

1 **Title:** The Pandemic Leadership Model: A Study of Medical Student Values During COVID-19

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29  
30 **Discussion Points.**

- 31 1. Leadership is more important than ever in medical education and medical graduates face rapidly  
32 changing demands in their careers.
- 33 2. COVID19 serves as a real-world crucible for leadership and provides the opportunity to determine what  
34 students value in their leaders.
- 35 3. The model of pandemic leadership describes the qualities students value and can inform future  
36 leadership curricula for medical programs.

37  
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40 *will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable*  
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42 *and all legal disclaimers that apply to the journal pertain.*

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1 **ABSTRACT.**

2 **Background:** Leadership training is of growing importance in medical education. The COVID-19 pandemic  
3 provides unique insight into the qualities and characteristics medical students value in leaders. Little standard  
4 information exists regarding best practices, competency-based leadership models or frameworks to guide  
5 leadership program development in undergraduate medical education. This study aims to determine what  
6 students value in leadership during a pandemic and what implicit leadership framework students use in order  
7 to inform medical education curricula.

8 **Methods:** We developed a survey instrument aimed to uncover student perceptions of effective and ineffective  
9 leadership qualities and examples, both during the current COVID-19 pandemic and during crises in general.

10 **Results:** Students identified the overarching themes of Communication, Other-Orientation, Personal  
11 Characteristics, Decisive Action, and Use of Information. These five themes were then built into the model of  
12 Pandemic Leadership within the context of complexity leadership theory and collective leadership theory.

13 **Conclusion:** This study is unique in its focus on student perceptions of leadership qualities both in general, and  
14 during a time of challenge that can serve as a real-world laboratory for leadership. We hope that this information,  
15 along with the pandemic leadership model, can serve as the first step to useful and relevant leadership training  
16 programs in undergraduate medical education.

17  
18 **Key Words:** Leadership, Medical Education, Pandemic, (Source: MeSH-NLM).  
19

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## 1 INTRODUCTION.

2 Today's medical school graduates face a rapidly changing practice environment. From decreasing physician  
3 autonomy, to increasing interprofessional collaborative care, to unprecedented public health challenges like the  
4 COVID19 pandemic, the challenges of practicing physicians continue to grow (1). This requires a corresponding  
5 broadening of undergraduate medical education (UME) to face these novel challenges.  
6

7 One critical factor required for a medical system to successfully adapt to rapid change is the presence of  
8 effective leaders. Leadership has been shown to be important in many medical contexts, with physicians'  
9 engagement in hospital leadership and management improving clinical outcomes and performance (2,3).  
10 Medical education curricula require a corresponding plan to prepare graduates to take on these leadership  
11 roles. While many studies evaluate leadership development in graduate medical and continuing medical  
12 education, there is a relative dearth of information surrounding training programs for UME (1,4–6). As such,  
13 medical students currently feel uninformed and unprepared about leadership and managerial roles within  
14 medicine and may face challenges navigating power dynamics within medicine (7,8).  
15

16 It is also crucial to ground training of medical students within relevant leadership theory (17,18). Upon review of  
17 existing structures two relevant leadership frameworks are called Complexity Leadership and  
18 Shared/Collective/Distributive leadership. Within these frameworks, leadership is seen as a complex system of  
19 interaction agents with unpredictable feedback networks which, in turn, output responsive results such as  
20 information-sharing, invention, and continued evolution to change (19–21). Complexity and shared leadership  
21 provide an ideal framework for the interdependent relationships and dynamism of the medical field. These  
22 structures are also well-suited to examine the responses to the current global pandemic.  
23

24 Additionally, little standard information exists about ideal leadership models or frameworks to shape program  
25 creation (9). In the UK, in order to shape curriculum development in leadership education, the National Health  
26 Service developed the “Medical Leadership Competency Framework”, followed by the Healthcare Leadership  
27 Model (10–12). These leadership frameworks emphasize the need for quality improvement (QI) projects  
28 organized by students and increased use of simulation. Similarly, the accreditation body for Australian medical  
29 schools recommend medical leadership teaching and assessment, but stop short of suggesting specific  
30 curricula for medical schools (13). Undergraduate medical education in the United States may benefit from a  
31 similar model, grounded in student understanding of leadership competencies. As a result of unclear standards  
32 and student values, current programs are highly varied, ranging from opt-in summer programs, to longitudinal  
33 diversity training (14–16).  
34

35 Although a recognized unmet need in UME, little literature exists on the values students require in leadership.  
36 There is a clear gap in understanding of the implicit model of leadership that students hold and the values they  
37 look for in leaders. The current global pandemic brought to light the importance of leadership in medicine. The  
38 objective of this study is to determine, through qualitative survey, the values that medical students at the \*\*\*  
39 Medical School hold for leadership during a pandemic, in order to inform the further development of medical  
40 education curricula. Additionally, in order to place the results within context of leadership theory, we aim to  
41 determine a model for pandemic leadership from the perspective of medical student values.  
42

## 1 **MATERIALS OR PATIENTS AND METHODS.**

### 2 **Study Design:**

3 We conducted a cross-sectional, qualitative study of medical students at the \*\*\* medical school.. Survey results  
4 were anonymous and all responses were collected within seven days. All aspects of the study were approved  
5 by the \*\*\* medical school's institutional review board (HUM00179411).

