1. Roughly 85 to 90 subjects participated in each treatment. The means indicate that some subject demographic characteristics are imbalanced across treatments. For example, Asian subjects are overrepresented in Treatment Cash Education and Treatment In-kind relative to control. Although not statistically distinct from control, female subjects are also underrepresented in Treatment In-kind, an issue we return to later in this section.

[10] The results that follow are estimated using only the subsample that passed all attention checks and answered all demographic questions. The results reported throughout the paper are qualitatively consistent when the 21 subjects who failed the attention checks and the three subjects who failed to complete the demographic questions are included in the sample. These results are presented in Appendix D.

TABLE 3.1: Summary Statistics

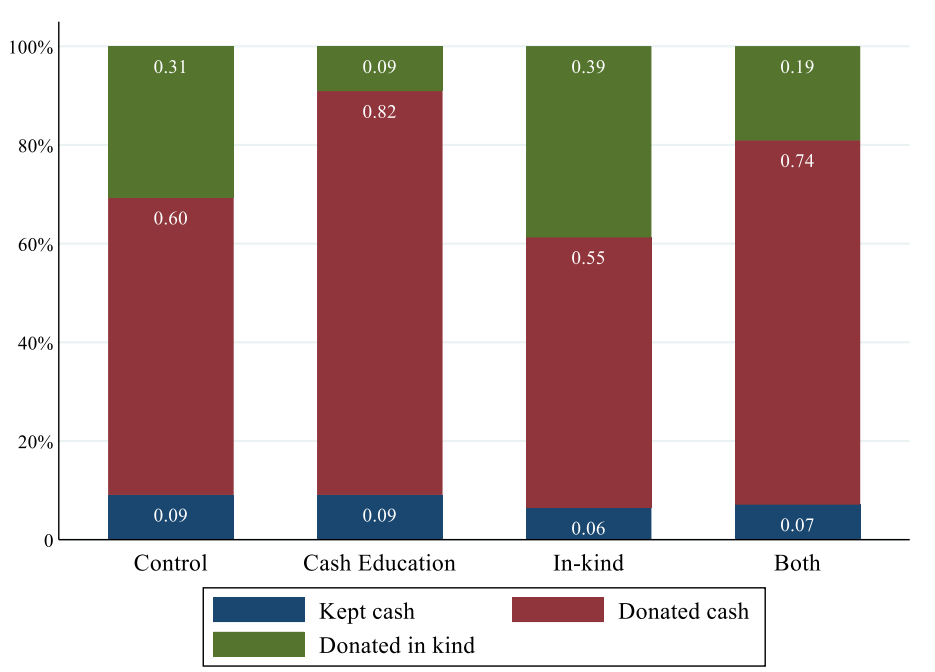
	Control	Cash Education	In-kind	Both	Total
Donation choices:					
Cash Donation	0.602	0.818***	0.548	0.738*	0.674
	(0.492)	(0.388)	(0.500)	(0.442)	(0.469)
	[53]	[72]	[51]	[62]	[238]
In-kind Donation	0.307	0.0909***	0.387	0.190*	0.246
	(0.464)	(0.289)	(0.490)	(0.395)	(0.432)
	[27]	[8]	[36]	[16]	[87]
No Donation	0.0909	0.0909	0.0645	0.0714	0.0793
(Keep Cash)	(0.289)	(0.289)	(0.247)	(0.259)	(0.271)
	[8]	[8]	[6]	[6]	[28]
Subject characteristics:					
Female	0.489	0.580	0.376	0.393	0.459
	(0.503)	(0.496)	(0.487)	(0.491)	(0.499)
	[43]	[51]	[35]	[33]	[162]
White	0.784	0.716	0.688	0.833	0.754
	(0.414)	(0.454)	(0.466)	(0.375)	(0.432)
	[69]	[63]	[64]	[70]	[266]
Black	0.0682	0.0114*	0.0538	0.0595	0.0482
	(0.254)	(0.107)	(0.227)	(0.238)	(0.214)
	[6]	[1]	[5]	[5]	[17]
Asian	0.0682	0.148*	0.183**	0.0952	0.125
	(0.254)	(0.357)	(0.389)	(0.295)	(0.331)
	[6]	[13]	[17]	[8]	[44]
Hispanic	0.125	0.193	0.226*	0.0833	0.159
	(0.333)	(0.397)	(0.420)	(0.278)	(0.366)
	[11]	[17]	[21]	[7]	[56]
Other Ethnicity	0.0795	0.125	0.0753	0.0119**	0.0737
	(0.272)	(0.333)	(0.265)	(0.109)	(0.262)
	[7]	[11]	[7]	[1]	[26]
Age 18-19	0.250	0.148*	0.161*	0.167	0.181
	(0.435)	(0.357)	(0.370)	(0.375)	(0.386)
	[22]	[13]	[15]	[14]	[64]
Age 20-21	0.602	0.648	0.710	0.619	0.646
	(0.492)	(0.480)	(0.456)	(0.489)	(0.479)
	[53]	[57]	[66]	[52]	[228]
Age 22-24	0.136	0.193	0.129	0.202	0.164
	(0.345)	(0.397)	(0.337)	(0.404)	(0.371)
	[12]	[17]	[12]	[17]	[58]
N.	88	88	93	84	353

Notes: The table provides summary statistics by treatment. The table reports mean coefficients, standard deviations in parentheses, and number of subjects in square brackets. Asterisks indicate significant differences between respective treatment and control, using two-sided *t*-tests for difference of group means at following significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Effect of treatments on donation choice

The raw data suggest that reading the different media articles had substantial impacts on the type of donation chosen by our subjects. Figure 3.2 and the top portion of Table 3.1 show the percentage of participants making each donation choice across the four treatment conditions.[11] There are several interesting results. First, the treatments had little effect at the extensive margin. They led to a shift in the type of donation subjects chose to make—cash or in-kind—rather than changing the overall number of subjects choosing to donate. The percentage of participants who kept the cash was both small (8 percent total) and statistically insignificantly different across treatments.

FIGURE 3.2: Percentage of participants making each donation choice, by treatment



Note: Donated in-kind represents a selection of either a first aid kit or batteries.

[11] Of the 87 (25 percent of) participants across all treatments who donated in-kind, only 16 chose to donate batteries. For this reason, we grouped both batteries and first aid kits together into one in-kind donation category.

Second, both of the treatments that had subjects read the cash education article describing the problems that result from in-kind donations and the benefits to organizations of donating cash resulted in an increase in cash donations. In the control group, 60 percent of participants donated cash and 31 percent in-kind. In both Treatment Cash Education and Treatment Both, subjects shifted from donating in-kind to donating cash. In Treatment Cash Education, relative to control, the proportion of subjects who donated cash increased by 22 percentage points to 82 percent, while the proportion of subjects who donated in-kind fell by 22 percentage points to 9 percent; both differences are significantly different from control using a two-sided *t* test (p=0.001 and p<0.001, respectively). Similarly, in Treatment Both, the proportion of subjects who donated cash increased by 14 percentage points to 74 percent, while the proportion of subjects who donated in-kind fell by 12 percentage points to 19 percent; the differences are again significantly different from control using a two-sided *t* test test (p=0.059 and p=0.079, respectively).

The in-kind donations article discussing local donation drives for particular items, however, had a smaller and statistically insignificant effect on the type of donation. In Treatment In-kind, the proportion of subjects who chose to donate cash fell by 5 percentage points, and the proportion of subjects who chose to donate in-kind increased by 8 percentage points relative to control, but the differences are statistically insignificant.

We next estimate the impact of our treatments on donation choice using a multinomial logistic regression. Let D_i be the donation type subject i chooses. Subjects have three choices d, where d = 1 if the subject chooses not to donate, d = 2 if the subject chooses to donate cash, and d = 3 if the subject chooses to donate in-kind. Since the raw data show no evidence of an effect of treatment at the extensive margin and our primary

concern is whether treatment can discourage donors from giving in-kind, we treat the in-kind donation as the base outcome and estimate the following equation for $d = 1$ and $d = 2$:

$$\ln \frac{\Pr(D_i=d)}{\Pr(D_i=3)} = \alpha_d + \beta_d^1 T_i + \beta_d^2 F_i + \beta_d^3 X_i \qquad (1)$$

where T_i is a vector of dummy variables indicating the treatment group assignment for subject i (Control, Treatment Cash, or Treatment In-kind, with Control as the omitted category), F_i is a dummy variable that equals 1 if subject i is female, and X_i is a vector of other subject characteristics including ethnicity and age.

Table 3.2 presents estimated relative risk ratios (RRR) of choosing to keep the cash or donate cash instead of donating in-kind in response to each treatment. As noted above, the base outcome is an in-kind donation. Columns 1 and 3 display the effect of treatment on the likelihood of not donating, and Columns 2 and 4 display the effect of our treatments on the likelihood of donating cash. We focus our discussion on columns 2 and 4 since our primary concern is whether subjects shift from in-kind to cash donations.

Consistent with the raw data, the estimates suggest that exposure to the cash education article substantially increases the chances that a subject will donate cash. Consider the estimates reported in column 4, where all controls are included in the specification. The estimated RRR of 4.25 indicates that the odds of favoring a cash donation over an in-kind donation are 4.25 times higher for subjects in Treatment Cash Education than subjects in the control group. Similarly, the RRR for Treatment Both of 1.97 indicates that the odds of favoring a cash donation over an in-kind donation is approximately twice as high for participants who viewed all three articles compared to those who only viewed the neutral article.

The estimates suggest that exposure to the in-kind donations article lowers the chance that a subject will donate cash instead of items. The estimate in column 4 suggests that the odds of favoring a cash donation over an in-kind donation are 0.57 times as likely for subjects in Treatment In-kind than subjects in the control group. Since the estimate is below 1, these subjects are less likely to select cash than subjects in control. The estimate is not statistically significant, however (p=0.106).

Overall, these results demonstrate an economically significant shift from in-kind to cash donations as a result of the cash education provided in the experiment. These results are consistent with the contention of Holguín-Veras et al. (2022) that if trusted organizations provided educational articles regarding the impact of material convergence, the articles could convince donors to donate cash instead of goods.

Differences by gender

Croson and Gneezy (2009) document differences in preferences by gender in a variety of contexts. In the charitable giving literature specifically, Eckel and Grossman (2003) and Eckel et al. (2005) find that women tend to be more generous than men, and Shang et al. (2020) find in a field experiment that past-donation priming resulted in 20 percent more donations from women but not from men. We also observe gender differences in giving patterns in our experiment. The estimates reported in columns 4 and 5 of Table 3.2 suggest that women in our sample are 0.12 times as likely as non-females to keep the endowment for themselves instead of donating goods and are 0.55 times as likely as non-

females to donate cash instead of donating goods. [12] Accordingly, we next consider whether the treatments have differential effects by gender.

