Initial Communication Media and Patient Revisit: Evidence from a Mental Healthcare Platform

Abstract

Sustaining user engagement is challenging for digital platforms, particularly in telehealth for chronic diseases, as patients' regular revisits are crucial. Yet it is unclear whether and how patient subsequent engagement is affected by initial communication media. Leveraging data from a mental healthcare platform, we classify service media into sync (audio, video) and async (text) and examine their relative effects. First, we observe disproportionately more revisits and larger health improvement associated with initial services over sync media, a finding that is consistent across different causal identification methods. Next, we explore the underlying mechanisms and show that the effect can be explained by cue multiplicity in sync-media communication. Finally, we capture effect heterogeneity using machine learning techniques and suggest that targeting and nudging patients with a high risk of health deterioration to use sync media for service communication is the most effective platform strategy to sustain patient engagement and improve their health.

Keywords: Digital Platform, Mental Health, Patient Revisit, Communication Media, Targeting Strategy, Machine Learning

Sustaining user engagement is a major challenge for digital platforms as many users only consume once and then become inactive (Ascarza et al. 2018; Gu et al. 2022). Although platforms have made substantial investments (e.g., informative and persuasive adverts and monetary incentives) in attracting consumers to re-engage in their services, these efforts are often futile. The recent industry report from TechSee indicates that the customer churn rate in online retail is as high as 22%. Another report from Zaius demonstrates that 75% of first-time customers do not make a second purchase from the same eCommerce platform. This is more concerning in telehealth for chronic diseases (e.g., mental disorders) as patients with such conditions require continuous treatments from physicians to maintain stable health conditions (Ormel and VonKorff 2021). To maximize the advantages of telehealth for mental disorders, it is critical to optimize the service design to motivate patient revisits in online healthcare services.

In response to these practical dilemmas, Information Systems (IS) literature has examined different strategies for user engagement in a variety of contexts, such as online learning (Leung et al. 2022), gaming (Gu et al. 2022), and dating (Jung et al. 2019). Extant research mainly focuses on the *content design* of informational incentives (e.g., Yang et al. 2019), while little is understood about the role of *media* that convey such content in online healthcare. We aim to address this gap by focusing on whether and how different media (text, audio, video) incentivize subsequent patient engagement. In addition, as the first impression may influence subsequent individual behaviors and many digital platforms only have one chance to attract users to stay, this study focuses on the impacts of the first online service (Tversky and Kahneman 1974). Second, IS literature on media has mainly focused on internal organization communication (e.g., Ferran and Watts 2008). We extend this stream of literature to external communication between patients and physicians on online healthcare platforms and explore different service experiences across media types. Finally, emerging literature in platform operations has studied targeting strategies for specific consumer segments to optimize the effectiveness of interventions and mitigate unnecessary side effects (Ascarza 2018; Lemmens and Gupta 2020). We design and evaluate different targeting strategies in telehealth to support personalized care and service continuity.

Integrating the above challenges and opportunities in platform practice and research, we aim to examine the role of different communication media for the initial online healthcare service, considering their relative effects on patient revisits and health improvement. We also delve deep into the underlying mechanisms of these effects and aim to contribute a data-driven strategy for patient subsequent engagement to platform practice and research by assessing various personalization strategies when applying media-based interventions to encourage patient revisits and improve patient health.

To study the service communication media, we collaborate with a leading Chinese mental healthcare platform and have acquired a unique large-scale dataset of over 21,000 patients. Each observation gives detailed information about a patient, including demographics, health status, their physician's attributes, service communication medium, and subsequent usage behaviors. First, we examine the media effects using Ordinary Least Squares (OLS) estimation for the baseline regression analysis. We find that sync-media (audio or video) communication in the first service leads to statistically significantly (at 95% confidence intervals) more patient revisits, by 10.1% in revisit probability and 12.2% in revisit frequency, than async medium (text) communication does in the following month.

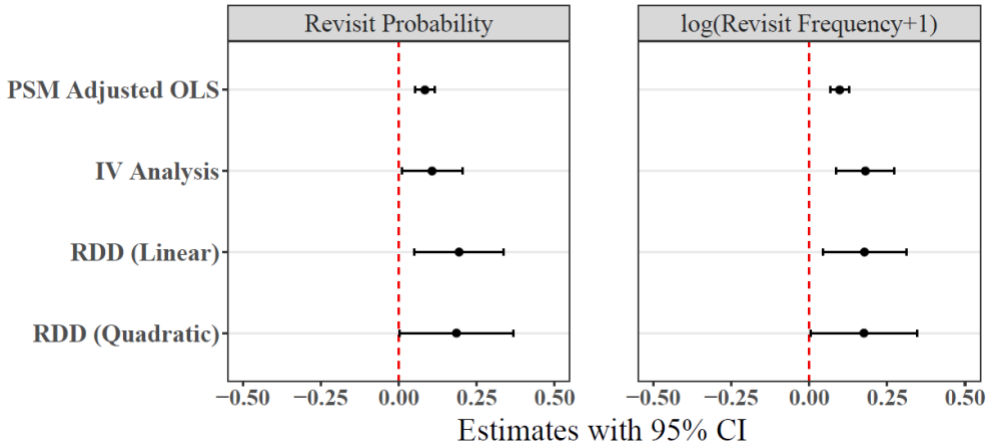

Figure 1. Relative Effects of Initial Sync (vs. Async) Media Communication on Patient Revisit