### 7 **Setting:**

8 Our study took place at the \*\*\* medical school. Students in all classes were invited to participate in the survey  
9 with a single email in April 2020, while students were removed from the clinical setting and were taking an online  
10 "Pandemic Medicine" course

### 12 **Participants:**

13 Our survey was sent to medical students in all four classes. Each class comprises approximately 160 students,  
14 with a subset participating in dual degree programs such as MD/MBA or MD/MPH programs. All students at the  
15 \*\*\* were eligible to participate. Each participant received an anonymized individual link that was only accessible  
16 from an email address associated with medical school students to ensure no ineligible responses. To prevent  
17 duplicate responses, each link only allowed one response. Non-students were excluded as the survey was only  
18 sent to and accessible from a medical school email address. The first screen of the survey was an informed  
19 consent page, giving detail about the risk, benefit, and purpose of study. Participants were able to agree or  
20 decline participation in the study without consequences.

### 22 **Variables/Measurement:**

23 The survey instrument was developed by a consensus group of experts from family medicine, leadership  
24 development, medical education, and survey research. The survey included five free-text questions assessing  
25 student perceptions of exemplary and poor leadership qualities. The full survey questions are shown in Table  
26 1. The survey was administered via an online platform (Qualtrics, Provo, Utah)(36).

### 28 **Bias:**

29 In order to reduce bias in collection and analysis, survey responses were anonymous. Each reviewer also  
30 followed the 15 point checklist of good thematic analysis presented by Clarke and Braun (27), including  
31 generating codes and themes independently before undergoing intercoder agreement exercises. We  
32 additionally performed a participant pilot with six representative students across multiple class years to ensure  
33 ease of survey understandability and identify any potential issues in survey design that may have led to bias.

### 35 **Study Size:**

36 Our study intended to gather a sample of student opinions from all four classes. The survey was sent to each  
37 class' email list serve at \*\*\*, reaching approximately 640 students. To ensure thematic saturation in our  
38 qualitative analysis, we aimed to collect information from 25% of all students (~160 participants).

**Qualitative Analysis:**

To analyze the survey responses, we used a thematic analysis approach, following the 6 phases described by Braun and Clarke (22,23). The 6 phases are: “1. Familiarizing yourself with your data; 2. Generating Initial Codes; 3. Searching for themes; 4. Reviewing themes; 5. Definite and naming themes; 6. Producing the report.”

Specifically, we followed the following analysis process: Two authors (AB, SO) independently read the entire data set to familiarize themselves with the scope of the content. They recorded initial ideas and notes about possible future themes and codes. Then, four authors (AB, NK, EKJ, and SO) independently performed a line-by-line reading, and re-reading, of the first 20% of the responses. Each author produced a set of initial codes from the data (24). The coders then underwent intercoder agreement exercises. Any coding disagreements were discussed between the coders until all coders agreed on a complete set of codes. Each coder then analyzed an additional 20% of the responses and one coder re-analyzed the initial 20% with the updated codes to ensure every response was reviewed by multiple authors in the analysis process.

Initial codes were then combined into common categories, which were then clustered to form overarching themes. This process was iterative and involved many re-readings of each section, refocusing analysis on broader levels of themes. Themes were evaluated based on the extent to which the theme captured sentiments expressed in the entire data set and encompassed codes. These themes were then reviewed by 4 authors and inter-coder agreement was achieved for all five themes. Themes were reviewed to ensure there was sufficient supporting data for each and that they are distinct from each other (25). After ensuring the codes and underlying data are accurately represented by the themes, a candidate “thematic map” was developed (Figure 1) to indicate the interrelationships among themes.

**Reflexivity Statement:**

This research is based in the \*\*\*, where the first two of the authors are students. The remaining authors are faculty at this institution. The researchers are students at the \*\*\* and faculty of the \*\*\*. In addition, the lead author has a background in teaching and developing leadership curricula for outdoor education and wilderness programs. Answers to the survey questions addressed leadership both within and outside of the \*\*\*.

## 1 RESULTS.

2 In total, of approximately 640 eligible students attending the \*\*\* medical school, 162 students participated in the  
3 survey. Table 2 displays the demographic characteristics of participants. Overall, 96 (59%) study participants  
4 were female, and 62 (38%) were male. An additional 1 (1%) respondent identified as transgender or nonbinary,  
5 3 (2%) respondents left this item blank. The median age was 25 (range, 22-39 years old), with broad  
6 representation from the four medical school classes with 32-49 (20-30%) from each year and 8 respondents  
7 (5%) dual degree participation. Specific reasons for non-participation were not assessed.