TABLE 3.2: Effects of media articles on donation choice

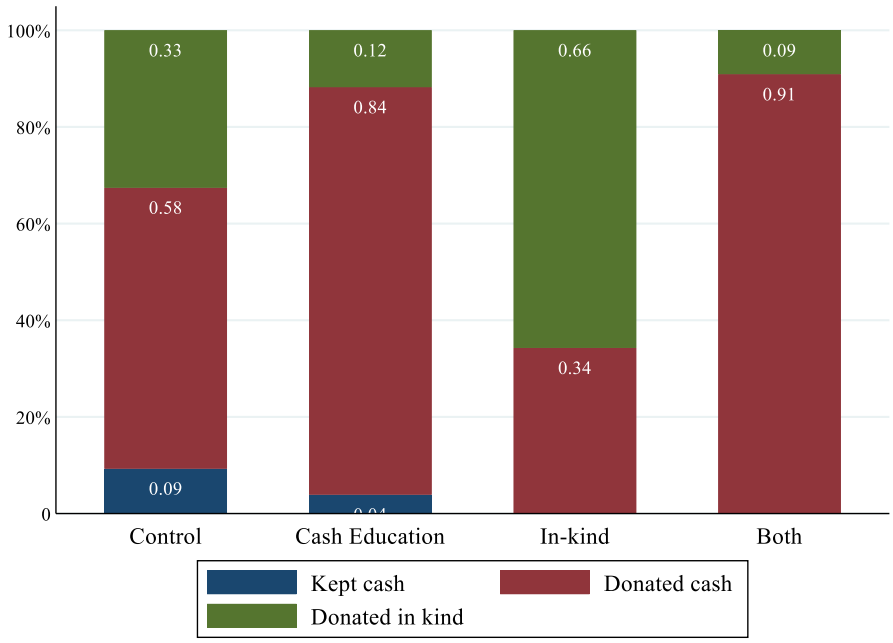
Donation choice:	Keep cash (1)	Donate cash (2)	Keep cash (3)	Donate cash (4)
Treatments				
Cash Education	3.37*	4.58***	3.69*	4.25***
	(2.17)	(2.02)	(2.56)	(1.93)
In-kind	0.56	0.72	0.33*	0.57
	(0.34)	(0.23)	(0.22)	(0.20)
Both	1.27	1.97*	1.40	1.97*
	(0.79)	(0.72)	(0.95)	(0.75)
Controls				
Female			0.12***	0.55**
			(0.07)	(0.16)
Hispanic			1.42	0.89
			(0.95)	(0.35)
White			0.12**	0.49
			(0.10)	(0.34)
Black			0.04**	0.11**
			(0.06)	(0.10)
Asian			0.95	0.94
			(0.99)	(0.78)
Age 18-19			5.99**	1.12
			(5.12)	(0.50)
Age 20-21			4.22*	1.88*
			(3.16)	(0.71)
Constant	0.30***	1.96***	0.98	3.88*
	(0.12)	(0.46)	(1.09)	(3.04)
Observations	353	353	353	353

Notes: Relative risk ratios of choosing the column's outcome relative to donating in-kind are reported. Standard errors in parentheses. */**/** indicate statistical significance at the 10/5/1 percent levels, respectively. Other ethnicity is the omitted race/ethnicity category. Age 22-24 is the omitted age category.

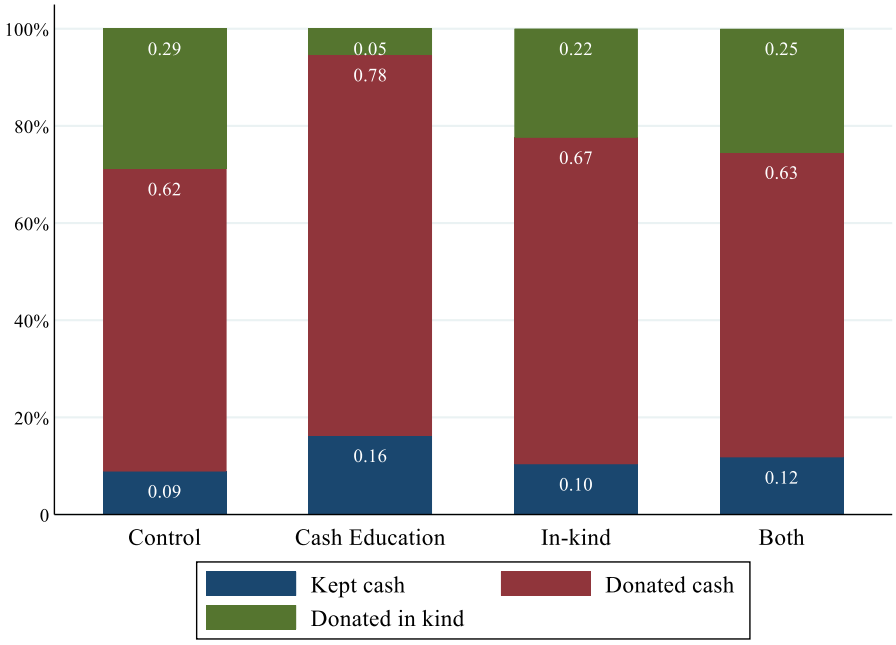
[12] Non-females include 187 subjects who answered the gender question with "male" and 4 who answered with "prefer not to say."

FIGURE 3.3: Percentage of participants making each donation choice, by treatment and gender

Panel A. Female



Panel B. Non-female



The proportion of females and non-females who selected each donation type by treatment are displayed in Panel A and Panel B of Figure 3.3, respectively. One difference is immediately apparent: female subjects had a much larger response to Treatment In-kind than non-female subjects. In response to the article describing the need for various items, female subjects chose to donate in-kind much more often and to donate cash much less often. Relative to control, the percentage of females who chose to donate in-kind rose from 33 percent to 66 percent (a 33 percentage point increase relative to control), and the percentage of females who chose to donate cash fell from 58 percent to 34 percent (a 24 percentage point decrease relative to control). Non-females, meanwhile, had little response to Treatment In-kind. The percentage who chose to donate in-kind actually decreased by 7 percentage points relative to control, and the percentage who chose to donate cash increased by 5 percentage points.

To investigate the differences in treatment effects by gender more carefully, we add interaction terms to equation 1 and estimate the following using a multinomial logistic regression:

$$\ln \frac{\Pr(D_i=d)}{\Pr(D_i=3)} = \alpha_d + \beta_d^1 T_i + \beta_d^2 F_i + \beta_d^3 T_i \times F_i + \beta_d^4 X_i \qquad (2)$$

where $T_i \times F_i$ is a vector of interaction terms between the female indicator and the three treatment indicators, and other variables are as previously defined.

The interpretation of interaction effects in a multinomial logit model is complicated because of the nonlinearity of the function. As Buis (2010) notes, however, this interpretation is clearer if the effects are presented as multiplicative effects, such as relative risk ratios. We follow that guidance here. Table 3.3 presents estimates of equation 1

separately for females and non-females in columns 1-2 and 3-4, respectively, and the estimate of equation 2 using the full sample in columns 5-6.[13]

First, non-female subjects were much more likely to keep their cash endowment instead of donating in-kind in response to Treatment Cash Education relative to control. The RRR for women reported in column 1 is 0.70 and is statistically insignificant, while the RRR for non-females (column 3) is 12.13 – non-female subjects are 12.13 times more likely to choose to keep the money than to donate in-kind in Treatment Cash Education than in control. The difference is statistically significant at the ten percent level, as indicated by the female-Treatment Cash Education interaction term in column 5. The RRR of 0.07 indicates that the effect of Treatment Cash Education on the propensity to keep cash instead of donating in-kind for females is 0.07 times that for non-females.

Treatment In-kind and Treatment Both also have differential effects by gender on the propensity to donate cash relative to the propensity to donate in-kind. Consistent with the raw data, our female subjects become more likely than non-female subjects to donate in-kind in response to Treatment In-kind, and more likely than non-females to donate cash in response to Treatment Both. The estimates in column 2 suggest that female subjects in Treatment In-kind are 0.13 times as likely to donate cash than donate in-kind than female subjects in control, and that female subjects in Treatment Both are 4.78 times more likely to donate cash than donate in-kind than female subjects in control. The estimates for non-female subjects are not statistically significant.

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[13] Estimated marginal effects, which are available by request from the authors, yield results that are consistent with the relative risk ratios.

TABLE 3.3: Effect of treatments on propensity to donate cash instead of donating in-kind, by gender

	Women		Non-women		All	
Donation choice:	Keep cash	Donate cash	Keep cash	Donate cash	Keep cash	Donate cash
	(1)	(2)	(3)	(4)	(5)	(6)
Treatments:						
Cash Education	0.70	2.89*	12.13**	6.15**	11.39**	6.23**
	(0.75)	(1.71)	(12.75)	(5.06)	(11.87)	(5.11)
In-kind	n/a	0.13***	1.41	1.31	1.38	1.33
		(0.08)	(1.17)	(0.67)	(1.14)	(0.66)
Both	n/a	4.78**	2.36	1.21	2.16	1.25
		(3.43)	(1.94)	(0.60)	(1.75)	(0.62)
Gender interactions:						
Female					0.85	0.80
					(0.72)	(0.39)
Female×Cash Ed.					0.07*	0.56
					(0.10)	(0.55)
Female×In-kind					n/a	0.18**
						(0.12)
Female×Both					n/a	4.12*
						(3.53)
Constant	2.51	13.97*	0.23	1.67	0.52	3.82
	(5.86)	(21.21)	(0.31)	(1.59)	(0.62)	(3.18)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	162	162	191	191	353	353

Notes: Relative risk ratios of choosing the column's outcome relative to donating in-kind are reported. Estimates labeled n/a could not be estimated because no female subjects chose to keep the cash endowment in Treatment In-kind and Treatment Both. Standard errors in parentheses. */**/** indicate statistical significance at the 10/5/1 percent levels, respectively.

The differences in these effects between female and non-female subjects are substantial, as indicated by the relative risk ratios on the interaction terms reported in column 6. The RRR of 0.18 on the female-Treatment In-kind interaction term indicates that the effect of Treatment In-kind on the propensity of female subjects to donate cash instead of donating in-kind is 0.18 times that of the effect on non-female subjects; the difference is significant at the five percent level. Female subjects are also more likely than non-female subjects to donate cash in lieu of donating in-kind in response to Treatment Both. The RRR of 4.12 on the female-Treatment Both interaction term indicates that the effect of Treatment Both on the propensity of female subjects to donate cash instead of donating in-kind is 4.12 times that of the effect on non-female subjects.

