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Introduction

In marketing, consumer action (for example, purchase behavior) is often modeled as a hierarchy; a simple model would link consumer need to product purchase[2]. In the simple model, the intervening variable, "awareness", is part of the product purchase variable; the model is most relevant for healthcare, particularly primary care, since patient loyalty is high in the sector[3].

However, for telemedicine to occur as a response to seeing a doctor, the patient has to learn about it, answer the "what is it" question. This learning often takes place at the doctor's office; for example, while calling for an appointment, the doctor's office may suggest telephone or video consultation over the traditional, office visit[4].

To what extent did awareness about telemedicine change during the Covid-19 pandemic? Is awareness related to the demographics of the population? This paper explores these and other related questions.

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[1] Professor, Illinois Institute for Rural Affairs, Western Illinois University.

[2] Expressed as a hierarchy, the effect would be from Need → Purchase

[3] A loyal patient would have learned or internalized the stimulus-stimulus association between *need* for primary care and her primary care provider; according to a recent survey from the Centers for Medicare and Medicaid Services, 95% of patients repeat visit their physician; see Medicare Current Beneficiary Survey, Summer Supplement, 2020.

[4] Patients may also self-select themselves for telemedicine, for example, by logging in to the patient portal or website of the healthcare provider.

Methodology

The data for the research came from the Covid-19 Summer 2020 supplement to the Medicare Current Beneficiary Survey (MCBS), conducted during June-July 2020[5]. The survey questions on telemedicine were recoded and used as the criterion variable (Algorithm 1).

ALGORITHM 1: Awareness Inference

Input:

ACV_TELMED[6]
1 = Yes
2 = No
D = Don't know

ACV_TELMEDBE[7]
1 = Yes
2 = No
D = Don't know

Output:

Awareness of telemedicine (AWTM); two levels with level 1 = aware now because of the pandemic and level 2 = have always been aware

> **for** ACV_TELMED = 1 and ACV_TELMEDBE = D **do**
> create AWTM = 1
>
> **for** ACV_TELMED = 1 and ACV_TELMEDBE = 1 & 2 **do**
> create AWTM = 2
>
> **end**

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[5] The Centers for Medicare & Medicaid Services (CMS) sponsor the MCBS, a longitudinal survey of a national sample of the Medicare population; see https://www.cms.gov/Research-Statistics-Data-and-Systems/Research/MCBS.

[6] Variable label or definition: PCP offers telehealth appointments.

[7] Variable definition: PCP offered telehealth before Covid-19.

To gain insights into the influences of demographics on awareness of telemedicine, crosstabulations were performed with AWTM (awareness) as the dependent variable and respondent's age, gender, race, and household income as predictors; area of residence (metro or nonmetro) was used as a control variable. The Chi-square test of independence, with type 1 error set at 5% level, was used to screen for statistically significant associations between the criterion variable and the predictors. Bayesian procedures were also used to understand multivariate associations between the criterion and the predictors.

Results

Crosstabs

Covid-19 made more people in the Midwest learn about telemedicine. The West had the most awareness about telemedicine; almost 4 out of 5 residents in the west were aware of the service during the pre-pandemic time period (Table 1).

Table 1: Awareness about Telemedicine: US Regions

	Midwest	Northeast	South	West	All Regions
Covid-19 induced awareness	32%	25%	25%	21%	25%
Pre-pandemic awareness	68%	75%	75%	79%	75%
Number of Respondents (mil)	7.11	5.85	11.47	7.73	32.17

Note: $\chi2 = 219,928$, $p < 0.01$

To learn more about the low awareness rate for telemedicine in the Midwest region, a number of bivariate analysis was implemented. As shown in Table 2, it is more of the metro residents that became aware of telemedicine services during the pandemic; seven out of ten nonmetro residents were already aware about the services when Covid-19 struck the nation in January 2020.

Table 2: Telemedicine Awareness in the Midwest: Metro and Nonmetro Differences

	Metro	Nonmetro
Covid-19 induced awareness	33%	28%
Pre-pandemic awareness	67%	72%
Number of Respondents (mil)	5.21	1.89

Note: $\chi2 = 19,802$, $p < 0.01$

Other insights from bivariate analyses include: (i) females have low awareness of telemedicine service, (ii) wealthier the individual, lower is the awareness about telemedicine, (iii) people less than 65 years old have more awareness of the service, in both the metro and the nonmetro, and (iv) people of color are more aware of telemedicine.

Bayesian Analysis

The bivariate analysis suggests the following variables, classified dichotomously, are important

predictors of awareness[8]:
  z_1 - person is a male;
  z_2 – person's income is less than $25,000 per year;
  z_3 - person is less than 65 years of age, and
  z_4 – person is nonwhite.

Table 3 shows the 16 possible patterns of the dichotomous predictors z_1 to z_4 and the associated conditional probabilities for each level of AWTM. These conditional probabilities are empirically observed proportions derived from the MCBS.

Table 3: Respondents' Demographics Associated with Levels of Awareness (AWTM) and Associated Conditional Probabilities

		Pattern			Conditional Probabilities P(Zi/AWTM)	
Z_i	z_1	z_2	z_3	z_4	AWTM = 1	AWTM = 2
1	0	0	0	0	0.115	0.088
2	0	0	0	1	0.007	0.021
3	0	0	1	0	0.039	0.056
4	0	0	1	1	0.012	0.013
5	0	1	0	0	0.422	0.337
6	0	1	0	1	0.031	0.023
7	0	1	1	0	0.012	0.014
8	0	1	1	1	0.000	0.006
9	1	0	0	0	0.041	0.038
10	1	0	0	1	0.006	0.013
11	1	0	1	0	0.023	0.035
12	1	0	1	1	0.001	0.008
13	1	1	0	0	0.262	0.304
14	1	1	0	1	0.008	0.015
15	1	1	1	0	0.021	0.027
16	1	1	1	1	0.000	0.003

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[8] Based on $\chi 2$ tests for independence between the criterion and the predictor variables; awareness = AWTM.

Table 3 suggests that given the respondent is classified as AWTM = 1 (awareness about telemedicine came about because of the Covid-19 pandemic), the probability of **her**:

> earning more than $25,000 per year, **and**
> being more than 65 years old, **and**
> being white

is $P(Z1 \mid AWTM = 1) = .115$; that is, about 12% of all those respondents classified as "Covid-19 induced awareness" did not possess attributes z_1 to z_4. Given that the respondent was classified "AWTM = 2 (had pre-pandemic awareness about telemedicine), however, only about 8% had null values for attributes z_1 to z_4.

Summary and Conclusion

This paper set out to address two questions about telemedicine: (i) to what extent did awareness about telemedicine change during the Covid-19 pandemic and (ii) is awareness related to the demographics of the population. Data from the MCBS were used to address the questions.

Of the 32.17mil Americans who are aware of telemedicine as at June-July 2020, 32% gained this awareness during the Covid-19 pandemic. In general, awareness about the service increased greatly among people with more than $25,000 in yearly income.

In conclusion, although the presence of Covid-19 is unfortunate, it is also an opportunity to provide more convenient, cost-effective, telemedicine service to patients. The pandemic has created awareness of telemedicine; it is hoped that this awareness will translate into liking of the service and its use by patients.