8  
9 Initial analysis of themes identified five overarching concepts related to leadership in a crisis, with corresponding  
10 sub-codes. Figure 1 illustrates the major leadership themes that were identified: communication, other-  
11 orientation, use of information, personal characteristics, and decisive action, with the corresponding codes used  
12 in analysis.

13  
14 The initial concept map with the above themes and codes was then revised into the pandemic leadership model,  
15 reflecting the interrelationships between the student themes (Figure 2). This model was compared with the  
16 codes and original data to ensure consistency and that it fully captured student perspectives. We walk through  
17 the use of the model and its relation to existing theory in detail with further supporting responses in Supplemental  
18 Appendix 1.

### 19 Sample responses and description of themes:

20  
21 **Personal Characteristics:** Students referred to several interpersonal and character traits displayed by  
22 good leaders. “Effective leaders act with humility, integrity, and respect; they are willing to learn what  
23 they don’t already know about the situation, and willing to take feedback from those who are most  
24 impacted/who are not in leadership positions.” - 26 Year old Female, Dual Degree Student

25  
26 **Communication:** Study participants repeatedly described the essential nature of clear and consistent  
27 communication in pandemic leadership as well as its relationship to decisive action. Conversely,  
28 examples of ineffective communication were explained when discussing poor leadership. “regular  
29 communication - people are especially hungry for information so communicating well can help to dispel  
30 fear” and that “the unknown scares people. Sharing as much information as possible helps morale...”  
31 -27 Year old Female, Early Branch student (M3)

32  
33 **Other-orientation:** This theme relates to both the ways leaders approach their communities and to  
34 building positive and effective teams. “A collaborative spirit is absolutely necessary to solve problems  
35 in real time that we have never faced before” - 24 Year old Female, Early Branches student (M3)

36  
37 **Decisive Action:** The theme of taking initiative and bravery in decisions was central to student’s  
38 descriptions of good leaders in a crisis. “Great communication, thoughtful and decisive action, and  
39 willingness to get to work. I think all of these behaviors put the entire community at ease, and instill a  
40 certain sense of trust” -26 Year old Male, Late Branches Student (M4)”

1        **Use of Information:** This central theme in the model of pandemic leaders refers to the gathering, use,  
2        and dissemination of information in crisis. “Good leaders spend more time listening to others than talking  
3        themselves, because it’s critical to be as fully informed as possible before making decisions.” -31 Year-  
4        old Male, Late Branch Student (M4)  
5

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## 1 **DISCUSSION.**

2 This study aimed to uncover the values that medical students hold for their leaders in the context of the current  
3 pandemic. Through qualitative approaches, five key themes were identified. The overarching values from the  
4 responses were examined through existing frameworks of leadership theory with a focus on complexity  
5 leadership theory and shared/collective leadership for the purpose of informing medical school leadership  
6 curricula.

7  
8 The theme of use of information arose in in the context of what makes a good leader and is central to the model  
9 of excellent leadership according to medical students. This relates directly to the theory of collective leadership,  
10 where leadership exists as a system of connected networks (26). These ideas parallel directly to student  
11 comments surrounding pandemic leadership. Leaders must know how to gather information, involving planning  
12 and using evidence-based information to distribute the truth to the public. Students stated that good leaders use  
13 data and evidence to make their decisions. Respondents stressed the importance of grounding in realism and  
14 rationality in good leaders. This theme relates to current leadership curriculum at the \*\*\* and the recent emphasis  
15 on evidence-based medicine in both clinical practice and training. This finding suggests that continued evidence  
16 based medicine training and additional education in information digestion and synthesis is appropriate for  
17 inclusion in leadership training curricula.

18  
19 The theme of “Other-orientation” was supported by many students’ comments. Other orientation refers to the  
20 ways in which leaders act in relation to those they lead or their communities at large. Students endorsed the  
21 need to be working toward the greater good, acting in service of others, and creating opportunities -- labeled  
22 broadly as team building. Medical education has more recently been moving past the traditional emphasis on  
23 management of illness, with more weight being placed on team collaboration and interprofessional training (27),  
24 directly supporting this expressed student value. At \*\*\*, this concept in leadership is taught through an exercise  
25 called the Leadership 360 degree evaluation, where feedback is solicited from evaluators from many different  
26 contexts and roles. This helps students to better understand the roles they play and their relationships to other  
27 aspects of the education and medical systems in which they interact.

28  
29 Another major theme was that consistent communication is essential for good leaders. This finding serves as  
30 additional support for the recent push among undergraduate medical educators to include communication and  
31 interpersonal skills at all levels of medical training (28,29). This leadership theme is specifically taught at the \*\*\*  
32 with presentation and speaking skills sessions, teambuilding lessons, and training in challenging conversations.