Mechanisms

Following the experiment, subjects answered three survey questions intended to measure how the treatments influenced their attitudes toward the different donation choices. Each question asked subjects to report the extent to which they agreed with a statement on a five-point Likert scale. The first two statements concerned attitudes toward donating cash. Statement 1 was "I trust that a donation of cash will truly help disaster victims." Statement 2 was "I think donating cash gives organizations the most flexibility to make an impact." The third statement concerned the subject's attitude towards donating in-kind. Statement 3 was "I like knowing what specific item will reach a disaster victim." Most subjects agreed with each statement. Across all treatments, 77 percent somewhat or strongly agreed with statement 1, 86 percent at least somewhat agreed with statement 2, and 69 percent at least somewhat agreed with statement 3.

TABLE 3.4: Effect of treatments on attitudes towards donation types

	Trust that cash helps		Think cash gives flexibility		Like knowing specific item reaches victim	
	Female	Non-female	Female	Non-female	Female	Non-female
	(1)	(2)	(3)	(4)	(5)	(6)
Treatments:						
Cash Education	0.055	0.034	0.043	0.132**	-0.006	0.102
	(0.079)	(0.099)	(0.032)	(0.053)	(0.092)	(0.097)
In-kind	-0.146	-0.062	0.036	-0.008	0.215***	0.024
	(0.104)	(0.097)	(0.030)	(0.071)	(0.078)	(0.097)
Both	-0.080	-0.070	0.025	0.018	0.079	0.064
	(0.100)	(0.099)	(0.033)	(0.068)	(0.093)	(0.093)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	162	191	162	191	162	191

Notes: Probit model estimates of the marginal effect of treatments on the probability that the subject agrees (somewhat or strongly) with the statement. Standard errors in parentheses. */**/** indicate statistical significance at the 10/5/1 percent levels, respectively. Other ethnicity is the omitted race/ethnicity category. Age 22-24 is the omitted age category.

To gauge the extent to which our treatments influenced the propensity to agree with these statements, we estimate the following as a probit model separately by gender:

$$\Pr(A_i^s = 1 \mid C_i) = \Phi(\beta_1 T_i + \beta_2 X_i) \qquad (3)$$

where A_i^s equals 1 if subject i somewhat agrees or strongly agrees with statement s, and equals 0 otherwise; C_i is a vector of variables that includes T_i and X_i; and other variables are as previously defined.

Table 3.4 presents the estimated average marginal effects of each treatment on the probability that a subject agrees with the statement. Two notable effects of the treatments on donation choice that differed by gender are consistent with the survey responses. First, female subjects were much more likely than non-female subjects to be influenced by Treatment In-kind to donate in-kind. The survey responses are consistent with this difference. As shown in column 5, female subjects were 21.5 percentage points more likely to agree that they like knowing a specific item reaches the victim in response to Treatment In-kind relative to control; there was no such effect among non-female subjects.

Second, non-female subjects had a stronger reaction to Treatment Cash Education than female subjects. Non-female subjects were 6.15 times more likely to donate cash instead of donating in-kind in response to Treatment Cash Education. Female subjects were only 2.89 times more likely to donate cash instead of donating in-kind in response to the same treatment. Though this difference is not statistically significant, the measured gap is consistent with the difference in the effect of Treatment Cash Education on the propensity to agree that giving cash gives organizations the most flexibility. Non-females who were exposed to the cash education article were 13.2 percentage points more likely to agree with

the statement relative to control. Female subjects were only 4.3 percentage points more likely, and the estimate is statistically insignificant.

Overall, the responses may help explain some of the starkest differences between the donation choices made by female and non-female subjects in response to treatment. Female subjects in Treatment In-kind were much more likely to donate in-kind relative to control than non-female subjects and were also more likely to agree with the statement that they like knowing what specific good reaches the disaster victim. Non-female subjects were more highly influenced by Treatment Cash Education to donate cash in lieu of donating in-kind and were also more strongly influenced by the same treatment to agree that giving cash gives organizations the most flexibility to make an impact.

However, not all results were consistent. For example, we found a differential impact by gender of Treatment Both on the probability of donating cash relative to donating in-kind, but Treatment Both had no differential impact by gender on the probability of agreeing with any of the survey statements.

Discussion

While our experiment was conducted in the laboratory with university students, our subjects appear to have similar donation preferences as the general public. Among subjects in the control group who did donate (over 90 percent), approximately 66 percent donated cash instead of in-kind. This is similar to survey findings from the U.S. Agency for International Development that of those Americans donating to relief organizations from 2008-2013, 65 percent gave cash donations (USAID, 2013).

The main effects of our treatments on donation choices suggest that the cash education article had a larger effect than the in-kind donations article. Treatment Cash

Education made our subjects 4.25 times more likely to donate cash instead of donating in-kind, while Treatment In-kind only made our subjects 0.57 times as likely to donate cash instead of donating in-kind (and this estimate is statistically insignificant). However, the latter result might be muted because women are underrepresented in the in-kind treatment (.376) compared to the control group (.489). While this difference is insignificant using a two-sided *t* test, our results show a large difference in the effect of Treatment In-kind by gender: female subjects in this treatment were much less likely to donate cash and much more likely to donate in-kind relative to control, but there was no such effect among non-female subjects. Had the proportion of females in the in-kind treatment been consistent with the control group and the overall experiment (46 percent women), we might have observed a higher proportion of in-kind donations within the in-kind treatment and thus a significant effect from the in-kind donation article.

Finally, our results may point to differences in the motivations behind donating between our female and non-female subjects. Gangadharan et al. (2018), later also replicated by Gandullia et al. (2020), examine the role of paternalism in making in-kind versus cash donations. The experimenters find that all types of donors prefer in-kind donations, but pure warm-glow donors are much less likely to give paternalistically (i.e., to give in-kind household or food items), likely because their warm-glow benefit does not depend on whether they donate cash or in-kind; in contrast, paternalistic altruists want to help recipients but also think they know best how money should be spent. The setting of their experiments relates to social poverty and may thus not directly apply in the context of natural or humanitarian disasters. Still, the fact that female subjects were more influenced by Treatment In-kind to donate in-kind than non-female subjects may suggest

that women in our experiment tend to be impure altruists in the sense of Andreoni (1989,1990), while men may be more motivated by warm-glow.

CONCLUSION

We study the impact of media articles designed to educate potential donors on the benefits of cash donations and the dangers of material convergence and the impact of media articles that explicitly reference local in-kind donation drives. Given the regularly documented logistical challenges associated with disaster material convergence, we aimed to identify the effect of cash education on a donor's decision to donate cash versus in-kind, as well as the effect of existing media patterns (e.g., listings for in-kind donation drives). Although our setting is a laboratory experiment, our setting is as natural and realistic as possible. We gave subjects the chance to donate to victims of a real disaster event, and used actual articles tied to the event that discuss the benefits of donating cash and the problems with donating goods or discuss donation drives for specific goods in the area where the experiment was conducted.

We find evidence that the cash education article is effective in promoting a change to cash donations and away from in-kind donations. The findings support the contention of Holguín-Veras et al. (2022) that if trusted organizations provide educational articles regarding the impact of material convergence, such articles can have an impact. Specifically, our primary finding shows that subjects who viewed a cash education article after a neutral article were over four times more likely to donate cash versus in-kind compared to subjects who only viewed a neutral article about the disaster event. This effect diminished to approximately two times as likely when subjects also viewed an article about a local in-kind donation drive. When subjects viewed only the neutral article, and the in-

kind donations article, the effect on the choice to donate cash instead of in-kind was negative but insignificant. However, female subjects were underrepresented in this treatment, and we do find a strong increase in the propensity to donate in-kind in response to the in-kind donations article among female subjects.

Our study has several limitations. Given the relatively high percentage of subjects choosing to donate (91-94% across each treatment), there exists the possibility of an experimenter demand effect on a subject's decision to donate or keep the endowment. However, the impact of such a demand effect is mitigated, given that our experimental objective centers around measuring shifts between in-kind and monetary donations rather than between donors and non-donors (Zizzo, 2010). If subjects did feel pressure to donate rather than keep the money for themselves, such pressure would be felt evenly across each treatment and therefore not impact the estimated effect from the cash education and in-kind donations article. There is also evidence that subjects in both lab and field settings donate differently with windfall endowments compared to earned income (Carlsson et al., 2013). Again, although similar behavior in our experiment might have impacted the proportion of subjects choosing to keep the money, such an impact would be consistent across treatments and not impact the core experimental objectives.

Another limitation is the exogenous assignment of information that subjects view. In real life, individuals endogenously select what information to gather or what media articles to read. Additionally, the real-world material convergence problem is impacted by both items explicitly purchased for donation and those already owned by donors. This experiment only explores the donation of goods purchased for donation (rather than goods donors may already have in their possession). Future research can build on the ecological

validity of this research by identifying methods for shifting the giving of used in-kind goods to cash donations.

Finally, the specific effects from our experiment are likely dependent on the real-world articles and disaster event we selected. A possible direction for future work would be to examine the effect of similar articles on different types of disasters (i.e., a local natural disaster, which could prompt additional in-kind donations). Future research could also examine the effect of different types of cash education. The article we chose was written specifically for the war in Ukraine; it would be worthwhile to explore the impact of such a specific article compared to other, more general forms of cash education.

Our findings have practical relevance for practitioners. In particular, disaster relief organizations and charities can reduce material convergence and effectively shift a substantial portion of their donations from in-kind to cash, without lowering overall donation quantities, by educating donors on the benefits of cash and the challenges of in-kind donations. Media outlets can also positively influence donation outcomes by educating potential donors on the benefits of cash donations in articles referencing post-disaster giving. Even when this education is viewed in addition to articles advertising local in-kind donation drives, it may still create a significant shift from in-kind to cash, helping to lessen problems stemming from material convergence.

APPENDIX C: Experiment instructions and procedures

We are inviting you to participate in this survey. **You must be at least 18 years old and located in the United States to participate.**

This survey is for a **research project** and will ask you to answer some questions about a humanitarian
disaster. The Principal Investigator (PI) of the research project is Associate Professor Effie Stavrulaki, Management Department, Bentley University.

Your answers are confidential and anonymous. You will not have to disclose any personal information (e.g., email), but we will ask you to anonymously enter some basic demographic information (e.g., your gender).

By participating in this project, you will contribute to the generation of knowledge regarding donation decisions. If you choose to participate, you will receive $1.00 in an envelope and additional cash depending on your decisions. We will use your assigned survey ID to provide you with an envelope with a cash amount equivalent to your chosen amount (*up to* $6).

The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify any subject. Research records will be stored securely and only the researchers identified above will have access to the records. The data will solely be used to discover general trends and themes across all participants for education or research purposes only. The data will be retained in a secure server for 5 years, beyond which point they will be erased.

