

A Comparative Cohort Study of Cardiac Outcomes in Outpatients Cared for over the Telephone Versus in-Person During the COVID-19 Pandemic

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Abstract: To slow the spread of coronavirus-2019, many healthcare providers in Canada transitioned to tele-health in order to treat patients and minimize office visits. We investigated if the type of patient-physician encounter: in-person versus tele-health phone consultation, has an impact on cardiovascular outcome in an outpatient cardiac clinic in Toronto, Ontario. We conducted a comparative cohort study between patients seen in the office and patients who spoke to the physician by phone. Demographic data was collected on both groups regarding, age, symptoms, and cardiac diagnoses. Both sets of patients underwent physiological testing prior to meeting with the physician. Outcome measures included unplanned phone calls or visits, procedures, hospitalizations, and death. *Results:* 47 patients were seen in the office and 50 patients were seen via tele-health phone consultation. Patients were all non-selected sequential. Metrics of demographic data did not differ between groups regarding age, sex, symptoms (palpitations, dyspnea, syncope, chest pain), and diagnoses (arrhythmia, coronary artery disease, devices, valve, heart failure, or cardiomyopathy). Odds ratio (OR) was calculated to compare outcome measures. Unplanned phone calls or visits (OR 1.61, CI 0.72, 3.61), procedures (OR 0.94, CI 0.13, 6.95), hospitalization (OR 0.93, CI 0.03, 2.89), and mortality (OR 0.46, CI 0.04, 5.25). We conclude that cardiovascular outcomes assessed did not differ by type of physician encounter. Both groups saw similar rates of physician intervention and changes to treatment plan. Further research into implications of tele-health on physician and patient satisfaction are needed.

Keywords: Tele-medicine, Cardiology, Cardiovascular, Arrhythmia

1. Introduction

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), responsible for the coronavirus disease 2019 (COVID-19) [1], altered medical care and practices to fit the new and changing pandemic conditions. To slow the transmission of COVID-19 and follow social distancing regulations, healthcare providers pivoted their practices from the traditional model of facility and office-based healthcare

delivery to tele-health, such as audio telephone call and video call [2]. As of April 2020, 43.5% of all out-patient primary care visits in the U.S.A. were conducted via tele-health as compared to less than 1% two months earlier [3]. The Canadian Cardiovascular Society and the Heart Failure Society of America recommended virtual methods of care [4]. This saw an exponential uptake of virtual care across Canada with 91.2% completed successfully by telephone audio-calls alone, instead of video call [5].

Patients with underlying cardiovascular disease are at increased risk for adverse outcomes if they are infected with COVID-19. Therefore, it is important to protect these vulnerable people with cardiovascular disease and provide appropriate follow up monitoring [6]. Prior to COVID-19, application of tele-health for cardiovascular disease was studied in the context of heart failure management with good results to significantly reduce hospitalizations for heart failure reasons [7, 8]. During the COVID-19 pandemic, tele-health across numerous specialties was shown to correlate with high patient satisfaction [9]. In cardiology, this finding held true, and patients reported high satisfaction regarding quality of care following tele-health outpatient visits. Factors that particularly improved patient satisfaction were convenience in terms in travel, gender, and non-white ethnicity [10].

We sought to investigate the quality of the clinical impact of this transition on cardiovascular outcomes over one year in a tertiary care clinical setting.

2. Methods

We conducted a comparative analysis between two groups of non-selected patients; a control group seen unmasked and face to face in the office prior to the COVID-19 pandemic, and a study group seen during the pandemic assessed via tele-health telephone only consultation. We chose our sample out of convenience because this work was initially preformed as a quality assessment. Forty-seven patients were seen by the physician in-person at the clinic between March 18th to 19th, 2019, and 50 patients were seen via a tele-health phone consultations between March 20th and 30th, 2020, following the start of the COVID-19 pandemic. All patients were cared for by the same outpatient tertiary care outpatient clinic specializing in arrhythmia related management.