33  
34 Students described in detail the need for leaders to take decisive action in a crisis. Sharing that leaders must  
35 take initiative and follow through on their vision. Decisive action taken by leadership at the medical school level,  
36 both by other students and by administration, were aimed at responding to the crisis and creating new  
37 opportunities for people to help during the pandemic. Students valued leaders who had bravery in how they  
38 pursued solutions and felt the best leaders worked hard to make those visions a reality. The connection between  
39 the pandemic leadership model and the existing frameworks of Complexity theory and Shared leadership theory  
40 suggests their appropriateness for effective leadership in the current context. Both models emphasize the need  
41 to respond to changing and dynamic systems and act within the framework of the interconnections of diverse

1 pieces (26), The closest parallel to this leadership concept in the \*\*\* leadership training is the Capstone-for-  
2 impact project, where medical students are given the opportunity to “take on the society’s biggest challenges in  
3 health, health care and health system delivery while in medical school” (30). Our findings suggest that programs  
4 like this are aligned with student values and may be useful as part of leadership training programs in additional  
5 settings.

6  
7 There are some notable limitations to this study. First, the survey was designed to address student perceptions  
8 of leadership in a crisis. By design, the response characteristics will be focused on positive and negative  
9 leadership in response to the current global pandemic. While this provided a unique opportunity to develop  
10 theory in the real world and is very relevant to future challenges physicians may face, it may also limit the  
11 generalizability of the results to a broader leadership curriculum. Leadership in the context of everyday practice  
12 may not be exactly the same as leadership during a crisis and students may value different characteristics.  
13 Additionally, this study surveyed students at one large medical school in the United States and as such, these  
14 findings may not represent the values medical students in other locations with different cultural milieus.

15  
16 However, given the increasing prevalence and importance of leadership training curricula in medical education,  
17 this study hopes to be used as the first step in developing effective and relevant leadership training programs  
18 in undergraduate medical education. Our aim is that by developing the pandemic model of leadership, we  
19 provide a framework for understanding the implicit belief medical students hold about their leaders. Specifically,  
20 these models could be used in the development of case studies, communication techniques, and skills grounded  
21 in the frameworks of these theories of leadership.

22  
23 Current leadership education programs are not grounded in an understanding of the characteristics and values  
24 students look for in their leaders (10, 11). Development of leadership curricula across medical education is  
25 limited without this understanding of the student views and attitudes towards ideal and poor leadership qualities.  
26 Our hope is that by developing the pandemic model of leadership, we provide a framework for understanding  
27 the implicit belief medical students hold about their leaders. This framework, in turn, can be used to help inform  
28 future curriculum development. The connection between the pandemic leadership model and the existing  
29 frameworks of Complexity theory and Shared leadership theory suggests their appropriateness for effective  
30 leadership in the current context. It is also important to note that there may be little to no space to add additional  
31 stand-alone leadership training content to full medical school curricula. Therefore, integrating leadership training  
32 into longitudinal curricula with natural overlapping content may be necessary to ensure time and space for this  
33 essential training.

34  
35 The context of a global pandemic provides a unique opportunity to find the values students look for in their  
36 leaders in the real world and fill this important gap, grounding medical school programs as they prepare students  
37 to meet the challenges of the future. Medical schools have an opportunity to better train their students to be  
38 leaders in crisis through specific training on the themes described above: information use and dissemination,  
39 decision-making and team-development, and communication skill. Leadership training programs in medical  
40 education would benefit from further grounding in these student values.