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with Bentley University. If you decide to participate, you are free to refuse to answer any question. You may also withdraw at any time without affecting those relationships.

The survey will take about between 5 to 10 minutes of your time.

You may only take this survey once. Repeat submissions will not receive compensation.

You may ask any questions you have now, or if you have questions later, you can contact us at estavrulaki@bentley.edu. If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), you are encouraged to contact Susan Richman, Bentley's IRB Chair, Bentley University, 175 Forest Street, Waltham, Massachusetts 02452, or srichman@bentley.edu or 781.891.2660.

Thank you.

Do you agree to participate in this study?

- ○ Yes
- ○ No

→

Please **write down the following code** to ensure you will receive participation payment.

Remember, your **responses are fully anonymous**. This code is only so you can receive payment.

Your unique code is: **13756**

→

C.1. Neutral article read first by all subjects:

A major humanitarian crisis is ongoing in Ukraine as a result of the recent Russian invasion. You may have seen or heard stories about it in the news recently. As part of this survey, you will be given an opportunity to help some of the people and communities affected.

Please read the following news article about the ongoing Russian Invasion of Ukraine:

U.S. officials: Russian escalation in Ukraine could lead to humanitarian crisis

By Erin Banco, Betsy Woodruff Swan and Sarah-Taïssir Bencharif
Published February 28, 2022

Refugees from Ukraine arrive at a temporary shelter on Feb. 28 near Korczowa, Poland. | Sean Gallup/Getty Images

The massing of Ukrainians at the Polish border is leading to urgent conversations among officials at the State Department and USAID about the need to quickly increase assistance to European countries accepting refugees, according to two senior Biden administration officials with direct knowledge of the situation.

Over the last several days, as many as 520,000 people have fled Ukraine, according to the United Nations, with the majority crossing to Poland and Moldova. The backup at the Polish border, where cars with fleeing Ukrainians are sitting idle, ranges from one to three days, the U.S. officials said — raising fears about Ukrainians' physical safety, and access to food, water, and medical support.

Did you read the article?

- ◯ Yes
- ◯ No

What type of event did the article discuss?

- ◯ Sporting event
- ◯ Hurricane
- ◯ Stock market news
- ◯ War in Ukraine

C.2 Treatment Cash Education

Subjects read the neutral article above and answer the attention check questions first, then see the following test and article:

In a moment, we'll be giving you an additional $6.00 (you will also receive $1.00 for your participation). You'll then have the opportunity to choose to either keep this money or use it in several different ways to help aid communities that have been affected by the war in Ukraine.

Before you make that decision, please read one more article about donations to help in Ukraine:

Please read the following article about donations to help in Ukraine:

Ukraine crisis: why you should donate money rather than supplies

By Sarah Schiffling And Wojciech D. Piotrowicz
Published March 3, 2022

Donations: Polish aid agencies are being overwhelmed by generous donations of food, water and clothing for Ukrainian refugees. REUTERS/Kacper Pempel

The humanitarian crisis in Ukraine and its effect on neighbouring countries has inspired people to collect donations. But these well-meaning efforts can cause headaches for those helping locally. In aid circles, the mantra has long been "cash is best".

According to the United Nations Human Rights Council, over 1 million refugees have arrived in neighbouring countries since the invasion began. To help people fleeing war, collections of donations have started in community centres in Liverpool, UK, ice hockey fan clubs in Mannheim, Germany, and many other places. Food, clothing, painkillers, blankets, toothpaste and other items are being collected in vast amounts.

Wojciech Piotrowicz is in Warsaw applying his research in humanitarian logistics. Shown media coverage of donations piling up in other countries, his immediate reaction was: "Terrible. In a worst-case scenario, we need to think of how to recycle this, there aren't even enough people to sort it all."

There are a few considerations worth thinking about before sending items rather than donating money.

1. What is needed?

With huge solidarity in Poland, the supply of donated items at the border far outstrips demand. There are so many items, they now have to be moved away from the border so as not to block the area. If anything is missing, it can be bought locally without adding the cost of international transport.

2. How will items be transported?

Anyone considering sending items should know who they are being sent to and who takes care of any required customs clearances and covers associated costs. Items should be expected at their destination with plans of how and where they will be handled. Send what is really needed, not what you think is needed.

3. How will items be stored and distributed?

The amount of donations in Poland has been so large that areas close to the border are running out of warehouse space before most international donations have arrived. Insufficient or inappropriate storage facilities can result in goods going to waste. Many images currently circulating show vast amounts of clothes laid out on the ground or in cardboard boxes at reception points at the Polish-Ukrainian border. Rainfall will quickly turn those donations into piles of rubbish.

4. What happens to unused items?

Needs in a humanitarian response shift constantly. Items that were desperately needed days ago are quickly available in abundance if donations are uncoordinated. Flexibility is important. While cash donations can be used flexibly, donated goods are fixed. Not all of them will be used.

Balancing cash and goods

In many humanitarian responses, 60% of donations end up in landfills. It is cheaper and more environmentally friendly to use items that are available locally rather than ship them around the world. It is also more likely to meet the actual and current needs.

Monetary donations remain the most efficient way to help.

[The article above was reduced from its original published version].

What did the previous article discuss?

- ○ Entertainment news
- ○ Climate change
- ○ Animal rescues
- ○ Cash donations

→

C.3 Treatment In-kind

Subjects read the neutral article above and answer the attention check questions first, then see the following test and article:

In a moment, we'll be giving you an additional $6.00 (you will also receive $1.00 for your participation). You'll then have the opportunity to choose to either keep this money or use it in several different ways to help aid communities that have been affected by the war in Ukraine.

Before you make that decision, please read one more article about donations to help in Ukraine:

Here's a list of Massachusetts residents and companies aiding Ukraine

By Diti Kohli
Updated March 3, 2022, 10:15 a.m.

While Russia's invasion of Ukraine continues amid an international outcry, Massachusetts residents have stepped up to aid Eastern Europeans threatened by the war.

Over 1 million people have sought refuge, according to United Nations estimates. Thousands of others have endured cold temperatures without water or electricity. In the midst of the crisis, many worthy groups are pooling funds and food, including Razom for Ukraine and Greater Boston Ukrainian churches.

Here are some locals (and companies) who have taken the lead:

Katya Malakhova

For days, donors stuffed Katya Malakhova's Newton home with cardboard boxes and trash bags.

The Newton resident was collecting medical supplies to send to the war-torn country — everything from bandages, gauze, tampons, soap, and latex gloves.

Donated medical supplies rested at the home of Katya Malakhova in Newton.CRAIG F. WALKER/GLOBE STAFF

"I'm touched, but the American public has been very generous when there's a crisis in the world," Malakhova told WBZ.

Yuliya Pokhylko

This week, Yuliya Pokhylko partnered with over 70 volunteers to create Ukraine Forward (ukraineforward.org). The activist group is gathering donations of items compiled on an Amazon wishlist and a separate online list of less conventional supplies — think walkie-talkies, tourniquets, intubation tubes, and tactical vests.

Sami Amr organized donated medical supplies at his home in Newton. Craig F. Walker/Globe Staff

Donors can ship the provisions to the Christ the King Ukrainian Catholic Church in Jamaica Plain, where Ukraine Forward packages the boxes. The haul is then taken to New Jersey in personal or U-Haul trucks and shipped to Poland via a Ukrainian logistics company, Meest.

To date, the group has raised at least $16,000 in money and supplies.

"The support is overwhelming," Pokhylko said. "And I'm grateful to see a number of organizations helping. There's no competition between us."

Pokhylko, 31, immigrated from Ukraine in 2017, but her mother, grandfather, in-laws, and friends have remained in the country.

[The article above was reduced from its original published version].

What was the previous article about?

- ○ Entertainment news
- ○ Donations to charity
- ○ Home repairs
- ○ Business closures

→

C.4 Treatment Both

Subjects are presented the text, articles, and attention check questions seen in sections A.1 through A.3.

C.5 Donation decision screen seen by all subjects

As part of this study, we are giving you $6. This is in addition to your $1 participation fee. You have the option to:

(1) donate it as cash to the International Committee of the Red Cross charity for their Ukraine crisis fund, or

(2) use it to buy one of the items listed below for victims of the Ukraine crisis. These are each items selected from a specific charity's wishlist.

(3) keep this money for yourself,

If you choose (1) we WILL donate $6 to the charity, and if you choose (2) we WILL send the item to a real charity collecting items to send to Ukraine.

What would you like to do with your $6?

- ○ Donate $6 to the International Committee of the Red Cross charity for their Ukraine crisis fund.
- ○ Use the full amount to purchase a 10-pack of AA batteries (a $6 value). It will be sent to Christ the King Ukrainian Catholic Church in Boston, a nonprofit organization currently holding a donation drive for Ukraine humanitarian aid.
- ○ Use the full amount to purchase a first aid kit (a $6 value). It will be sent to Christ the King Ukrainian Catholic Church in Boston, a nonprofit organization currently holding a donation drive for Ukraine humanitarian aid.
- ○ Do not donate; keep your $6. It will be paid to you as part of your earnings for participating in this study.

→

C.6 Survey questions

Please answer the following questions about your donation decision:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1) I trust that a donation of cash will truly help disaster victims	○	○	○	○	○
2) I think donating cash gives organizations the most flexibility to make an impact when helping disaster victims	○	○	○	○	○
3) I like knowing what specific item will reach a disaster victim	○	○	○	○	○

→

Please answer a few final demographic questions:

Make sure to click the arrow at the end to submit your survey!

What gender do you identify as?

- ○ Male
- ○ Female
- ○ Non-binary / third gender
- ○ Prefer not to say

What is your age?

- ○ Under 18
- ○ 18 - 19
- ○ 20 - 21
- ○ 22-24
- ○ 25 - 34
- ○ 35 - 44
- ○ 45 - 54
- ○ 55 - 64
- ○ 65 - 74
- ○ 75 - 84
- ○ 85 or older

Are you of Hispanic/Latino/Spanish origin

- ○ Yes
- ○ No

How would you best describe yourself?

- White / Caucasian
- Black or African American
- American Indian or Alaska Native
- Asian
- Native Hawaiian or Pacific Islander
- Other

What is your region of origin?

- North America
- Latin America and Caribbean
- Western Europe
- Central Europe
- Eastern Europe
- Middle East and North Africa
- Sub-Saharan Africa
- East Asia and Pacific
- South Asia
- Oceania

→

We thank you for your time spent taking this survey.
Your response has been recorded.

