

Introduction

In the field of healthcare, the last few decades have witnessed an increasingly shift towards technologizing healthcare. The use of technology, like robots, is now routine in most countries of the world, although their spread across the globe is not uniform. Specifically, in healthcare, humanoid robots were introduced essentially to facilitate the rehabilitative processes¹, to improve patient's recreation, recovery and communication. Aim of this study is to evaluate the effectiveness of humanoid robots in a diagnostic process. In particular, at our Centre, we applied humanoid robot technology in outpatient activities in order to increase the diagnostic sensitivity of Mini Mental State Examination (MMSE) in diagnosing mild cognitive impairment (MCI).

Methods

We enrolled 20 patients (9 males and 11 females) with mean age of 73.10 ± 7.97 years. According to a randomized design, patients included in the study underwent MMSE administered by a neurologist/psychologist (Group-H) or administered by a semi-humanoid robot manufactured by SoftBank Robotics, called Pepper (Group-R) (Fig.1). In order to avoid learning bias, each patient underwent to MMSE for the first time. Scores obtained at MMSE of both groups were analyzed. Statistical analysis was performed on averaged traces from each participant by using the R 3.0 software package. A 95% of confidence level was set with a 5% alpha error. Statistical significance was set at p<0.05. Furthermore, to produce parameters capable of evaluating patient's compliance to MMSE, a multiple-choice questionnaire, consisting of 7 items, was created and administered to each patient after the MMSE to explore different psychological aspects. Indeed, we would like to speculate that higher adherence to the MMSE test is able to increase the diagnostic sensitivity for MCI of the test.

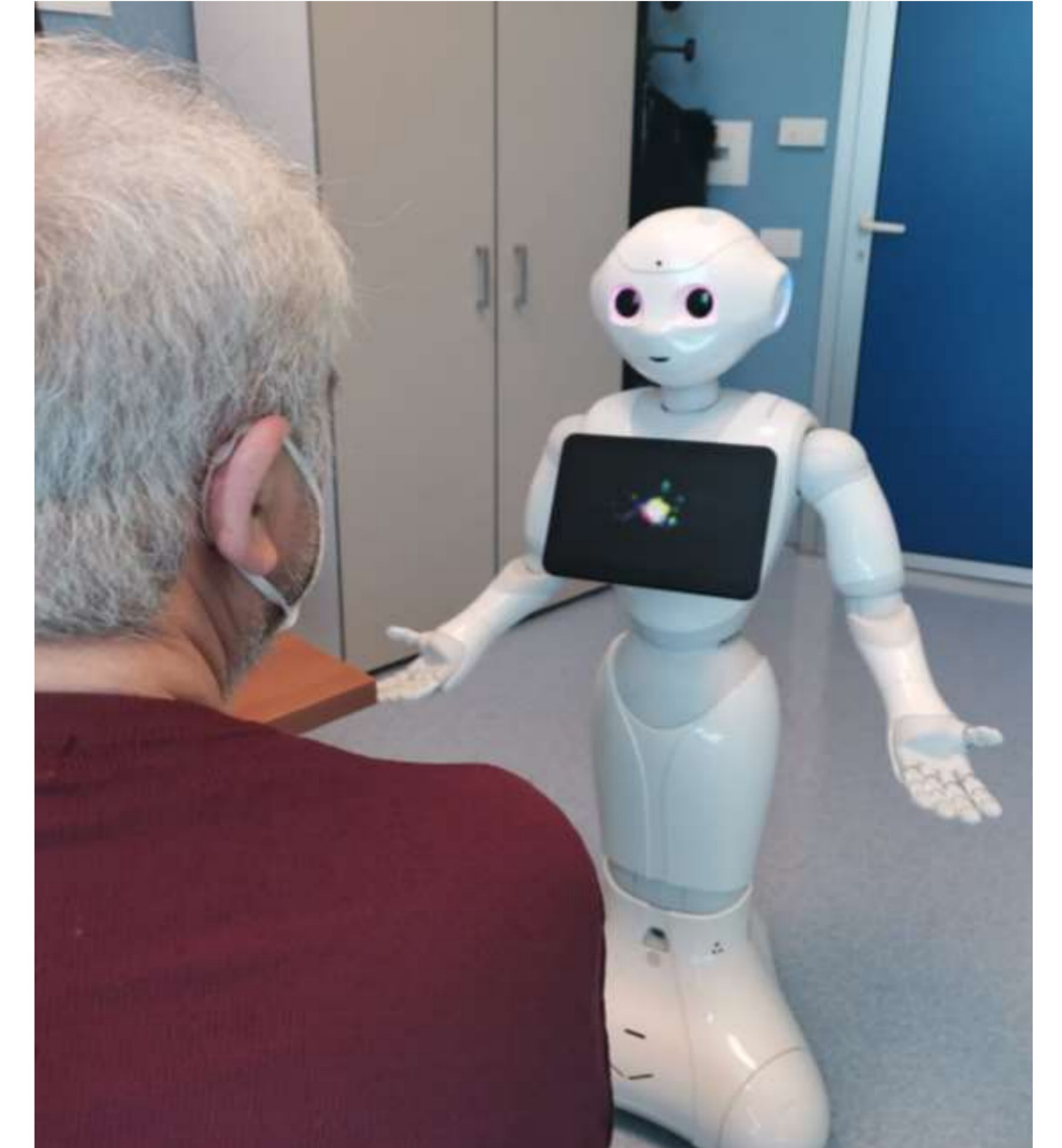


Fig.1 Pepper, a semi-humanoid robot manufactured by SoftBank Robotics.