1 **REFERENCES.**

- 2
- 3 1. Gawande AA. Creating the educated surgeon in the 21st century. *Am J Surg.* 2001 Jun 1;181(6):551–6.
- 4 2. Prybil LD. Size, Composition, and Culture of High-Performing Hospital Boards. *Am J Med Qual.* 2006 Jul  
5 1;21(4):224–9.
- 6 3. Veronesi G, Kirkpatrick I, Vallascas F. Clinicians on the board: What difference does it make? *Soc Sci*  
7 *Med.* 2013 Jan 1;77:147–55.
- 8 4. Stoller JK, Rose M, Lee R, Dolgan C, Hoogwerf BJ. Teambuilding and Leadership Training in an Internal  
9 *Medicine Residency Training Program.* *J Gen Intern Med.* 2004;19(6):692–7.
- 10 5. Awad SS, Hayley B, Fagan SP, Berger DH, Brunicardi FC. The impact of a novel resident leadership  
11 training curriculum. *Am J Surg.* 2004 Nov 1;188(5):481–4.
- 12 6. Doughty RA, Williams PD, Seashore CN. Chief Resident Training: Developing Leadership Skills for  
13 Future Medical Leaders. *Am J Dis Child.* 1991 Jun 1;145(6):639–42.
- 14 7. Rouhani MJ, Burleigh EJ, Hobbis C, Dunford C, Osman NI, Gan C, et al. UK medical students'  
15 perceptions, attitudes, and interest toward medical leadership and clinician managers. *Adv Med Educ*  
16 *Pract.* 2018 Feb 16;9:119–24.
- 17 8. Kumar V D. Good, bad and ugly: Exploring the Machiavellian power dynamics of leadership in medical  
18 education. *J Adv Med Educ Prof.* 2019 Jan 1;7(1):42–6.
- 19 9. McKimm J, Swanwick T. Leadership development for clinicians: what are we trying to achieve? *Clin*  
20 *Teach.* 2011;8(3):181–5.
- 21 10. Webb AMB, Tsipis NE, McClellan TR, McNeil MJ, Xu M, Doty JP, et al. A First Step Toward  
22 Understanding Best Practices in Leadership Training in Undergraduate Medical Education: A Systematic  
23 Review. *Acad Med.* 2014 Nov;89(11):1563–70.
- 24 11. Neeley SM, Clyne B, Resnick-Ault D. The state of leadership education in US medical schools: results of  
25 a national survey. *Med Educ Online.* 2017 Jan 1;22(1):1301697.
- 26 12. Stringfellow TD, Rohrer RM, Loewenthal L, Gorrard-Smith C, Sheriff IHN, Armit K, et al. Defining the  
27 structure of undergraduate medical leadership and management teaching and assessment in the UK.  
28 *Med Teach.* 2015 Aug 3;37(8):747–54.
- 29 13. Ross SJ, Sen Gupta T, Johnson P. Leadership curricula and assessment in Australian and New  
30 Zealand medical schools. *BMC Med Educ.* 2021 Jan 7;21(1):28.
- 31 14. Jordan TM, Willey JM, Brenner JM. Innovation in Leadership Development in Undergraduate Medical  
32 Education. *Med Sci Educ.* 2021 Feb 1;31(1):17–8.
- 33 15. LeBlanc C, Sonnenberg LK, King S, Busari J. Medical education leadership: from diversity to inclusivity.  
34 *GMS J Med Educ.* 2020 Mar 16;37(2):Doc18.
- 35 16. Chapman AL, Christie R, Lamont R, Lewandowska M, Tong L, Tsim F, et al. Leadership development in  
36 undergraduate medical education: evaluation of students' perceptions of a student-selected leadership  
37 module. *BMJ Lead.* 2020 Sep 1;4(3).
- 38 17. Avolio BJ, Walumbwa FO, Weber TJ. Leadership: Current Theories, Research, and Future Directions.  
39 *Annu Rev Psychol.* 2009 Jan;60(1):421–49.
- 40 18. Lord RG, Epitropaki O, Foti RJ, Hansbrough TK. Implicit Leadership Theories, Implicit Followership  
41 Theories, and Dynamic Processing of Leadership Information. *Annu Rev Organ Psychol Organ Behav.*  
42 2020 Jan 21;7(1):49–74.