Newly referred patients seen in-office completed pre-planned tests before their visit according to physician discretion. Returning patients had tests prearranged as part of their care management plan. Physiological tests included: cardiac echocardiography, ambulatory ECG monitoring and blood work. Exercise stress tests and vascular doppler studies were completed by selected patients. Test results were obtained by the office prior to physician encounter with patient.

During the in-person office visit, the patient first met with a healthcare professional to review current symptoms, blood pressure, review medications taken and review important concerns. This data was abstracted to the digital chart and then reviewed by the physician when they met with the patient where current symptoms, history, and physical exam were reviewed again in-person. After the clinical assessment a therapy plan was established. As needed, expert translators were available and utilized in the office.

During the pandemic, patient visits were restricted to the purpose of acquisition of physiologic data, there was no in-person physician encounter during these visits or health care professional abstraction of symptoms, concerns, or medications. The patients only met with the physician via a

scheduled tele-health phone call to review physiologic data, symptoms, history, upon which as needed adjustment were made in management program. Physical exam and blood pressure data were not available at that time. As needed, family members acted as translators. All tele-health interactions were by phone only.

One physician treated all the in-person patients at the same location and from the same referral base. During the COVID-19 pandemic, all patients in the clinic were moved to tele-health. All patients coming to the clinic for physiological tests were first screened for COVID-19 symptoms by phone prior to visit and then again on arrival to the clinic. Standard PPE and masks were worn, and social distancing was maintained in accordance with Ontario regulations. Blood work was completed at local laboratories.

Treatment plans and cardiac clinical outcome data was collected via chart review using a commercial EMR data system (CerebrumTM, Aware MD/Well Health, Vancouver, Canada) in January 2022. Outcome measures included unscheduled phone calls or visits to the clinic for symptomatic cardiac problem, emergency room visits, unplanned procedures, hospitalizations, and death. Demographic variables collected include age, gender, new or returning patient, cardiac medical diagnosis, pre-encounter medical tests, and management changes at principal visit. The chart review process was completed under the consistent supervision of the clinician and principal investigator of this study, DN, by the authors, LS and HB. Patient deaths were confirmed by family doctors or patient families.

2.1. Statistical Analysis

The demographic data from both groups was first analyzed about age, sex, diagnosis, initial testing, length of follow-up, new or returning patient status, and number of changes to management during the appointment. We wished to assess if the nature of patient-physician meeting influenced management. This was done through assessing the averages between both groups and using a chi-squared test or a student's t-test, where applicable, to calculate a p-value for certain metrics. By design, the same time frame of analysis was used and set one year apart.

The primary analysis included outcome measures such as unscheduled follow-up phone calls or visits, unplanned procedures, hospitalization, and death from all participants according to their respective cohort. For each outcome, we initially analysed the data through descriptive statistics including various central tendency and variability measures, distribution properties, outlier detection, and means assessed through unpaired nonparametric tests. We then estimated odds ratios (ORs) and 95% confidence intervals (CIs) to quantify the associations between appointment type (in-person/virtual) and various cardiovascular-related outcomes.

2.2. Ethical Statement

All patients were managed as part of usual clinical practice under the sole care of the physician/senior author (DN) at the

clinic. No personal health record data was accessed other than that routinely available in clinical care by the physician. This study is a part of quality assurance initiative in response to changes in clinic policy related to the pandemic and to the requirements for patient care, all changes in practice were initiated for no other purpose. As such this report falls below the level of scrutiny required for formal Research Ethics Board approval process with no concerns about the adequate protection of participants according to the standards of the Tri-Council policy on ethical conduct for research involving humans (TCPS 2) [11].

3. Results

Ninety-seven patients were follow-up for a total of 34 months \pm 1 day in the in-person group and 22 months \pm 4 days for the tele-health group. New patients made up 13% and 6% of the sample in the in-person and tele-health groups respectively ($p=ns$). An arrhythmia diagnosis was present in 45% of patients.