APPENDIX D: Analysis including subjects who failed attention checks and who did not answer demographic questions in the sample

TABLE D.1: Effects of media articles on donation choice
(Subjects who failed attention checks and did not answer demographic questions included)

Donation choice:	Keep cash (1)	Donate cash (2)	Keep cash (3)	Donate cash (4)
Treatments				
Cash Education	2.64	3.52***	2.94	3.64***
	(1.62)	(1.39)	(1.96)	(1.52)
In-kind	0.60	0.73	0.35	0.62
	(0.36)	(0.23)	(0.23)	(0.21)
Both	1.21	1.60	1.21	1.55
	(0.71)	(0.54)	(0.77)	(0.55)
Controls				
Female			0.15***	0.60*
			(0.08)	(0.16)
Hispanic			1.34	0.87
			(0.87)	(0.32)
White			0.16**	0.64
			(0.12)	(0.39)
Black			0.06**	0.14**
			(0.07)	(0.11)
Asian			1.28	1.09
			(1.23)	(0.81)
Age 18-19			5.75**	1.08
			(4.83)	(0.47)
Age 20-21			3.66*	1.61
			(2.67)	(0.57)
Constant	0.28***	1.97***	0.72	3.17
	(0.11)	(0.45)	(0.76)	(2.24)
Observations	377	377	374	374

Notes: Relative risk ratios of choosing the column's outcome relative to donating in-kind are reported. Standard errors in parentheses. */**/** indicate statistical significance at the 10/5/1 percent levels, respectively. Other ethnicity is the omitted race/ethnicity category. Age 22-24 is the omitted age category.

Table D.2: Effect of treatments on propensity to donate cash instead of donating in-kind, by gender (Subjects who failed attention checks included)

	Women		Non-women		All	
Donation choice:	Keep cash	Donate cash	Keep cash	Donate cash	Keep cash	Donate cash
	(1)	(2)	(3)	(4)	(5)	(6)
Treatments:						
Cash Education	0.50	2.60*	7.89**	4.20**	7.48**	4.33**
	(0.54)	(1.46)	(7.53)	(2.96)	(7.11)	(3.04)
In-kind	n/a	0.15***	1.43	1.33	1.43	1.46
		(0.08)	(1.17)	(0.66)	(1.16)	(0.70)
Both	0.55	2.80*	1.81	1.04	1.66	1.07
	(0.74)	(1.71)	(1.43)	(0.49)	(1.32)	(0.50)
Gender interactions:						
Female					0.85	0.85
					(0.71)	(0.40)
Female×Cash Ed.					0.09*	0.74
					(0.13)	(0.65)
Female×In-kind					n/a	0.16***
						(0.11)
Female×Both					0.42	2.90
					(0.62)	(2.17)
Constant	3.79	22.98**	0.23	1.67	0.40	3.08
	(8.71)	(34.18)	(0.31)	(1.59)	(0.46)	(2.31)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	175	175	199	199	374	374

Notes: Relative risk ratios of choosing the column's outcome relative to donating in-kind are reported. Estimates labeled n/a could not be estimated because no female subjects chose to keep the cash endowment in Treatment In-kind. Standard errors in parentheses. */**/** indicate statistical significance at the 10/5/1 percent levels, respectively.

TABLE D.3: Effect of treatments on attitudes towards donation types
(Subjects who failed attention checks included)

	Trust that cash helps		Think cash gives flexibility		Like knowing specific item reaches victim	
	Female	Non-female	Female	Non-female	Female	Non-female
	(1)	(2)	(3)	(4)	(5)	(6)
Treatments:						
Cash Education	0.082	0.002	0.051	0.106*	-0.031	0.107
	(0.077)	(0.102)	(0.039)	(0.061)	(0.090)	(0.094)
In-kind	-0.084	-0.087	0.046	-0.021	0.212***	0.040
	(0.098)	(0.098)	(0.036)	(0.074)	(0.076)	(0.094)
Both	-0.039	-0.079	0.017	0.000	0.108	0.068
	(0.092)	(0.097)	(0.042)	(0.071)	(0.086)	(0.089)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	175	199	175	199	175	199

Notes: Probit model estimates of the marginal effect of treatments on the probability that the subject agrees (somewhat or strongly) with the statement. Standard errors in parentheses. */**/** indicate statistical significance at the 10/5/1 percent levels, respectively. Other ethnicity is the omitted race/ethnicity category. Age 22-24 is the omitted age category.

REFERENCES

Abazari, S. R., Jolai, F., & Aghsami, A. (2022). Designing a humanitarian relief network considering governmental and non-governmental operations under uncertainty. *International Journal of System Assurance Engineering and Management, 13*(3), 1430-1452. https://doi.org/10.1007/s13198-021-01488-y

Abidi, H., De Leeuw, S., & Klumpp, M. (2014). Humanitarian supply chain performance management: a systematic literature review. *Supply Chain Management, 19*(5/6), 592-608. https://doi.org/10.1108/SCM-09-2013-0349

Acimovic, J., & Goentzel, J. (2016). Models and metrics to assess humanitarian response capacity. *Journal of Operations Management, 45*, 11-29. https://doi.org/10.1016/j.jom.2016.05.003.

Aeppel, T. (2021). COVID creates shortages of an array of U.S. medical supplies. *Reuters*. https://www.reuters.com/world/the-great-reboot/covid-creates-shortages-an-array-us-medical-supplies-2021-09-20/

Agarwal, S., Kant, R., & Shankar, R. (2021). Modeling the enablers of humanitarian supply chain management: a hybrid group decision-making approach. *Benchmarking: An international journal, 28*(1), 166-204. https://doi.org/10.1108/BIJ-03-2020-0093

Altay, N., Kovács, G., & Spens, K. (2021). The evolution of humanitarian logistics as a discipline through a crystal ball. *Journal of Humanitarian Logistics and Supply Chain Management, 11*(4), 577-584. https://doi.org/10.1108/JHLSCM-06-2021-0056

Altay, N., & Ramirez, A. (2010). Impact of disasters on firms in different sectors: implications for supply chains. *Journal of Supply Chain Management, 46*(4), 59-80. https://doi.org/10.1111/j.1745-493X.2010.03206.x

Andreoni, J. (1989). Giving With Impure Altruism: Applications to Charity and Ricardian Equivalence. *Journal of Political Economy, 97*, 1447-1458. https://doi.org/10.1086/261662

Andreoni, J. (1990). Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving. *The Economic Journal, 100*(401), 464. https://doi.org/10.2307/2234133

Apte, A., & Heath, S. (2011). Request and Response Processes for Department of Defense Support during Domestic Disasters. *Journal of Homeland Security and Emergency Management, 8*(1), 1824. https://doi.org/10.2202/1547-7355.1824

Arshinder, A. K., & Deshmukh, S. G. (2008). Supply chain coordination: perspectives, empirical studies and research directions. *International Journal of Production Economics, 115*(2), 316-335. https://doi.org/10.1016/j.ijpe.2008.05.011

Baffoe, B. O. K., & Luo, W. (2020). Humanitarian Relief Sustainability: A Framework of Humanitarian Logistics Digital Business Ecosystem. *Transportation Research Procedia, 48*, 363-387. https://doi.org/10.1016/j.trpro.2020.08.032

Balcik, B., Beamon, B. M., Krejci, C. C., Muramatsu, K. M., & Ramirez, M. (2010). Coordination in humanitarian relief chains: Practices, challenges and opportunities. *International Journal of Production Economics, 126*(1), 22-34. https://doi.org/10.1016/j.ijpe.2009.09.008

Banomyong, R., Varadejsatitwong, P., & Oloruntoba, R. (2019). A systematic review of humanitarian operations, humanitarian logistics and humanitarian supply chain performance literature 2005 to 2016. *Annals of Operations Research, 283*(1-2), 71-86. https://doi.org/10.1007/s10479-017-2549-5

Bansal, P., Smith, W. K., & Vaara, E. (2018). New Ways of Seeing through Qualitative Research. *Academy of Management Journal, 61*(4), 1189-1195. https://doi.org/10.5465/amj.2018.4004

Bealt, J., & Mansouri, S. A. (2018). From disaster to development: a systematic review of community-driven humanitarian logistics. *Disasters, 42*(1), 124-148. https://doi.org/10.1111/disa.12232

Bergdoll, J., Clark, C., Xiaonan, K., Osili, U., Coffman, S., Kumar, S., Saronson, B., Sato, G., Davis-Jones, M., Entcheva, R., Gulliver-Garcia, T., & Webster, R. (2019). *US Household Disaster Giving in 2017 and 2018*. https://hdl.handle.net/1805/19403

Brusset, X., & Teller, C. (2017). Supply chain capabilities, risks, and resilience. *International Journal of Production Economics, 184*, 59-68. https://doi.org/10.1016/j.ijpe.2016.09.008

Buell, R. W., Porter, E., & Norton, M. I. (2021). Surfacing the submerged state: Operational transparency increases trust in and engagement with government. *Manufacturing & Service Operations Management, 23*(4), 781-802. https://doi.org/10.1287/msom.2020.0877

Buis, M. L. (2010). Stata tip 87: Interpretation of interactions in nonlinear models. *The Stata Journal, 10*(2), 305-308.

Burel, G. (2019, December 25, 2019). Looking Ahead – Future of the Strategic National Stockpile. *Domestic Preparedness*. https://www.domesticpreparedness.com/healthcare/looking-ahead-future-of-the-strategic-national-stockpile/

Cao, M., Vonderembse, M. A., Zhang, Q., & Ragu-Nathan, T. (2010). Supply chain collaboration: conceptualisation and instrument development. *International Journal of Production Research, 48*(22), 6613-6635. https://doi.org/10.1080/00207540903349039

Carlsson, F., He, H., & Martinsson, P. (2013). Easy come, easy go: The role of windfall money in lab and field experiments. *Experimental Economics, 16,* 190-207. https://doi.org/10.1007/s10683-012-9326-8

Çelik, M., Ergun, Ö., Johnson, B., Keskinocak, P., Lorca, Á., Pekgün, P., & Swann, J. (2012). Humanitarian logistics. In *New Directions in Informatics, Optimization, Logistics, and Production* (pp. 18-49). INFORMS. https://doi.org/https://doi.org/10.1287/educ.1120.0100

Chari, F., Ngcamu, B. S., & Novukela, C. (2021). Supply chain risks in humanitarian relief operations: a case of Cyclone Idai relief efforts in Zimbabwe [Supply chain risks in humanitarian relief]. *Journal of Humanitarian Logistics and Supply Chain Management, 11*(1), 29-45. https://doi.org/10.1108/JHLSCM-12-2019-0080

Christopher, M., & Peck, H. (2004). Building the resilient supply chain. *The International Journal of Logistics Management, 15*(2), 1-14. https://doi.org/10.1108/09574090410700275

Coronese, M., Lamperti, F., Keller, K., Chiaromonte, F., & Roventini, A. (2019). Evidence for sharp increase in the economic damages of extreme natural disasters. *Proceedings of the National Academy of Sciences, 116*(43), 21450-21455. https://doi.org/10.1073/pnas.1907826116

Creswell, J. W. (2013). *Qualitative Inquiry and Research Design: Choosing among Five Approaches* (3 ed.). Sage.