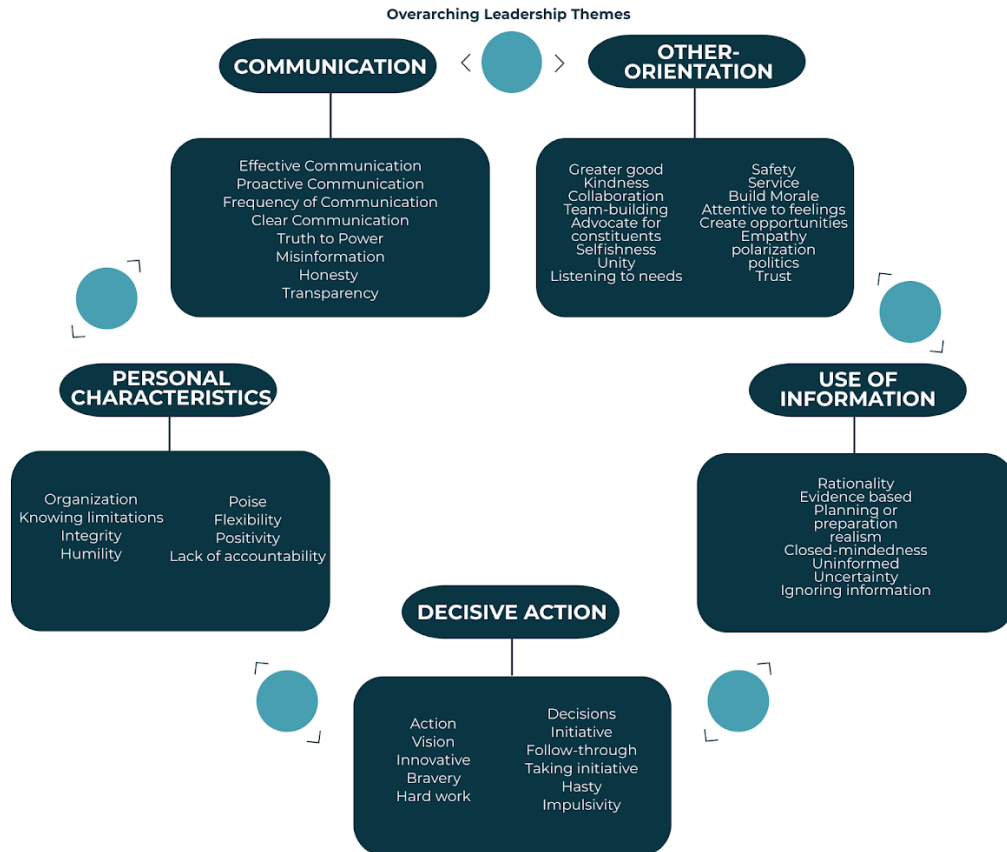
- 1 19. Uhl-Bien M, Marion R, McKelvey B. Complexity Leadership Theory: Shifting leadership from the  
2 industrial age to the knowledge era. *Leadersh Q.* 2007 Aug;18(4):298–318.
- 3 20. Hazy JK, Goldstein JA, Lichtenstein BB. Complex systems leadership theory: An introduction. *Complex*  
4 *Syst Leadersh Theory New Perspect Complex Sci Soc Organ Eff.* 2007;1.
- 5 21. Day DV, Gronn P, Salas E. Leadership capacity in teams. *Leadersh Q.* 2004 Dec;15(6):857–80.
- 6 22. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol.* 2006 Jan;3(2):77–101.
- 7 23. Hsieh H-F, Shannon SE. Three Approaches to Qualitative Content Analysis. *Qual Health Res.* 2005  
8 Nov;15(9):1277–88.
- 9 24. Boyatzis RE. *Transforming Qualitative Information: Thematic Analysis and Code Development.* SAGE;  
10 1998. 204 p.
- 11 25. Patton MQ. *Qualitative evaluation and research methods, 2nd ed.* Thousand Oaks, CA, US: Sage  
12 Publications, Inc; 1990. 532 p. (*Qualitative evaluation and research methods, 2nd ed.*).
- 13 26. Uhl-Bien M. Complexity and COVID-19: Leadership and Followership in a Complex World. *J Manag*  
14 *Stud [Internet].* 2021 Mar 18 [cited 2021 Apr 28]; Available from:  
15 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8014336/>
- 16 27. Burgess A, Kalman E, Haq I, Leaver A, Roberts C, Bleasel J. Interprofessional team-based learning  
17 (TBL): how do students engage? *BMC Med Educ.* 2020 Dec;20(1):118.
- 18 28. Roth CG, Eldin KW, Padmanabhan V, Friedman EM. Twelve tips for the introduction of emotional  
19 intelligence in medical education. *Med Teach.* 2019 Jul 3;41(7):746–9.
- 20 29. Myers CG, Pronovost PJ. Making Management Skills a Core Component of Medical Education. *Acad*  
21 *Med.* 2017 May 1;92(5):582–4.
- 22 30. University of Michigan Medical School. *Impact Curriculum.* Available from:  
23 <https://medicine.umich.edu/medschool/education/md-program/curriculum/impact-curriculum>. Last  
24 updated 2021; cited Aug 28, 2021
- 25

1 **FIGURES AND TABLES.**

2

3 **Figure 1.** Leadership themes identified with corresponding sub-codes from response data of students at the \*\*\*  
 4 Medical School

5

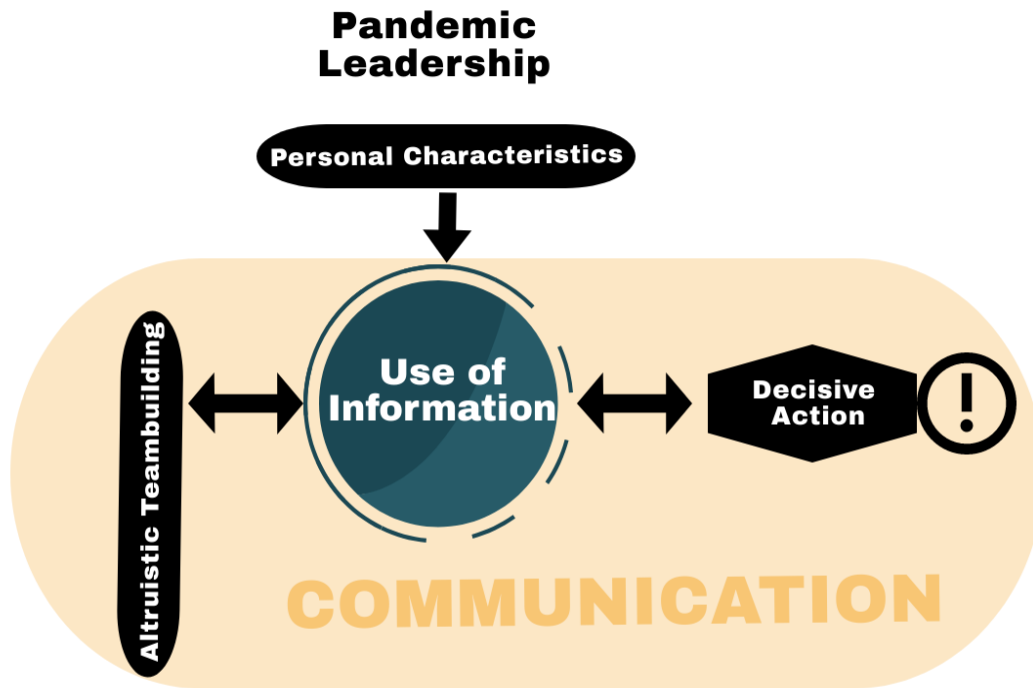


6

7

ACCEPT

- 1 **Figure 2.** The Pandemic Leadership Model was derived from student perspectives of leadership at the \*\*\* during
- 2 the COVID19 pandemic.