To cross-validate the findings, we adopt multiple causal identification methods, including propensity score matching (PSM), instrumental variables (IV) analysis, and a fuzzy regression discontinuity design (fuzzy RDD). For the IV analysis, the first instrument is the percentage of sync

media usage by the same physician with *other* patients before the focal service. The second instrument is a dummy variable denoting whether the corresponding physician has opened up sync media before the focal service. Both instruments are valid as they strongly correlate with the sync media usage but do not directly affect the focal patient's behavior. For the fuzzy RDD, the running variable is the patient's first service time, and the cutoff value is the time when the patient's physician opens up sync-media services. The RDD analysis is restricted to a 10-day symmetrical window around the cutoff and uses 2SLS regressions with linear and quadratic smooth functions to obtain RDD estimates. The consistent estimates from PSM, IV, and Fuzzy RDD corroborate the positive effect of sync media communication (Figure 1).

In addition to patient revisit, we examine the changes in health conditions after the initial sync-media (versus async-media) service using patient self-reported data from online surveys before the first and second services, respectively. We find that sync-media communication statistically significantly increases the curative effect and decreases symptom severity and suicide tendency (Figure 2).

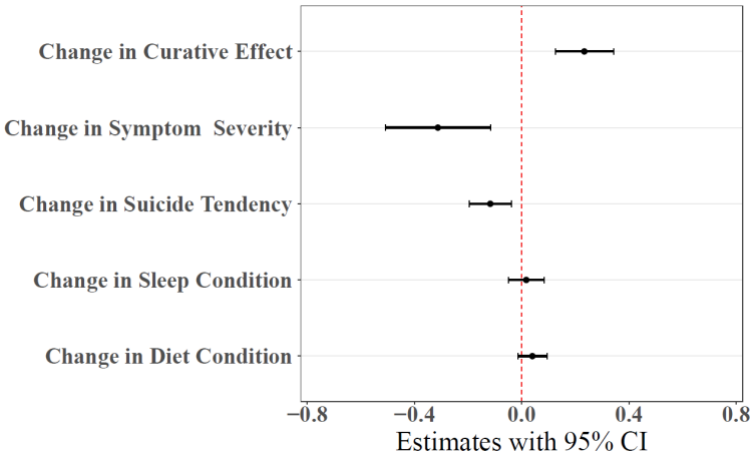

Figure 2. Relative Effects of Initial Sync (vs. Async) Media Communication on Health Conditions

Having established compelling evidence for the effect of initial media communication on patient revisit and health improvement, we further explore the underlying mechanisms. IS and media literature suggest that feedback immediacy and cue multiplicity may explain the performance differences across media (Dennis and Kinney 1998; Kahai and Cooper 2003). Audio and video outperform text in these two factors as they support higher response speed and more cues (e.g., tone or facial expressions) (Table 1).

Table 1. Differences in Feedback Immediacy and Cue Multiplicity among Media

	Feedback Immediacy		Cue Multiplicity		
	Low	High	Verbal Cue	Vocal Cue	Visual Cue
Text	√		√	√	√
Audio		√		√	√
Video		√			√

We empirically explore the role of feedback immediacy and cue multiplicity in healthcare communication by conducting pairwise comparisons of media effects on patient revisits. We find that while both audio- and video-based services show positive impacts relative to text-based ones, video can incentivize more revisit frequency than audio (Figure 3). Despite further evidence needed to better distinguish feedback immediacy from cue multiplicity, the relative advantage of video (versus audio) in enhancing revisit frequency suggests the value of visual cues in mental healthcare engagement.