Croson, R., & Gneezy, U. (2009). Gender Differences in Preferences. *Journal of Economic Literature, 47*(2), 448-474. https://doi.org/10.1257/jel.47.2.448

Damgaard, M. T., & Gravert, C. (2017). Now or never! The effect of deadlines on charitable giving: Evidence from two natural field experiments. *Journal of Behavioral and Experimental Economics, 66,* 78-87. https://doi.org/10.1016/j.socec.2016.04.013

Damoah, I. S. (2022). Exploring critical success factors (CSFs) of humanitarian supply chain management (HSCM) in flood disaster management (FDM). *Journal of Humanitarian Logistics and Supply Chain Management, 12*(1), 129-153. https://doi.org/10.1108/JHLSCM-01-2021-0003

Denk, N., Kaufmann, L., & Carter, C. R. (2012). Increasing the rigor of grounded theory research – a review of the SCM literature. *International Journal of Physical Distribution & Logistics Management, 42*(8/9), 742-763. https://doi.org/10.1108/09600031211269730

Destro, L., & Holguín-Veras, J. (2011). Material Convergence and Its Determinants. *Transportation Research Record: Journal of the Transportation Research Board, 2234*(1), 14-21. https://doi.org/10.3141/2234-02

Diamond, D. (2022a). Government watchdog says HHS is at 'high risk' of botching a future crisis. *Washington Post*. https://www.washingtonpost.com/health/2022/01/27/gao-hhs-mismanaged-pandemic-response/

Diamond, D. (2022b). Officials reorganize HHS to boost pandemic response. *The Washington Post*. https://www.washingtonpost.com/health/2022/07/20/biden-administration-aspr-independent-division/

Dube, N., & Broekhuis, M. (2018). Humanitarian Logistics at a Crossroads: How Logisticians Reconcile Their Professional and Humanitarian Identities in Response to Tougher Host Government Regulations. *Risks, Hazards & Crisis in Public Policy*, *9*(2), 151-182. https://doi.org/10.1002/rhc3.12134

Dube, N., Van der Vaart, T., Teunter, R. H., & Wassenhove, L. N. V. (2016). Host government impact on the logistics performance of international humanitarian organisations. *Journal of Operations Management*, *47-48*(1), 44-57. https://doi.org/10.1016/j.jom.2016.05.011

Dubey, R., Gunasekaran, A., Childe, S. J., Roubaud, D., Wamba, S. F., Giannakis, M., & Foropon, C. (2019). Big data analytics and organizational culture as complements to swift trust and collaborative performance in the humanitarian supply chain. *International Journal of Production Economics*, *210*, 120-136. https://doi.org/10.1016/j.ijpe.2019.01.023

Duong, L. N. K., & Chong, J. (2020). Supply chain collaboration in the presence of disruptions: a literature review. *International Journal of Production Research*, *58*(11), 3488-3507. https://doi.org/10.1080/00207543.2020.1712491

Eckel, C. C., & Grossman, P. J. (2003). Rebate versus matching: does how we subsidize charitable contributions matter? *Journal of Public Economics*, *87*(3-4), 681-701. https://doi.org/10.1016/S0047-2727(01)00094-9

Eckel, C. C., Grossman, P. J., & Johnston, R. M. (2005). An experimental test of the crowding out hypothesis. *Journal of Public Economics*, *89*(8), 1543-1560. https://doi.org/10.1016/j.jpubeco.2004.05.012

Edwards, J. T., & List, J. A. (2014). Toward an understanding of why suggestions work in charitable fundraising: Theory and evidence from a natural field experiment. *Journal of Public Economics*, *114*, 1-13. https://doi.org/10.1016/j.jpubeco.2014.02.002

Farahani, R. Z., Lotfi, M. M., Baghaian, A., Ruiz, R., & Rezapour, S. (2020). Mass casualty management in disaster scene: A systematic review of OR&MS research in humanitarian operations. *European Journal of Operational Research*, *287*(3), 787-819. https://doi.org/10.1016/j.ejor.2020.03.005

Fathalikhani, S., Hafezalkotob, A., & Soltani, R. (2020). Government intervention on cooperation, competition, and coopetition of humanitarian supply chains. *Socio-Economic Planning Sciences, 69*, 100715. https://doi.org/10.1016/j.seps.2019.05.006

Finkenstadt, D. J., Handfield, R., & Guinto, P. (2021). Why the U.S. still has a severe shortage of medical supplies. *Harvard Business Review*. Retrieved 6 December 2021, from https://hbr.org/2020/09/why-the-u-s-still-has-a-severe-shortage-of-medical-supplies

Foerster, J. (2021). While Frequency Of Natural Disasters Is Increasing, Related Death Tolls Are Actually Decreasing. *Forbes*. https://www.forbes.com/sites/jimfoerster/2021/10/01/while-frequency-of-natural-disasters-increasing-related-death-tolls-are-actually-decreasing/?sh=3f664b001b18

Fritz, C. E., & Mathewson, J. H. (1957). *Convergence behavior in disasters; a problem in social control*. National Academy of Sciences-National Research Councel.

Gabler, C. B., Richey Jr, R. G., & Stewart, G. T. (2017). Disaster resilience through public–private short-term collaboration. *Journal of Business Logistics, 38*(2), 130-144. https://doi.org/10.1111/jbl.12152

Gandullia, L., Lezzi, E., & Parciasepe, P. (2020). Replication with MTurk of the experimental design by Gangadharan, Grossman, Jones & Leister (2018): Charitable giving across donor types. *Journal of Economic Psychology, 78*, 102268. https://doi.org/10.1016/j.joep.2020.102268

Gangadharan, L., Grossman, P. J., Jones, K., & Leister, C. M. (2018). Paternalistic giving: Restricting recipient choice. *Journal of Economic Behavior & Organization, 151*, 143-170. https://doi.org/10.1016/j.jebo.2018.03.007

Ghazali, D. A., Guericolas, M., Thys, F., Sarasin, F., Arcos González, P., & Casalino, E. (2018). Climate Change Impacts on Disaster and Emergency Medicine Focusing on Mitigation Disruptive Effects: an International Perspective. *International Journal of Environmental Research and Public Health, 15*(7), 1379. https://doi.org/10.3390/ijerph15071379

Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational research methods, 16*(1), 15-31. https://doi.org/10.1177/1094428112452151

Glaser, B. G. (1978). *Theoretical sensitivity: Advances in the methodology of grounded theory*. Sociology Press.

Goldschmidt, K. H., & Kumar, S. (2016). Humanitarian operations and crisis/disaster management: A retrospective review of the literature and framework for

development. *International Journal of Disaster Risk Reduction, 20*, 1-13. https://doi.org/10.1016/j.ijdrr.2016.10.001

Grange, R., Heaslip, G., & McMullan, C. (2020). Coordination to choreography: the evolution of humanitarian supply chains. *Journal of Humanitarian Logistics and Supply Chain Management, 10*(1), 21-44. https://doi.org/10.1108/JHLSCM-12-2018-0077

Hanfield, R., Finkenstadt, D. J., Schneller, E. S., Godfrey, A. B., & Guinto, P. (2020). A Commons for a Supply Chain in the Post-COVID-19 Era: The Case for a Reformed Strategic National Stockpile. *The Milbank Quarterly, 98*(4), 1058-1090. https://doi.org/10.1111/1468-0009.12485

Hapeman, K. (2012). The effects of politics on natural disasters: Lessons learned from Bangladesh. *Case Specific Briefing Paper Humanitarian Aid in Complex Emergencies; University of Denver: Denver, CO, USA*.

Heaslip, G., & Barber, E. (2014). Using the military in disaster relief: systemising challenges and opportunities. *Journal of Humanitarian Logistics and Supply Chain Management, 4*(1), 60-81. https://doi.org/10.1108/JHLSCM-06-2021-0056

Heaslip, G., & Kovács, G. (2019). Examination of service triads in humanitarian logistics [Service triads in humanitarian logistics]. *International Journal of Logistics Management, 30*(2), 595-619. https://doi.org/10.1108/IJLM-09-2017-0221

Heider, F. (2013). *The psychology of interpersonal relations*. Psychology Press. https://doi.org/https://doi.org/10.1037/10628-000

Hernández Gress, E. S., Hernández-Gress, N., & Contla, K. S. (2021). Methodology for Designing Humanitarian Supply Chains: Distribution of COVID-19 Vaccines in Mexico. *Administrative Sciences, 11*(4), 134. https://doi.org/10.3390/admsci11040134

HHS. (2022). *Public Health Supply Chain and Industrial Base One-Year Report*. https://aspr.hhs.gov/MCM/IBx/2022Report/Pages/default.aspx

HHS ASPR. (2022a). *Mission and Key Priorities*. Retrieved December 7, 2021 from https://aspr.hhs.gov/AboutASPR/WorkingwithASPR/BoardsandCommittees/Pages/Mission-and-Key-Priorities.aspx

HHS ASPR. (2022b). *Strategic National Stockpile*. Retrieved November 28, 2022 from https://aspr.hhs.gov/AboutASPR/WorkingwithASPR/BoardsandCommittees/Pages/Mission-and-Key-Priorities.aspx

Holguín-Veras, J., Encarnación, T., Van Wassenhove, L. N., Pokharel, S., Cantillo, V., Amaya, J., Wachtendorf, T., & Rilling, J. (2022). Reducing material convergence in disaster environments: The potential of trusted change agents. *Transportation*

research part E: logistics and transportation review, 162, 102736. https://doi.org/10.1016/j.tre.2022.102736

Holguín-Veras, J., Jaller, M., Van Wassenhove, L. N., Pérez, N., & Wachtendorf, T. (2012). On the unique features of post-disaster humanitarian logistics. *Journal of Operations Management, 30*(7), 494-506. https://doi.org/10.1016/j.jom.2012.08.003

Holguín-Veras, J., Jaller, M., Wassenhove, L. N. V., Pérez, N., & Wachtendorf, T. (2014). Material Convergence: Important and Understudied Disaster Phenomenon. *Natural Hazards Review, 15*(1), 1-12. https://doi.org/10.1061/(ASCE)NH.1527-6996.0000113

Huber, M., Van Boven, L., McGraw, A. P., & Johnson-Graham, L. (2011). Whom to help? Immediacy bias in judgments and decisions about humanitarian aid. *Organizational Behavior and Human Decision Processes, 115*(2), 283-293. https://doi.org/10.1016/j.obhdp.2011.03.003

