Rehabilitation via **home** **b**ased gaming exercise for the **upper-limb** post **s**troke (RHOMBUS): results of an intervention feasibility trial

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Purpose: Effective interventions to promote upper-limb recovery post-stroke are characterised by intensive and repetitive movements. It is reported that stroke survivors move their arm an average of 32 times per therapy session; this is insufficient to drive neuroplastic change. The RHOM- BUS study aimed to determine the safety, feasibility and acceptability of the Neurofenix platform for home-based rehabilitation of the upper-limb post stroke.

Methods: The Neurofenix platform was designed and developed by bioengineers, stroke survivors and therapists. The platform is a non-immersive, virtual reality device designed to enable stroke survivors to independently exercise their upper-limb. A non-randomised intervention and parallel process evaluation was undertaken with community dwelling stroke survivors with mild to severe arm impairment (9-25 Motricity Index for shoulder and elbow). Participants were trained to use the Neurofenix platform at home for 7-weeks; aiming for a weekly dose of 225minutes. Out- comes assessed at baseline, 8 weeks and 12 weeks were gross level of disability, pain, objectively measured arm function and impairment, self-reported arm function, passive range of movement, spasticity, fatigue, participation, quality of life (QOL) and health service use. Feasibility, acceptability and safety were determined through fidelity to the intervention as measured objectively by the Neurofenix platform, a postintervention questionnaire,and monitoring of adverse events. (Semi-structured interviews were undertaken but not reported in this paper)

Results: Thirty participants (women n = 14), median age 60, median 4.9 years post-stroke, Fugl Meyer Assessment - Upper Extremity scores 8 to 63 were recruited. Participants exercised a median 17.4 hours (15,092 movements) during the 7-week intervention. The Neurofenix platform had high acceptability (median enjoyment 4/5) and satisfaction levels (median QUEST score 36/40). Related adverse events were mild and short term (e.g. muscle soreness). Shoulder external rotation improved by 7.1∘ (95%CI 2.4-11.8, p=.049) and the odds of shoulder pain at 8 weeks was lower than that at baseline (OR 0.45, 95%CI 0.24-0.83, p = 0.010).

Conclusion(s): Results suggest the Neurofenix platform is a safe, feasible, and acceptable intervention for independent home-based rehabilitation of the upper-limb post stroke; future work is required to determine efficacy in a definitive randomised controlled trial.

Implications: Study findings illustrate the importance of co-design by bioengineers, stroke survivors and physiotherapists in innovative health technology. Participants included stroke survivors with severely affected upper limbs, communication difficulties, and mild cognitive problems culminating in an inclusive sample better reflecting the diverse clinical population. Findings contribute to the growing evidence base on virtual reality devices for delivering innovative high intensity upper limb stroke rehabilitation.

Key-Words: stroke, virtual reality, upper-limb rehabilitation