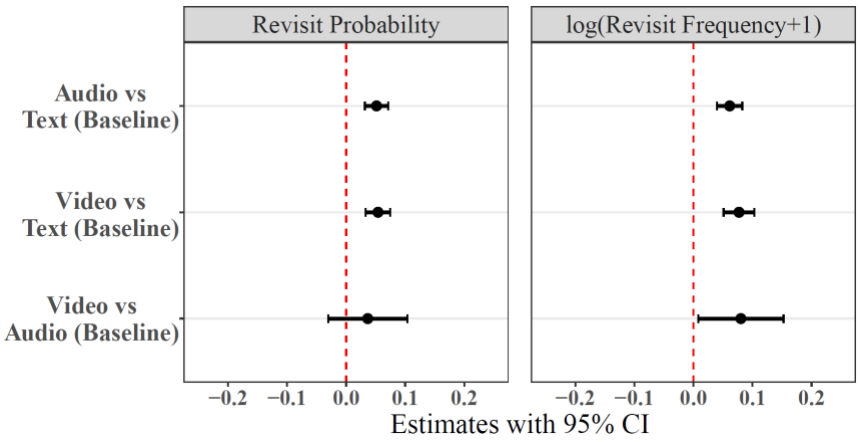

Figure 3. Pairwise Comparisons of Media Effects on Patient Revisit

Finally, to implement effective media-based interventions (i.e., initial sync-media communication) for patient revisits and health improvement, we assess different targeting strategies in their performance to maximize the welfare of all stakeholders (i.e., patients, physicians, and the platform). We adopt three user retention strategies suggested by marketing literature: (i) targeting users with the highest probability of churning (*churn risk*) to intervene, (ii) targeting users with the highest increment of retention probability if intervened (*retention lift*), and (iii) targeting users with the highest increment of profit if intervened (*profit lift*). Considering the importance of patient health conditions in our context, we

also consider a new strategy, (iv) targeting users with the highest probability of health deterioration (*health risk*). We estimate and compare the effectiveness of these targeting strategies by leveraging machine learning techniques. We first compare various algorithms (e.g., logistic regression, random forest, and XGBoost) and select the random forest model due to its greatest predictive performance to predict the scores for *churn risk*, *retention lift*, *profit lift*, and *health risk* of each patient. Second, we rank the patients based on these predicted scores (descending) and segment them into deciles (i.e., 0-10%, 10%-20%, …, 90%-100%). Finally, we select the top P of patients (e.g., 30%; P=100% if the platform targets the whole patient base) as the "targeted subgroup" and replicate the baseline estimates to obtain and compare the effects of sync-media for all "targeted subgroups" across the four targeting strategies. The result suggests that, considering resource constrain to apply media-based interventions (e.g., top 30% patients), while *retention lift* is the optimal choice to improve patient revisits, targeting patients with higher *health risk* is a better strategy for its optimal performance in improving health conditions and suboptimal performance in incentivizing patient revisits (Figure 4).

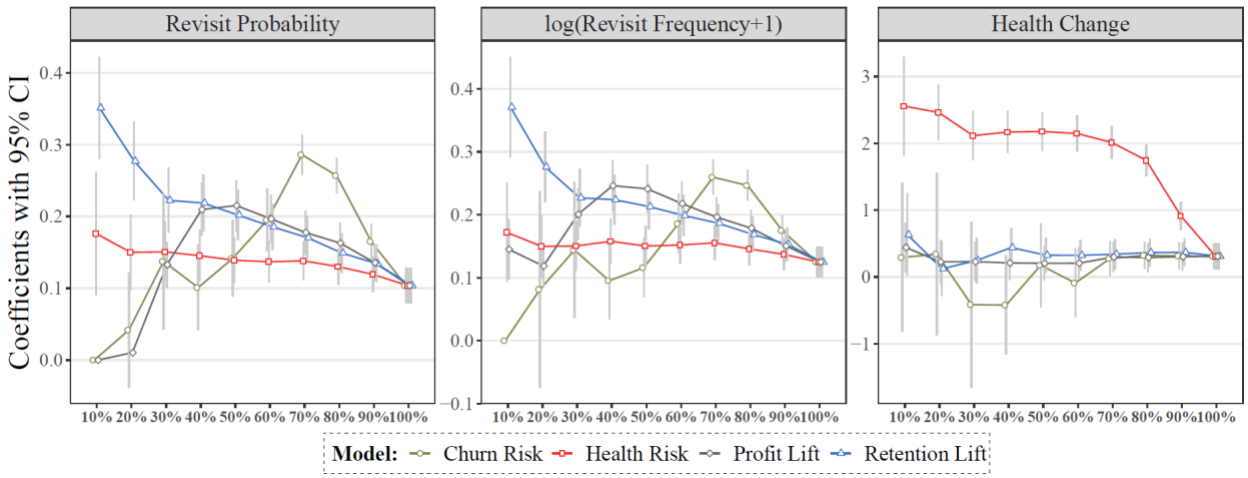

Figure 4. Treatment Effects for Top N Deciles across Four Platform Targeting Strategies

In conclusion, this work has the potential to make important contributions. First, this study represents the early empirical effort to reveal the benefits of initial sync-media communication in telehealth for chronic disease management. Utilizing healthcare service records and online surveys of

patients from a large digital mental healthcare platform, we are able to precisely measure the changes in patient behaviors and their health conditions and further obtain compelling and consistent effect estimates from multiple causal identification strategies. Second, our findings illuminate the nuances between two sync media (i.e., audio and video) and stress the importance of visual cues in telemedicine for mental disorders. Researchers and practitioners have been debating the relative advantage of video-based telehealth services compared to audio- or text-based ones. Our findings engage in this lively debate and offer insights. Finally, we propose a health risk-based targeting strategy and demonstrate its performance in reconciling and maximizing the benefits to patients, physicians, and the platform, which offers important design and business implications for online healthcare platforms. We hope this study would spark fruitful scholarly discussion on media-based interventions for digital healthcare.

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