Jahre, M. (2017). Humanitarian supply chain strategies–a review of how actors mitigate supply chain risks. *Journal of Humanitarian Logistics and Supply Chain Management, 7*(2), 82-101. https://doi.org/10.1108/JHLSCM-12-2016-0043

Johnson, N., Elliott, D., & Drake, P. (2013). Exploring the role of social capital in facilitating supply chain resilience. *Supply Chain Management*. https://doi.org/10.1108/SCM-06-2012-0203

Jüttner, U., & Maklan, S. (2011). Supply chain resilience in the global financial crisis: an empirical study. *Supply Chain Management, 16*(4), 246-259. https://doi.org/10.1108/13598541111139062

Kabra, G., & Ramesh, A. (2015). Analyzing ICT Issues in Humanitarian Supply Chain Management: A SAP-LAP Linkages Framework. *Global Journal of Flexible Systems Management, 16*(2), 157. https://doi.org/10.1007/s40171-014-0088-3

Kessler, J. B., & Milkman, K. L. (2018). Identity in Charitable Giving. *Management science, 64*(2), 845-859. https://doi.org/10.1287/mnsc.2016.2582

Khanuja, A., & Jain, R. K. (2019). Supply chain integration: a review of enablers, dimensions and performance. *Benchmarking: An international journal, 27*(1), 264-301. https://doi.org/10.1108/BIJ-07-2018-0217

Klein, P. (2020). *America's Medical Supply Crisis* PBS. https://www.pbs.org/wgbh/frontline/film/americas-medical-supply-crisis/

Kleindorfer, P. R., & Saad, G. H. (2005). Managing Disruption Risks in Supply Chains. *Production and Operations Management, 14*(1), 53-68. https://doi.org/10.1111/j.1937-5956.2005.tb00009.x

Klumpp, M., & Losk, D. (2021). Long-Term Economic Sustainability of Humanitarian Logistics—A Multi-Level and Time-Series Data Envelopment Analysis. *International Journal of Environmental Research and Public Health, 18*(5), 2219. https://doi.org/10.3390/ijerph18052219

Kovacs, G., Moshtari, M., Kachali, H., & Polsa, P. (2019). Research methods in humanitarian logistics. *Journal of Humanitarian Logistics and Supply Chain Management, 9*(2), 325-331. https://doi.org/10.1108/JHLSCM-12-2019-082

Kumar, S., Niedan-Olsen, K., & Peterson, L. (2009). Educating the supply chain logistics for humanitarian efforts in Africa: a case study. *International Journal of Productivity and Performance Management, 58*(5), 480-500. https://doi.org/10.1108/17410400910965733

Kunz, N., & Gold, S. (2015). Sustainable humanitarian supply chain management - Exploring new theory. *International Journal of Logistics Research and Applications, 20*(2), 85-104. https://doi.org/10.1080/13675567.2015.1103845

Kunz, N., & Reiner, G. (2012). A meta-analysis of humanitarian logistics research. *Journal of Humanitarian Logistics and Supply Chain Management, 2*(2), 116-147. https://doi.org/10.1108/20426741211260723

Kunz, N., & Reiner, G. (2016). Drivers of government restrictions on humanitarian supply chains. *Journal of Humanitarian Logistics and Supply Chain Management, 6*(3), 329-351. https://doi.org/10.1108/JHLSCM-04-2016-0009

Li, Z., Pan, Y., Yang, W., Ma, J., & Zhou, M. (2021). Effects of government subsidies on green technology investment and green marketing coordination of supply chain under the cap-and-trade mechanism. *Energy Economics, 101*, 105426. https://doi.org/10.1016/j.eneco.2021.105426

Lu, Q., Goh, M., & De Souza, R. (2018). An empirical investigation of swift trust in humanitarian logistics operations [Humanitarian logistics operations]. *Journal of Humanitarian Logistics and Supply Chain Management, 8*(1), 70-86. https://doi.org/10.1108/JHLSCM-07-2017-0033

Manouchehrabadi, M. K., & Yaghoubi, S. (2019). Solar cell supply chain coordination and competition under government intervention. *Journal of Renewable and Sustainable Energy, 11*(2), 023701. https://doi.org/10.1063/1.5035266

Marshall, A., Bashir, H., Ojiako, U., & Chipulu, M. (2018). A Machiavellian behavioural framing of social conflict risks in supply chains. *Management Research Review, 41*(11), 1290-1308. https://doi.org/10.1108/MRR-01-2018-0022

Martins, C., & Pato, M. (2019). Supply chain sustainability: A tertiary literature review. *Journal of Cleaner Production, 225*, 995-1016. https://doi.org/10.1016/j.jclepro.2019.03.250

Mejia, J., Urrea, G., & Pedraza-Martinez, A. J. (2019). Operational Transparency on Crowdfunding Platforms: Effect on Donations for Emergency Response. *Production and Operations Management, 28*(7), 1773-1791. https://doi.org/10.1111/poms.13014

Mogotsi, K., & Saruchera, F. (2023). The influence of lean thinking on philanthropic organisations' disaster response processes. *Journal of Humanitarian Logistics and Supply Chain Management, 13*(1), 42-60. https://doi.org/10.1108/JHLSCM-07-2022-0079

Mora-Ochomogo, E. I., Mora-Vargas, J., & Serrato, M. (2016). A Qualitative Analysis of Inventory Management Strategies in Humanitarian Logistics Operations. *International Journal of Combinatorial Optimization Problems and Informatics, 7*(1), 40-53.

Munyon, T. P., Jenkins, M. T., Crook, T. R., Edwards, J., & Harvey, N. P. (2019). Consequential cognition: Exploring how attribution theory sheds new light on the firm-level consequences of product recalls. *Journal of Organizational Behavior, 40*(5), 587-602. https://doi.org/10.1002/job.2350

Mushanyuri, B. E., & Ngcamu, B. S. (2020). The effectiveness of humanitarian supply chain management in Zimbabwe. *Journal of Transport and Supply Chain Management, 14*. https://doi.org/10.4102/jtscm.v14i0.505

Negi, S. (2022). Humanitarian logistics challenges in disaster relief operations: A humanitarian organisations' perspective. *Journal of Transport and Supply Chain Management, 16*. https://doi.org/10.4102/jtscm.v16i0.691

Nurmala, N., de Leeuw, S., & Dullaert, W. (2017). Humanitarian–business partnerships in managing humanitarian logistics. *Supply Chain Management*. https://doi.org/10.1108/SCM-07-2016-0262

Ogie, R., James, S., Moore, A., Dilworth, T., Amirghasemi, M., & Whittaker, J. (2022). Social media use in disaster recovery: A systematic literature review. *International Journal of Disaster Risk Reduction*, 102783. https://doi.org/10.1016/j.ijdrr.2022.102783

Ottoni-Wilhelm, M., Vesterlund, L., & Xie, H. (2017). Why Do People Give? Testing Pure and Impure Altruism. *American Economic Review, 107*(11), 3617-3633. https://doi.org/10.1257/aer.20141222

Pacheco, J., & Laguna, M. (2020). Vehicle routing for the urgent delivery of face shields during the COVID-19 pandemic. *Journal of Heuristics, 26*(5), 619-635. https://doi.org/10.1007/s10732-020-09456-8

Popay, J., Roberts, H., Sowden, A., Petticrew, M., Arai, L., Rodgers, M., Britten, N., Roen, K., & Duffy, S. (2006). Guidance on the conduct of narrative synthesis in

systematic reviews. *A product from the ESRC methods programme Version, 1*(1), b92. https://doi.org/10.13140/2.1.1018.4643

Prater, E., Biehl, M., & Smith, M. A. (2001). International supply chain agility-Tradeoffs between flexibility and uncertainty. *International Journal of Operations & Production Management*. https://doi.org/10.1108/01443570110390507

Pratt, M. G. (2009). From the Editors: For the Lack of a Boilerplate: Tips on Writing Up (and Reviewing) Qualitative Research. *Academy of Management Journal, 52*(5), 856-862. https://doi.org/10.5465/amj.2009.44632557

Quarshie, A. M., & Leuschner, R. (2020). Interorganizational interaction in disaster response networks: A government perspective. *Journal of Supply Chain Management, 56*(3), 3-25. https://doi.org/10.1111/jscm.12225

Rahman, M. M., Farah, T., Mahmuda Zaman, M., Abedin, A., & Aryal, K. R. (2022). Assessing Barriers in Humanitarian Supply Chains for Cyclone in Coastal Areas of Bangladesh: An Interpretive Structural Modeling (ISM) Approach. *Sustainability, 14*(15), 9724. https://doi.org/10.3390/su14159724

Rancourt, M.-È., Bellavance, F., & Goentzel, J. (2014). Market analysis and transportation procurement for food aid in Ethiopia. *Socio-Economic Planning Sciences, 48*(3), 198-219. https://doi.org/10.1016/j.seps.2014.07.001

Randall, W. S., & Mello, J. E. (2012). Grounded theory: an inductive method for supply chain research. *International Journal of Physical Distribution & Logistics Management, 42*, 863-880. https://doi.org/10.1108/09600031211269794

Rau, H., Samek, A., & Zhurakhovska, L. (2022). Do I care if you are paid? Field experiments and expert forecasts in charitable giving. *Journal of Economic Behavior & Organization, 195*, 42-51. https://doi.org/10.1016/j.jebo.2021.12.020

Rayawan, J., Tipnis, V. S., & Pedraza-Martinez, A. J. (2021). On the connection between disaster mitigation and disaster preparedness: the case of Aceh province, Indonesia [Disaster mitigation and disaster preparedness]. *Journal of Humanitarian Logistics and Supply Chain Management, 11*(1), 135-154. https://doi.org/10.1108/JHLSCM-12-2019-0081

Rodríguez-Espíndola, O., Albores, P., & Brewster, C. (2018). Disaster preparedness in humanitarian logistics: A collaborative approach for resource management in floods. *European Journal of Operational Research, 264*(3), 978-993. https://doi.org/10.1016/j.ejor.2017.01.021

Rousseau, D. M., Manning, J., & Denyer, D. (2008). 11 Evidence in Management and Organizational Science: Assembling the Field's Full Weight of Scientific Knowledge Through Syntheses. *The Academy of Management Annals, 2*(1), 475-515. https://doi.org/10.1080/19416520802211651

Salam, M. A., & Khan, S. A. (2020). Lessons from the humanitarian disaster logistics management: A case study of the earthquake in Haiti: A case study of the earthquake in Haiti [Humanitarian logistics management]. *Benchmarking*, *27*(4), 1455-1473. https://doi.org/10.1108/BIJ-04-2019-0165

Sánchez, Á. (2022). Group identity and charitable contributions: Experimental evidence. *Journal of Economic Behavior & Organization*, *194*, 542-549. https://doi.org/10.1016/j.jebo.2021.12.032