- 3
- 4

Accepted,

1 **Table 1.** Free response and demographic questions surrounding students' views of good and poor leaders in a  
 2 pandemic at the \*\*\* Medical School  
 3

<b>Question</b>	<b>Answer Method</b>
<b>1</b> What are some examples of good leadership that you have seen or experienced at any level (from your peers or class representatives through national/international leaders) during the COVID19 pandemic? Please be as specific as possible.	Free text
<b>2</b> What do you think are the most beneficial or effective qualities/behaviors of leaders during a crisis like the current COVID19 pandemic? Please explain why.	Free text
<b>3</b> What do you think are the most detrimental or ineffective qualities/behaviors of leaders during a crisis like the current COVID19 pandemic? Please explain why.	Free text
<b>4</b> What, if anything, are you learning about others from observing their reactions or behavior during this time (including peers, friends, family, leaders)?	Free text
<b>5</b> What, if anything, are you learning about yourself during this time?	Free text
<b>6</b> What is your current phase of training?	Multiple Choice
<b>7</b> How do you describe your gender identity? (Mark all that apply)	Multiple choice
<b>8</b> Please select your age below	Multiple choice

4  
5

1 **Table 2.** Sociodemographic information for survey respondents

2

<b>Demographic Characteristics</b>	<b>Number</b>	<b>Percentage</b>	<b>Median</b>	<b>Mode</b>
Total	162	100%		
Scientific Trunk (M1)	32	20%		
Clinical Trunk (M2)	33	21%		
Early Branches (M3)	49	30%		
Graduating Branches (M4)	38	24%		
Dual Degree/MSTP	8	5%		
Female Students	96	59%		
Male Students	62	38%		
Other/Not listed	4	2%		
Age			26yrs	25yrs

3

4

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1 **Supplemental Appendix 1: Detailed Review and Examples of Leadership Themes in Context**

2  
3 Student responses were analyzed for themes which are presented here in context, with examples.

4  
5 **Use of Information**

6 The theme of information arose in many contexts surrounding the question of what makes a good leader and is  
7 central to the model of excellent leadership according to medical students. This central theme refers to both the  
8 gathering of information and the dissemination of information.

9  
10 “Good leaders spend more time listening to others than talking themselves, because it’s critical to be as fully  
11 informed as possible before making decisions.” -31 Year-old Male, Late Branch Student (M4)

12  
13 Use of information arose strongly in the passages about qualities of bad leadership as well, with particular  
14 emphasis placed on closed-mindedness and ignoring or avoiding information. Students felt that these qualities  
15 limited effectiveness in a crisis.

16  
17 “Narrow-mindedness and stubbornness [limit effectiveness] because situations evolve so quickly you can’t get  
18 attached to any 1 idea or plan.” -Male Dual-Degree Student

19  
20 **Other-Orientation-->Altruistic Team-building**

21 This theme relates to both the positive values of the leader and the coalition and team building activities of the  
22 leader. This theme is directly related to the interconnected nature of complexity leadership theory and integral  
23 to the shared leadership theory. “Other-orientation” refers to the ways in which leaders act in relation to those  
24 they lead or their communities at large. Several described the need to be working toward the greater good,  
25 acting in service of others, and creating opportunities -- labeled broadly as team building.

26  
27 Others discussed the characteristics of kindness, selflessness, and empathy in ideal leaders that they observed,  
28 leading to the altruistic label.

29  
30 One student, discussing the importance of altruism during the pandemic, described the ideal leader as,

31  
32 “someone who is approachable, kind and comforting in these times, while doing their best to help in any way.”  
33 -24 Year old Female, Scientific Trunk student (M1)

34  
35 Many students discussed the need to team-build and work together. This emphasis on team-building to solve  
36 problems is present throughout student comments and is reflective of the collective leadership ideal that people  
37 are inherently most capable as a coalition.

38  
39 When discussing examples of particularly bad leadership, students discussed polarization, politics and  
40 selfishness.

1 “Selfishness is detrimental because everybody is sacrificing something” -28 Year old Female, Clinical Trunk  
2 Student (M2)

3  
4 These attitudes reflect a rejection of traditional leadership hierarchy in favor of collective leadership in a  
5 pandemic.

