Uncovering Preference and Scale Heterogeneity in Digital Neurorehabilitation: Results from a Discrete Choice Experiment

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Background: Innovations in Neurorehabilitation

- Stroke as a leading cause of persistent disability with significant impact on daily activities and participation in the environment.
- Digital health interventions (DHIs) such as health apps, humanoid robots, and telerehabilitation services offer new opportunities to create value by considering patient preferences, thereby improving acceptance.
- Using a discrete choice experiment (DCE), patient preferences were analyzed, and heterogeneity was initially observed through mixed logit (MXL) analysis.

Study Objective: Patient Preferences

- Understanding heterogeneity to tailoring interventions to individual needs, improving patient satisfaction, acceptance, and outcomes.
- Study aimed to identify scale and preference heterogeneity in patient decision-making to better understand the variations in individual preferences and choice behavior.
- **Preference Heterogeneity**: Indicates variations in individual preferences.
- **Scale Heterogeneity**: Refers to differences in choice behavior randomness.

Method: Discrete Choice Experiment

- **Overall study design:** Investigated decision context around digital neurorehabilitation spanning multiple disciplines, focused on interventions for everyday activities, excluding acute rehabilitation for breathing or independence (e.g., toilet use, food intake).
- **Decision Model:** 1) Literature review; 2) Interviews (N = 14 stroke survivors), Expert discussions (N = 5); Resulting in 7 attributes related to technical aspects, costs, and success.
- **Target population:** Individuals aged 18 years and older, residing in Germany, including stroke survivors and the general population.
- **Partial-Profile Design:** 20 blocks, with 6 best-best-ranking tasks presenting 4 of 7 attributes.
- **Statistical Analysis:** 1) MXL analyzed mean utilities with random variation across individuals, capturing preference heterogeneity; 2) Latent Class Analysis (LCA) identified preference subgroups (latent classes) with distinct choice behavior; 3) Heteroscedastic Conditional Logit Model (HET) used to analyze unobservable variables affecting decision behavior.

Results: Preference and Scale Heterogeneity

- 3-class solution used for subgroup analysis, N = 1055 (Figure 1, Figure 2):
  - **Class 1** (21.33% of respondents): Primarily driven by copayment preferences; Preferred lower copayment ($ß_{80€}$=-3.355, p < 0.000; $ß_{0€}$= 3.058, p < 0.000).
  - **Class 2** (32.23% of respondents): Most important was therapy success within 6 months; Preferred higher therapy success ($ß_{60\%}$=-4.035, p < 0.000; $ß_{100\%}$=3.909, p < 0.000).
  - **Class 3** (46.45% of respondents): Prioritized technical aspects, copayment, and therapy success; Most important attribute: contact with healthcare professionals ($ß_{direct}$=0.941, p < 0.000); Also valued therapy success, patient choice in therapy process, information, copayment, and data processing; Preferred direct contact, self-determined location flexibility, and progress feedback ($ß_{place}$=0.632, p < 0.000; $ß_{change}$=0.433, p < 0.000).

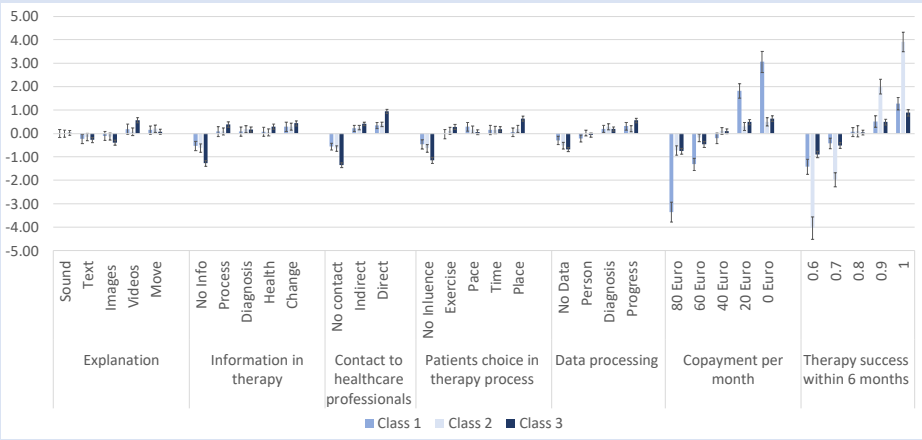

Figure 1: LCA mean coefficients for 3-class solution, N = 1055; AIC: 16415.8; BIC: 15771.89

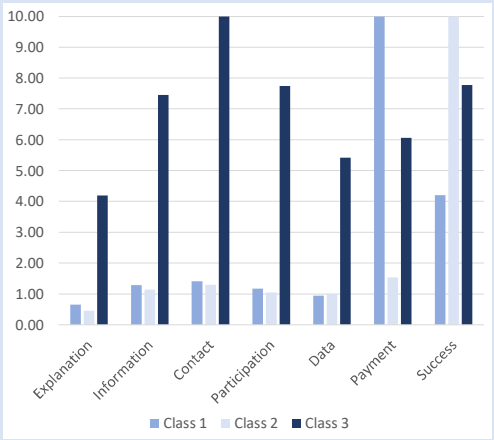

Figure 2: Relative importance normalized on 10-point scale.

- Class distribution based on respondents' characteristics in 3-class solution:
  - Higher proportion of older individuals and stroke survivors, as well as lower satisfaction with their health status and lower readiness to use DHIs in Class 2 compared to Class 3.
  - Similar distinctive characteristics in Class 1 compared to Class 2.
  - No significant differences in the current use or perceived importance of DHIs.
- Scale heterogeneity revealed by HET, N = 1055:
  - Low scale parameter indicates high variance in participants' choices with less consistency.
  - Significant findings in therapy and health-related dimensions.
  - Health status consistently impacted scale heterogeneity, showing its influence on decision consistency across all models.

Discussion:

- LCA identified three distinct subgroups, each group exhibits unique preferences.
- Class 1: A cost-sensitive group that prioritizes lower self-cost contributions over other factors.
- Class 2: A therapy success-oriented group that focuses on therapy outcomes, aligning with the perceived usefulness dimension of the Technology Acceptance Model (TAM).
- Class 3: A technical aspects-oriented group that emphasizes usability, including customization and information exchange, highlighting the perceived ease of use (TAM).
- Without favorable technical conditions (ease of use), acceptance cannot be achieved, and without clear therapeutic benefits (usefulness), acceptance also fails. Both technical and therapeutic factors are essential in shaping patient engagement and sustained acceptance.
- Furthermore, health status emerged as a key factor influencing decision-making consistency.
- The results can improve neurorehabilitative care through balanced digital solutions.

References: Available upon request**; Disclosure:** The research project was funded by European Social Fund (reference ESF/14-BM-A55-0001/19-A02) and the Ministry of Education, Science and Culture of Mecklenburg-Vorpommern, Germany; **Institutional Review Board:** Ethics Committee at Hochschule Neubrandenburg (HSNB/177/21); **Correspondence**: akfischer@hs-nb.de