Results

Twenty patients randomly distributed into two groups: 10 patients for the Group-H and 10 patients for Group-R. No significant differences were identified between the two groups analyzed for age, MMSE scores and questionnaire responses. Chi-square test did not show a significant difference between psychic domains relatively to the questionnaire and Mann-Whitney U test did not show differences in MMSE scores between the two groups.

However, really interesting are the answers to some items in questionnaire shown in percentages. In particular, clear discordances between the two groups were revealed in the answers given to the following items: Q4. "Did I have the desire/did I discontinue the test?", Q5. "Did I feel frustrated?", Q7. "Would you willingly repeat the test at the next visit?". Answers to these items, expressed as percentages, showed better patient satisfaction with robot-administered MMSE (Fig.2).

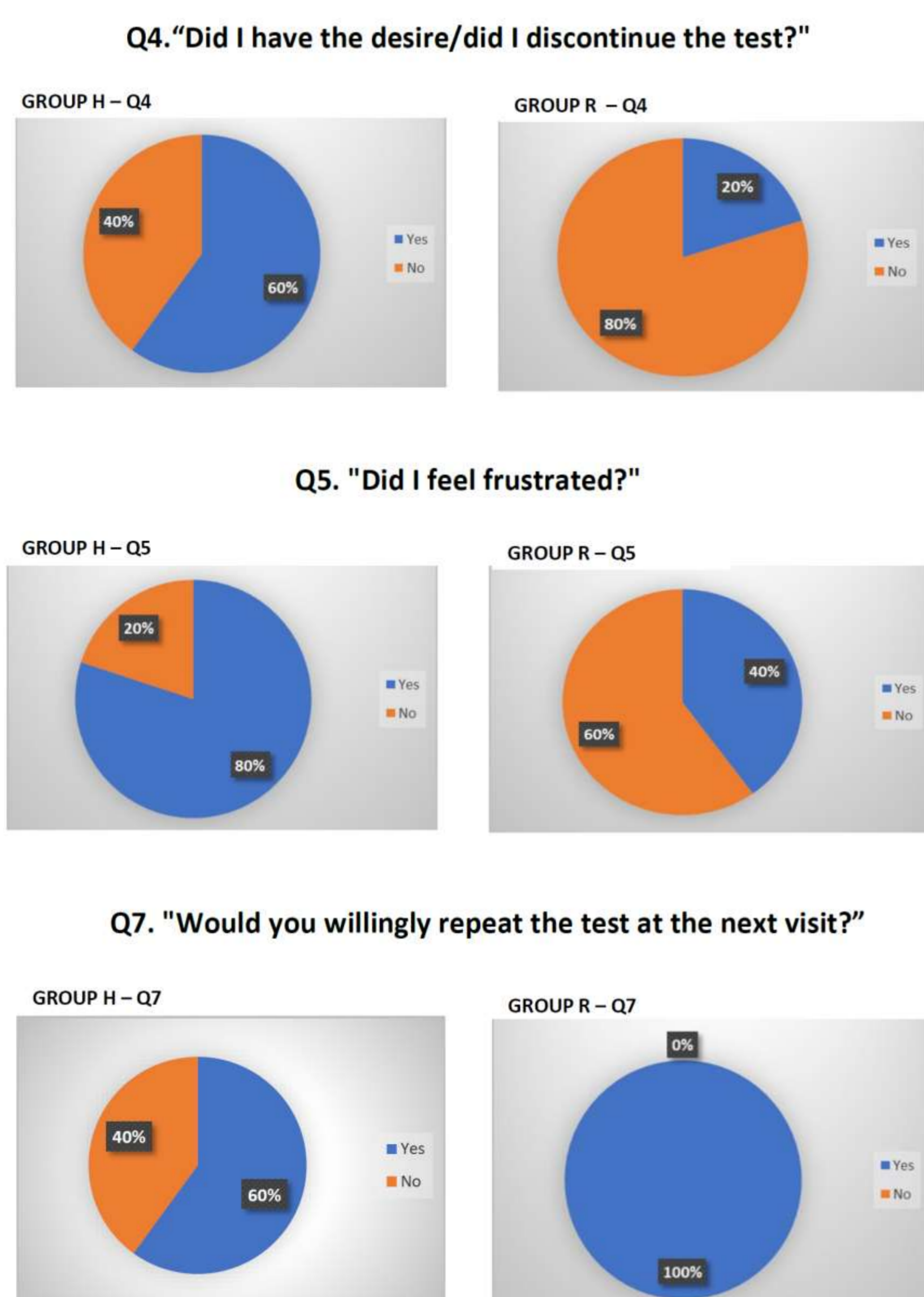


Fig.2 Answers given to items Q4, Q5, Q7 expressed in percentages.

Conclusions

Based on the results obtained from the analysis of these preliminary data, we can argue that there are no significant differences between the effectiveness of humanoid robots and humans in administering MMSE in MCI diagnostic process.

The results actually obtained suggest that the use of robots, as Pepper, in clinical practice can be supportive but not more effective in the diagnostic process of MCI. However, a larger sample is needed to further validate these initial results.

Acknowledgement

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References

¹ Feingold-Polak R, Barzel O, Levy-Tzedek S. A robot goes to rehab: a novel gamified system for long-term stroke rehabilitation using a socially assistive robot-methodology and usability testing. J Neuroeng Rehabil. 2021 Jul 28;18(1):122.