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Western Illinois University

Who Uses Telemedicine, Believers or Disbelievers of Covid-19 ?

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Introduction

The Covid-19 pandemic has claimed the life of 396,000 Americans, as at January 16, 2021[2]. The pandemic has strained the healthcare system; hospitals continue to experience record number of admissions and shortages of healthcare workers[3]. Elective procedures are being delayed due to fear of Covid-19 infection among elective cases[4].

To manage patient load and to ensure continuity of care, capable healthcare providers have turned to telemedicine[5]; telemedicine is the use of information and telecommunication technologies (ITC) by a healthcare provider to diagnose or treat a patient's medical condition[6]. Predictions are that telemedicine use would decline post pandemic[7].

A major premise of the argument for decline in telemedicine use, post Covid-19, is that the demand for telemedicine is primarily driven by the patient's desire to avoid Covid-19 infection when

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[2] John Hopkins University, Baltimore, MD
[3] https://www.wsj.com/articles/covid-19-surge-strains-hospitals-once-again-11605100312
[4] https://www.nejm.org/doi/full/10.1056/NEJMclde2028735
[5] For example, 47% of Medicare fee-for-service primary care visits in Illinois were provided via telehealth during April 2020, compared with an average of less than 1% before the COVID-19 public health emergency; see https://aspe.hhs.gov/system/files/pdf/263866/HP_IssueBrief_MedicareTelehealth_final7.29.20.pdf.
[6] US Code Citation: 42 USC §254c-16(a)(4).
[7] See for example, Grossman et al (2020). The future of telemedicine visits after Covid-19: perceptions of primary care pediatricians, *Israel Journal of Health Policy Research*, 9:53.

visiting a doctor's office[8]. In other words, the stronger is a patient's belief about the threats of Covid-19, the higher is the probability of her use of telemedicine. This paper empirically explores this assertion using a Bayes procedure[9]. The results of this research should help shape marketing strategies to position telemedicine in the healthcare marketspace. For example, if it is found that the odds of using telemedicine are the same for both believers and non-believers of Covid-19, then factors that are salient for telemedicine use should be identified and used to shape consumer responses to telemedicine.

Methodology

Data for the study came from 3154 respondents, all residents of the state of Massachusetts. The respondents were participants in the Blue Cross Blue Shield, Coronavirus tracking survey, conducted during April, 2020.[10] Respondents' beliefs about Covid-19 were measured using 14 items, all binary coded. For example, for the question, "Since the coronavirus crisis began, have you washed your hands more than usual", the "Yes" response was coded "1" and the "No" response was assigned a value of "0"; Table 1 lists all the 14 'beliefs' variables.

Table 1: Measures of Beliefs about Covid-19

Questions[11]	Value Labels and Definitions	
How closely have you been following news about coronavirus?	1 = Very or somewhat closely.	0 = Not too closely and not closely at all.
How serious of a threat do you think coronavirus poses to:	1 = Very or somewhat serious.	0 = Not too serious and not at all serious.
People across the state		
People in your city or town		
You personally		
Elderly people		
Which of the following best describes how you are approaching the coronavirus situation:		
Visiting anyone	1= Not seeing anyone.	0 = Seeing people.
Shopping	1 = Not going to stores.	0 = No change to my usual pattern.
Since the coronavirus crisis began, have you:		
Washed your hands more than usual	1 = Yes	0 = No
Avoid handshakes		
Cleaned common surfaces more than usual		
Changed how you get around your area		
Cancelled major travel plans		
Cancelled social plans		
To the best of your knowledge, are there enough Covid-19 tests		

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[8] See for example, https://patientengagementhit.com/news/patients-fear-losing-patient-provider-relationship-in-pcp-closures.

[9] Technically, it is the theorem "the stronger is a patient's belief about the threats of Covid-19, the higher is the probability of her use of telemedicine" that is tested.

[10] Micro data were obtained from Roper, #31117310.

[11] Questions have been trimmed, not a reproduction of the original.

To classify respondents based on beliefs about Covid-19, a cluster analysis of all the 14 items in Table 1 was implemented; the complete linkage clustering algorithm was used. The clusters' use of telemedicine, their education, income, and political affiliation were examined[12]; Zubin's *t* test was used to compare proportions of various groups manifesting a particular attribute[13]. In addition, Chi-square tests were used to test for independencies among qualitative variables in crosstabs.

The assertion that the probability of telemedicine use will be higher for a person who believes that the threat of Covid-19 is serious (call it H_1) was verified by computing posterior odds; letting H_2 stand for the alternate to H_1, that telemedicine

use will be higher for a nonbeliever of Covid-19, the posterior odds would be:

$$\frac{p(H1|D)}{p(H2|D)} = \frac{p(D|H1)}{p(D|H2)} \frac{p(H1)}{p(H2)}$$

where, the left-hand side is posterior odds; the first term on the right-hand is the likelihood ratio and the second term on the right-hand side is the prior odds.

Findings

In all, 1728 cases had complete responses for all 14 belief items and they were included in data analysis. The cluster analysis resulted in four clusters; see Figure 1.