Of the 47 patients seen in the office, the mean age was 72 \pm 4 years, the majority was male (56%) and 13% were new patients. Most common symptoms included: Palpitations (15%), Dyspnea (2%), Syncope (2%) and Chest Pain (1, 2%). The chief diagnoses included: Arrhythmia (57%), Hypertension (43%), coronary artery disease (CAD) (17%), Devices (15%), Valve (4%), Heart failure (2%), and Cardiomyopathy (0%). Tests obtained prior to physician meeting included echocardiography (echo) (40%), electrocardiography (ECG) (15%), 24-hour ambulatory ECG monitoring (6%), 48-hour ambulatory ECG monitoring (13%), 72-hour ambulatory ECG monitoring (11%), 14-day

ambulatory ECG monitoring (15%), stress echocardiography (SE) (23%) and carotid doppler (2%).

Of the 50 patients seen via tele-health, the mean age was 71 \pm 4 years, the majority were female (56%), and 3% were new patients. The most common symptoms included: Palpitations (18%), Syncope (2%), Chest Pain (0%), and Dyspnea (0%). The chief diagnoses included: Arrhythmia (62%), Hypertension (50%), CAD (12%), Devices (6%), Valve (8%), Heart failure (2%), and Cardiomyopathy (4%). Tests obtained prior to physician meeting included echo (30%), ECG (6%), 24-hour ambulatory ECG monitoring (4%), 48-hour ambulatory ECG monitoring (4%), 72-hour ambulatory ECG monitoring (44%), 14-day ambulatory ECG monitoring (4%), SE (16%) and carotid doppler (0%).

Between group analyses showed significant differences only for a higher percentage of patients treated via tele-health receiving a 14-day ambulatory ECG monitoring prior to the visit ($p<0.01$) with more in-office visit patients completed 3-day ambulatory ECG monitoring ($p<0.05$). The remaining comparisons showed no significant differences (Table 1).

Odds ratio (OR) and proportions of events (%) were calculated to compare outcome measures. Unplanned phone calls or visits (OR 1.61, CI 0.72-3.61), procedures (OR 0.94, CI 0.13-6.96), hospitalization (OR 0.93, CI 0.30-2.89), and mortality (OR 0.46, CI 0.04-5.25). (Table 2, Figure 1). While unplanned visits/calls had an OR over 1, the 95% confidence interval extended past OR = 1. The rest of the outcomes; unplanned procedures, hospitalization, and death, all had OR less than 1. The proportions of unplanned phone calls or visits was 38.3% vs 50%, procedures were 4.3% vs 4%, hospitalization was 14.9% vs 14%, and mortality was 4.3% vs 2%, in in-person vs tele-health groups, respectively (Table 3).