### 6 7 **Communication**

8 In pandemic leadership, communication serves as a central theme and the substrate and filter through which  
9 information flows to and from others for team-building and altruism. Communication is also the vehicle for  
10 decisive action and for communicating the results of those actions. Clear and consistent communication was  
11 also seen as important for leaders.

12  
13 One student appreciated that, when writing about one of the leaders of the pandemic response:

14  
15 “Effective communication includes giving the right amount of information, in the right platform, and organized in  
16 a way that emphasis[sic] key points” -Female, Early Branches Student (M3)

17  
18 The idea of regular and timely updates in order to address fears, communicate strategies, and provide  
19 information as situations evolve was present in a large plurality of student comments. This relates to the  
20 relationship of communication to others, for use in reassuring and supporting other teams.

21  
22 When discussing poor leadership, communication remained a central theme, with students stating: “not having  
23 one constant message is very detrimental” and that “making false statements confuses the public, abolishes  
24 public unity, can lead to less trust in public health officials.” -25 Year old Female, Clinical Trunk Student (M2)

25  
26 A lack of transparency or honesty, unclear communication and the spread of misinformation were held up as  
27 communication characteristics of bad leadership. Communication between systems is one of the central tenets  
28 of complexity theory and of collective leadership. This sentiment was paralleled in student comments about  
29 pandemic leadership.

### 30 31 **Decisive Action**

32 Students described in detail the need for leaders to take decisive action in a crisis. Sharing that leaders must  
33 take initiative and follow through on their vision. Several students cited decisive action taken by leadership at  
34 the medical school level, both by other students and by administration. These actions were aimed at responding  
35 to the crisis and creating new opportunities for people to help during the pandemic. The leaders were described  
36 as having bravery in how they pursued solutions and that the best leaders worked hard to make those visions  
37 a reality. This is best described as the output or endpoint of the pandemic leadership model. In parallel with  
38 complexity theory, action is informed by and feeds back into information systems, forming an interconnected  
39 loop.

1 “Great communication, thoughtful and decisive action, and willingness to get to work. I think all of these  
2 behaviors put the entire community at ease, and instill a certain sense of trust” -26 Year old Male, Late Branches  
3 Student (M4)

4  
5 Students discuss the relationship of action with an understanding of others and of the complexity of the  
6 situation. Poor leaders were said to embody opposite characteristics, with one student commenting on laziness  
7 and lack of hard work.

8  
9 “Laziness: “big idea” people can sometimes pitch their idea but not contribute to making it actionable, and this  
10 is further complicated by a pandemic, when everyone is stretched thin. If you're going to lead a team, you  
11 should be willing (and expecting!) to put in the most hours. Coattail riding: sort of articulated in the above points,  
12 but the craziness of a crisis makes it easier for behaviors like this to go unnoticed. This would leave me very  
13 disappointed in a leader.” -23 Year old Female, Scientific Trunk Student (M3)

14  
15 This speaks to the ineffectiveness of leadership that does not take the system and interrelatedness of the teams  
16 into account. This more isolated view of leadership is the converse to complexity theory and collective leadership  
17 and again affirms the fit of these models within effective pandemic leadership.

### 18 19 **Personal Characteristics**

20 The theme of personal characteristics refers to intrinsic traits and methods of acting of the leaders themselves.  
21 Participants described several personal traits that good leaders embody. These traits are strongly emphasized  
22 in the theory of shared leadership and deemphasized in more traditional hierarchical models of leadership.  
23 Specifically, many discussed the need for humility in leadership, saying that it's very important for leaders to  
24 know their limitations.

25  
26 “Effective leaders act with humility, integrity, and respect; they are willing to learn what they don't already know  
27 about the situation, and willing to take feedback from those who are most impacted/who are not in leadership  
28 positions.” - 26 Year old Female, Dual Degree Student

29  
30 By discussing the need to receive feedback from other stakeholders in the system, this quote relates directly to  
31 complexity theory in relation to systems and situational approach. They also directly refer to the need to work  
32 with additional experts and lead a collective, again confirming the appropriateness of collective leadership theory  
33 in this case.

34  
35 Poor leaders were described as arrogant and displayed a lack of accountability in their actions; characteristics  
36 that fit within the issues of traditional leadership theories. When describing negative leadership qualities, one  
37 student mentioned:

38  
39 “Blaming others for one's own shortcomings. In this pandemic, this is particularly detrimental, when we see  
40 leaders emerging and offering their talents in new ways (i.e. the auto executives shifting production to respirators

1 and ventilators), there is no reason to blame others. All of us can do something to help.” -28 Year old Female,  
2 Late Branches Student (M4)

3

4 These actions of blaming others and avoiding responsibility are the antithesis of shared leadership and further  
5 support this model's effectiveness in complex situations such as a global pandemic.

6

7 In the Pandemic Leadership model (figure 2), personal characteristics inform the use of information and altruistic  
8 team building, with unidirectional arrows. The intrinsic characteristics of the leader inform their orientation and  
9 response to the pandemic.

10

11

12

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