Figure 1: Insights into Optimal Number of Clusters[14]
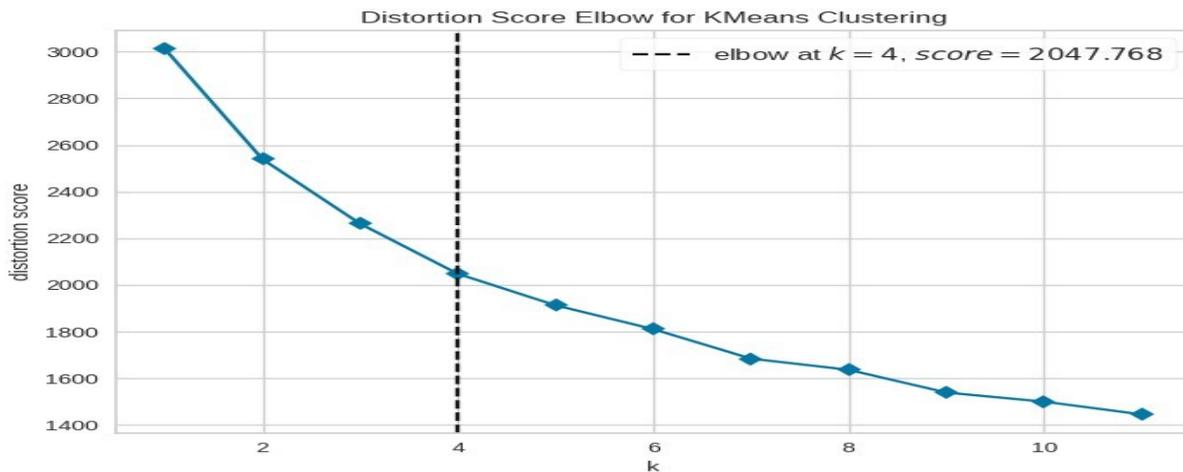
Table 2 profiles the clusters on belief variables that statistically differ among the clusters; as shown in the table, clusters A and D strongly believe that Covid-19 is a serious threat whereas clusters B and C do not believe that Covid-19 is a threat.

For example, majority of the nonbelievers engage in acts such as visiting "many people". In contrast, almost nine out of ten respondents who believe that Covid-19 is a threat do not even shake hands with others.

Table 2: Beliefs about Covid-19: Responses of Clusters

Cluster	Serious Threat for Me	Not Visiting Anyone	Avoided Handshakes	Enough Covid-19 Tests are Available	Number of Members
A	89%	64%	97%	15%	1487
B	17%	31%	57%	33%	104
C	16%	30%	33%	36%	131
D	83%	100%	89%	0%	6
Zubin's t (AD versus BC)	2.35	2.73	2.82	2.4	

Common features of the group include: 1 in 3 has a bachelor's degree; 1 in 4 earns less than $50,000 per annum; 1 in 2 claims to be an independent, not a Democrat or a Republican, and females believe more about the negatives of Covid-19, for example, that it is a serious threat for elderly people.

Figure 2 highlights group differences in the use of telemedicine; respondents who do not visit others or shake hands with others (the believers of Covid-19) tend to have used telemedicine more than nonbelievers of Covid-19. However, a Chi-square test of independence among variables failed to reject the hypothesis of independence between group membership and use of telemedicine[15]. Put another way, telemedicine use does not vary between believers and nonbelievers of Covid-19.

Figure 2: Telemedicine Use by Groups

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[15] Note: χ2 Critical =7.815; observed = 0.061.

Data from the cluster analysis suggest that the prior probability of a person being a Covid-19 believer is 0.86 and the probability of her using telemedicine is 0.31. The same numbers for a nonbeliever are 0.14 for the prior and 0.16 for the likelihood. The product of prior and likelihood gives the posterior (Table 3).

Table 3: Priors and Likelihood Ratios

Group	Probability (Prior)	Likelihood
Covid-19, believers	0.86	0.31
Covid-19, nonbelievers	0.14	0.16
Prob. of telemedicine use	0.92	0.08

Table 3 shows the results of Bayes analysis, posterior odds for use of telemedicine by Covid-19 believers and nonbelievers. The table answers the question about the probability of a telemedicine user being a believer of the threats posed by Covid-19, for example, that the virus poses a serious threat for the elderly; a randomly chosen telemedicine user being a believer of the threats of Covid-19 is 0.92.

Summary and Conclusion

The user of telemedicine is highly likely to hold the belief that Covid-19 is a serious threat to the city, town or the nation. This doesn't mean that nonbelievers of Covid-19 do not use telemedicine; in fact, telemedicine use is based on beliefs other than Covid-19 threat perceptions. What are the determinants of telemedicine choice?

Economic theory states that product choice is based on utility maximization; the goal of human action is to seek pleasure and avoid pain. Every object or action may be thought of from the point of view of pleasure or pain inflicting properties. These properties are called the utility of the object, pleasure is provided by positive utility and pain by negative utility.

Time and cost have been suggested as salient attributes or positive utilities of telemedicine[16]. Negative utilities include loss of social contact with the doctor and lack of security and confidentiality of health records[17]. For telemedicine to

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[16] See for example, Kammbwa B., Ratcliffe, J., Shulver, W., Killington, M., Taylor, A., Crotty, M., ... & Kidd, M. R. (2017). Investigating the preferences of older people for telehealth as a new model of health care service delivery: A discrete choice experiment. *Journal of Telemedicine and Telecare*, *23*(2), 301-313.

[17] Low, J. A., Toh, H. J., Tan, L. L. C., Chia, J. W. K., & Soek, A. T. S. (2020). The Nuts and Bolts of Utilizing Telemedicine in Nursing Homes –The GeriCare@ North Experience. *Journal of the American Medical Directors Association*, *21*(8), 1073-1078.

become successful, research is needed to understand benefits that are important for the potential users of the service. This research has shed some light on people who use telemedicine; my previous research on the topic explored the environment in which telemedicine gains awareness in the marketplace[18]. Future research will explore the value people ascribe to telemedicine.

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[18]   See http://www.iira.org/wp-content/uploads/ 2021 /01/telemedicine_awareness_v3_1.pdf.