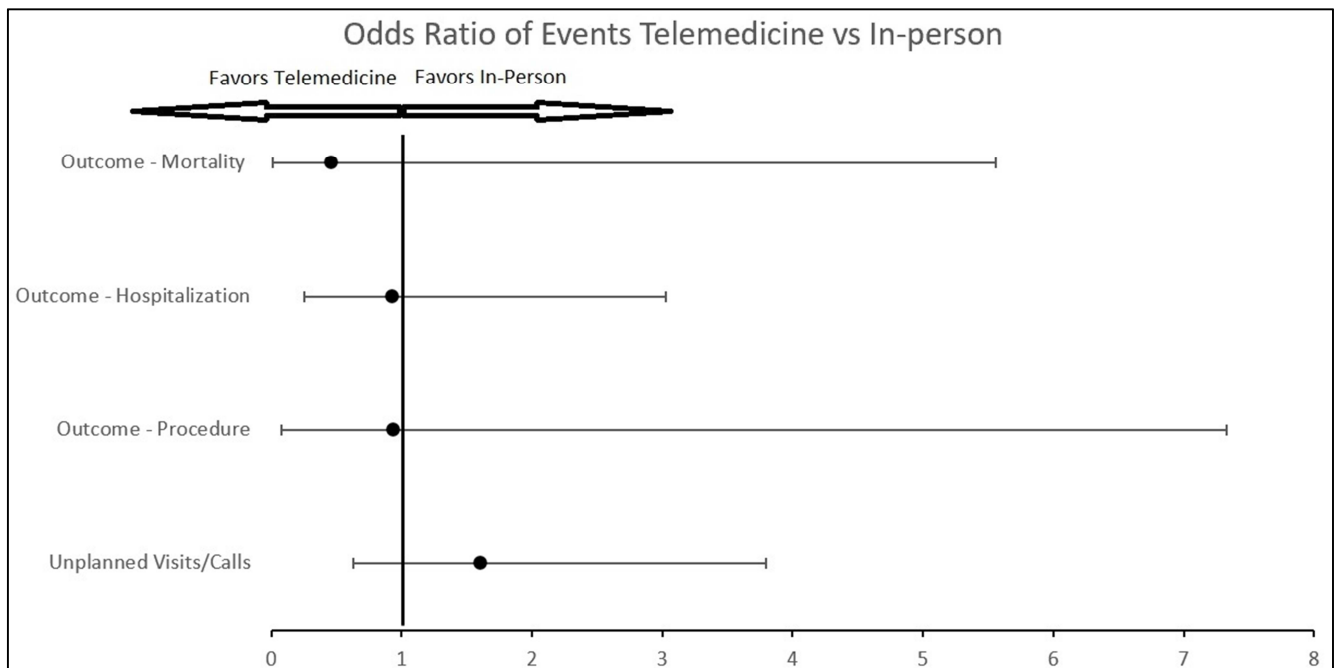


Figure 1. Odds ratio (OR) of the various tracked outcomes between the in-person group and the telemedicine group. The OR value for unplanned calls and visits extended over 1, as did the confidence interval.

Table 1. Demographic Data: 24-hour ECG monitoring (H1), 48-hour day ECG monitoring (H2), 72-hour ECG monitoring (H3), 14-day ECG monitoring (H14), CAD (coronary artery disease), Echo (echocardiogram), ECG (electrocardiography), and SE (stress echocardiogram).

Demographic Data		In-Person visit	Tele-med phone consultation	P-value
Symptoms	Number of patients	47	50	ns
	Age (mean)	72	71	ns
	Gender (F)	44%	56%	ns
	New/Returning Patient	13%	6%	ns
	Palpitations	15%	18%	ns
	Syncope	2%	2%	ns
	Dyspnea	2%	0%	ns
	Chest Pain	2%	0%	ns
	Arrhythmia	57%	62%	ns
	CAD	17%	12%	ns
Diagnosis	Devices	15%	6%	ns
	Valve	4%	8%	ns
	Hypertension	43%	50%	ns
	Heart Failure	2%	2%	ns
	Cardiomyopathy	0%	4%	ns
	Echo	40%	30%	ns
	ECG	15%	6%	ns
	H1	6%	4%	ns
Initial Testing	H2	13%	4%	ns
	H3	11%	44%	0.0002
	H14	15%	2%	0.02
	SE	23%	16%	ns
	Carotid Doppler	2%	0%	ns
	Changes in management	38%	40%	ns
	Length of follow-up (months)	34	22	

Table 2. Outcome measures.

Odds Ratio Table		
Event	Odds Ratio	95% CI
Unplanned Visits/Calls	1.61	(0.72-3.61)
Procedure	0.94	(0.13-6.96)
Hospitalization	0.93	(0.30-2.89)
Mortality	0.46	(0.04-5.25)

Table 3. Proportion of Outcome Events.