Schiffling, S., & Piotrowicz, W. D. (2022). Ukraine crisis: why you should donate money rather than supplies. *The Conversation* https://theconversation.com/ukraine-crisis-why-you-should-donate-money-rather-than-supplies-178245

Scholten, K., & Schilder, S. (2015). The role of collaboration in supply chain resilience. *Supply Chain Management*. https://doi.org/10.1108/SCM-11-2014-0386

Schulz, J. F., Thiemann, P., & Thöni, C. (2018). Nudging generosity: Choice architecture and cognitive factors in charitable giving. *Journal of Behavioral and Experimental Economics*, *74*, 139-145. https://doi.org/10.1016/j.socec.2018.04.001

Shang, J., Reed, A., Sargeant, A., & Carpenter, K. (2020). Marketplace donations: The role of moral identity discrepancy and gender. *Journal of Marketing Research*, *57*(2), 375-393. https://doi.org/10.1177/0022243719892592

Sharma, N., Sahay, B., Shankar, R., & Sarma, P. (2017). Supply chain agility: review, classification and synthesis. *International Journal of Logistics Research and Applications*, *20*(6), 532-559. https://doi.org/10.1080/13675567.2017.1335296

Shekarian, M., & Mellat Parast, M. (2021). An Integrative approach to supply chain disruption risk and resilience management: a literature review. *International Journal of Logistics Research and Applications*, *24*(5), 427-455. https://doi.org/10.1080/13675567.2020.1763935

Singh, P. J., & Power, D. (2009). The nature and effectiveness of collaboration between firms, their customers and suppliers: a supply chain perspective. *Supply Chain Management*. https://doi.org/10.1108/13598540910954539

Singh, R. K., Gupta, A., & Gunasekaran, A. (2018). Analysing the interaction of factors for resilient humanitarian supply chain. *International Journal of Production Research*, *56*(21), 6809-6827. https://doi.org/10.1080/00207543.2018.1424373

Smith, A. B. (2020). *2010-2019: A landmark decade of U.S. billion-dollar weather and climate disasters* (ClimateWatch Magazine, Issue. https://www.climate.gov/news-features/blogs/beyond-data/2010-2019-landmark-decade-us-billion-dollar-weather-and-climate

Smith, A. B. (2022). *2021 U.S. billion-dollar weather and climate disasters in historical context*. https://www.climate.gov/news-features/blogs/beyond-data/2021-us-billion-dollar-weather-and-climate-disasters-historical

Soosay, C. A., & Hyland, P. (2015). A decade of supply chain collaboration and directions for future research. *Supply Chain Management*. https://doi.org/10.1108/SCM-06-2015-0217

Starr, M. K., & Van Wassenhove, L. N. (2014). Introduction to the Special Issue on Humanitarian Operations and Crisis Management. *Production and Operations Management, 23*(6), 925-937. https://doi.org/10.1111/poms.12227

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Sage Publications.

Sudusinghe, J. I., & Seuring, S. (2021). Supply chain collaboration and sustainability performance in circular economy: A systematic literature review. *International Journal of Production Economics*, 108402. https://doi.org/10.1016/j.ijpe.2021.108402

Swanson, D. R., & Smith, R. J. (2013). A Path to a Public-Private Partnership: Commercial Logistics Concepts Applied to Disaster Response. *Journal of Business Logistics, 34*(4), 335-346. https://doi.org/10.1111/jbl.12031

Tang, C. S. (2006). Perspectives in supply chain risk management. *International Journal of Production Economics, 103*(2), 451-488. https://doi.org/10.1016/j.ijpe.2005.12.006

Tasnim, Z., Hamid, A. B. A., Yogesh, D. K., & Shareef, M. A. (2022). Sustainable disaster supply chain management for relief operations in Bangladesh. *Journal of Humanitarian Logistics and Supply Chain Management, 12*(2), 285-304. https://doi.org/10.1108/JHLSCM-07-2021-0062

Tennant, S., & Fernie, S. (2014). Theory to practice: A typology of supply chain management in construction. *International Journal of Construction Management, 14*(1), 56-66. https://doi.org/10.1080/15623599.2013.875268

Tyson, A., & Funk, C. (2022). *Increasing Public Criticism, Confusion Over COVID-19 Response in U.S.* https://www.pewresearch.org/science/2022/02/09/increasing-public-criticism-confusion-over-covid-19-response-in-u-s/

U.S. Agency for International Development (USAID) Center for International Disaster Information. (2013). *CIDI Poll: The majority of Americans (63%) Donate to Relief Organizations in the Aftermath of Natural Disasters.* https://www.prnewswire.com/news-releases/usaid-cidi-poll-majority-of-americans-63-have-donated-to-relief-organizations-in-the-aftermath-of-natural-disasters-in-the-past-five-years-understand-monetary-donations-are-preferred-way-to-contribute-234209901.html

Ülkü, M. A., Bell, K. M., & Wilson, S. G. (2015). Modeling the impact of donor behavior on humanitarian aid operations. *Annals of Operations Research, 230*(1), 153-168. https://doi.org/10.1007/s10479-014-1623-5

UNICEF. (2020). *COVID-19 impact assessment and outlook on personal protective equipment*. https://www.unicef.org/supply/stories/covid-19-impact-assessment-and-outlook-personalprotective-equipment

Urquhart, C. (2013). *Grounded Theory for Qualitative Research: A Practical Guide*. Sage Publications. https://doi.org/10.4135/9781526402196

Vega, D., & Roussat, C. (2015). Humanitarian logistics: the role of logistics service providers. *International Journal of Physical Distribution & Logistics Management, 45*(4), 352-375. https://doi.org/10.1108/IJPDLM-12-2014-0309

Velasquez, G. A., Mayorga, M. E., & Cruz, E. A. R. (2019). Prepositioning inventory for disasters: a robust and equitable model. *OR Spectrum, 41*(3), 757-785. https://doi.org/10.1007/s00291-019-00554-z

Vickery, S., Calantone, R., & Droge, C. (1999). Supply chain flexibility: An empirical study. *Journal of Supply Chain Management, 35*(3), 25-24. https://doi.org/10.1111/j.1745-493X.1999.tb00058.x

Vosooghidizaji, M., Taghipour, A., & Canel-Depitre, B. (2020). Supply chain coordination under information asymmetry: a review. *International Journal of Production Research, 58*(6), 1805-1834. https://doi.org/10.1080/00207543.2019.1685702

Wachtendorf, T., Brown, B., & Holguin-Veras, J. (2013). Catastrophe Characteristics and their Impact on Critical Supply Chains: Problematizing Materiel Convergence and Management Following Hurricane Katrina. *Journal of Homeland Security and Emergency Management, 10*(2), 497-520. https://doi.org/10.1515/jhsem-2012-0069

Wachtendorf, T., Kendra, J. M., & Lea, B. (2010). Community Behavior and Response to Disaster. In E. Daily & R. Powers (Eds.), *International Disaster Nursing* (pp. 29-40). Cambridge University Press. https://doi.org/https://doi.org/10.1017/CBO9780511841415.006

Wachtendorf, T., Penta, S., & Nelan, M. M. (2014). When push comes to shove: The framing of need in disaster relief efforts. In *Learning and Calamities* (pp. 255-272). Routledge.

Waters, R. D., & Tindall, N. T. (2011). Exploring the impact of American news coverage on crisis fundraising: Using media theory to explicate a new model of fundraising communication. *Journal of Nonprofit & Public Sector Marketing, 23*(1), 20-40. https://doi.org/10.1080/10495142.2010.494875

Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological review*, *92*(4), 548. https://doi.org/10.1037/0033-295X.92.4.548

Weiner, B. (1995). *Judgments of responsibility: A foundation for a theory of social conduct*. Guilford Press.

Wilson, M. M. J., Tatham, P., Payne, J., Cécile, L. H., & Shapland, M. (2018). Best practice relief supply for emergency services in a developed economy: Evidence from Queensland Australia: Evidence from Queensland Australia [Best practice relief supply]. *Journal of Humanitarian Logistics and Supply Chain Management*, *8*(1), 107-132. https://doi.org/10.1108/JHLSCM-03-2017-0008

Wisetjindawat, W., Ito, H., Fujita, M., & Eizo, H. (2014). Planning Disaster Relief Operations. *Procedia - Social and Behavioral Sciences*, *125*, 412-421. https://doi.org/10.1016/j.sbspro.2014.01.1484

Wong, G., Greenhalgh, T., Westhorp, G., Buckingham, J., & Pawson, R. (2013). RAMESES publication standards: meta-narrative reviews. *BMC Medicine*, *11*(1), 20. https://doi.org/10.1111/jan.12092

Yadav, D. K., & Barve, A. (2015). Analysis of critical success factors of humanitarian supply chain: An application of Interpretive Structural Modeling. *International Journal of Disaster Risk Reduction*, *12*, 213-225. https://doi.org/10.1016/j.ijdrr.2015.01.008

Ye, Y., Jiao, W., & Yan, H. (2020). Managing Relief Inventories Responding to Natural Disasters: Gaps Between Practice and Literature [https://doi.org/10.1111/poms.13136]. *Production and Operations Management*, *29*(4), 807-832. https://doi.org/10.1111/poms.13136

Yin, R. K. (2018). *Case Study Research and Applications: Design and Applications* (6th ed. ed.). Sage Publications.

Zarghamee, H. S., Messer, K. D., Fooks, J. R., Schulze, W. D., Wu, S., & Yan, J. (2017). Nudging charitable giving: Three field experiments. *Journal of Behavioral and Experimental Economics*, *66*, 137-149. https://doi.org/10.1016/j.socec.2016.04.008

Zhang, L., Tian, J., Fung, R. Y. K., & Dang, C. (2019). Materials procurement and reserves policies for humanitarian logistics with recycling and replenishment mechanisms. *Computers & Industrial Engineering*, *127*, 709-721. https://doi.org/10.1016/j.cie.2018.11.013

Zizzo, D. J. (2010). Experimenter demand effects in economic experiments. *Experimental Economics*, *13*, 75-98. https://doi.org/10.1007/s10683-009-9230-z

VITA

Peter Imbriale received his B.S. in Operations Research and Computer Analysis from the United States Coast Guard Academy (USCGA) in 2012. For four years, he served as an officer on Coast Guard ships in the Caribbean Sea. He earned his Master's in Business Administration (MBA) and M.S. in Business Analytics and Project Management from the University of Connecticut in 2018. Peter served as an Instructor of Management at the USCGA from 2018-2020 and will join the USCGA's School of Leadership and Management as a member of the Permanent Commissioned Teaching Staff in the Fall of 2023.

Permanent Address: 11 Duchess Dr, Old Lyme, CT 06371

This manuscript was typed by the author.