Proportion of Outcome Events		
Event	In-Person	Telemedicine
Unplanned Visits/Calls	38.3%	50%
Procedure	4.3%	4%
Hospitalization	14.9%	14%
Mortality	4.3%	2%

4. Discussion

In the process of a clinic quality assurance evaluation, we have found that when the only major variable changing is whether the clinical encounter is in-person or by telephone there is no significant difference in care management and cardiac clinical outcome among a consecutive series of non-selected patients coming to a cardiology outpatient arrhythmia clinic. There are no differences in phone calls, unplanned visits, hospitalizations, or death due to a cardiovascular cause over a discrete period.

To our knowledge, this is the first study to assess the

impact of type of physician-patient encounter on outpatient clinical cardiac outcomes. Although the small sample size may result in a lack of statistical power, our finding is supported by similar analysis/studies in other specialty health settings of diabetes, asthma, and inflammatory bowel disease [12-14].

In both groups, encounter in person or by phone led to a change in therapy by 38% and 40% respectively (p=ns). This suggests that quality of clinical care is comparable when decisions on management are informed by physiologic data collected in advance of a direct patient-physician encounter. We cannot determine with this data how much of the change in therapy was based on physiological data or the result of interaction with the patient. It is clear however, that changes in therapy occur regardless of interaction type.

In both groups there was a similar and large amount of physiological testing. The only difference is a larger proportion of 14-day compared to 72-hour ambulatory holter monitoring on the tele-health group compared to the in-person groups. There is no ready explanation for this lone difference in testing, which seems to have had no measurable impact and perhaps was influenced by the fact that longer monitored patients were known to be phone follow up only.

Our data has potentially important quality improvement implications. As we move into a post-pandemic world, the possibility that phone only tele-health may continue as a significant mode for outpatient healthcare delivery remains [15]. The necessity for an additional video signal for tele-

health technologies is not clear. Our study found no differences in measurable outcomes using phone only telehealth. A change in policy to mandate or preferentially encourage a video signal for telemedicine, as has recently taken place in Ontario, Canada [16], does not have a proven superiority and from this data would be unlikely to so improve patient care [17, 18]. Cho *et al* found in 91% of 1034 patients treated by phone-only tele-health benefitted from care with a high degree of patient satisfaction in Ontario [10]. Phone only follow up has the benefits in allowing ease of access with low intensity technology requirement. Furthermore, the phone is convenient and accessible with respect to patients of all ages and technological capacities, and for physician convenience and location.

5. Limitations

Our study focuses on a single variable: phone vs in-person, in clinical cardiac outpatient practice which is primarily serving arrhythmia patients. By design aspects of this study may limit the generalizability of our conclusions: the sample is small, confined to a single physician in a cardiac arrhythmia outpatient setting with a large amount of physiological testing in both groups. This allows an analysis of only the effect of patient encounter type, and controls for confounding variables. As well, there was a long-term care relationship present in many patients with 13% and 6% of patients being new patients in the in-person versus tele-health groups respectively. Although the outcomes measured are unambiguous, there may be other differences present that are important even if there was no impact on primary outcomes measures. Of note, patients were seen at the same time of year in consecutive years to further decrease bias in patient selection.

Non-verbal signs, such as posture, gaze, touch, and voice quality, impart profound information and their absence has been theorized to damage the patient-physician relationship [19]. It may impede trust building, empathy, and overall patient outcomes [20]. It is possible that these important but not measured attributes would have an impact on an unmeasured parameter of patient satisfaction or health-related quality of life. The relative value of such differences, if present, are not known.

We did not formally assess the impact of phone only intervention on physician professional satisfaction, which we believe warrants further study as tele-health may see a rise in physician 'burnout' [21].

6. Conclusion

We have found no measurable difference between in-office encounters compared to tele-health phone only consultation in an outpatient cardiology arrhythmia setting. We have seen comparable physician intervention in care management in both groups. As such, we suggest that care can be maintained by phone-only tele-health encounters in an established patient-provider practice. Further research into implications of tele-health on physician and patient satisfaction are needed.

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