The Impact of Assistive Technology on the Quality of Life of Home-Dwelling Individuals with Parkinson's: *A Scoping Review*

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Objectives

By the end of this presentation...

1. *Understand* the potential impact the use of assistive technologies at home can have on the quality of life (QoL) of older adults with Parkinson's

2. *Recognize* devices that are most effective in improving QoL of home-dwelling older adults with Parkinson's

3. *Understand* why physical therapists should be aware of home-based assistive devices for older adults with Parkinson's
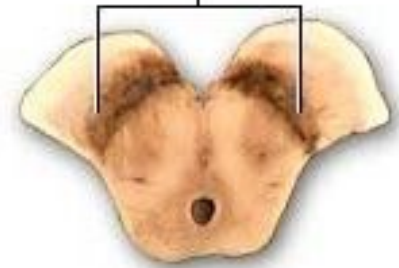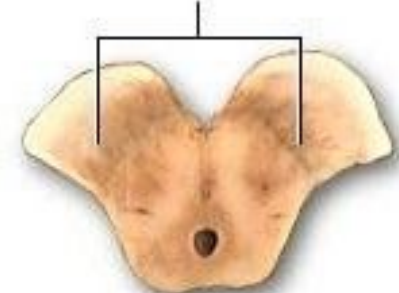
Background

Parkinson's Disease (PD)

❖ Depletion of dopaminergic neurons in the substantia nigra[1]

❖ More than 6 million people diagnosed with Parkinson's Disease[2]

❖ Median age of onset = 68 years (men) & 70 years (women)[1]

Substantia nigra

Diminished substantia nigra as seen in Parkinson's disease

Impacts of PD

"Cardinal Signs"[3]

Tremors

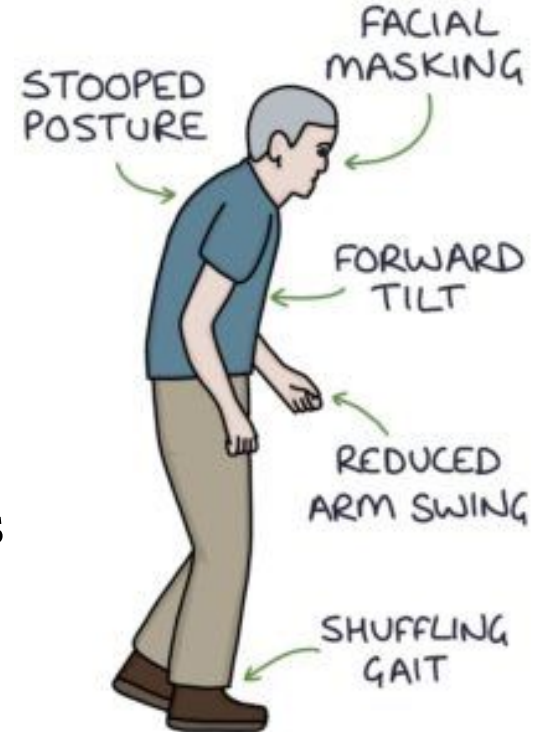**R**igidity

Akinesia

Postural instability

There is a varied prominence of symptoms progression.[3]

STOOPED POSTURE

FACIAL MASKING

FORWARD TILT

REDUCED ARM SWING

SHUFFLING GAIT

https://zerotofinals.com/medicine/neurology/parkinsons/

Assistive Technologies

❖ Utilize technology to assist the user and allow them to become as independent as possible.[4]
  - Less money to spend on caregivers
  - Increased sense of independence and self worth

❖ Can either *assist* or *monitor* the user.[4]

❖ In the home, this creates a supportive environment, enabling an active role in daily life.[1]

Purpose

This scoping review analyzed the impact of assistive technology on QoL of home-dwelling individuals with Parkinson's Disease.

Methods

Databases

❖ ProQuest

❖ Cochrane

❖ PubMed

❖ EBSCO

Search Terms

("Assistive technology" OR "assistive technologies" OR "assistive device" OR "assistive devices" OR "technology" OR "technologies" OR "smart home" OR "smart homes" OR "home automation" OR "domotics" OR "smart technology")

AND

(home OR "home environment" OR "home-based" OR "home health") AND (Parkinsons OR "Parkinson's Disease" OR "Parkinson Disease" OR "parkinsonism")

AND

"quality of life"

Search Limits

❖ Published 2012-2022 (all databases)

❖ Peer-Reviewed (ProQuest, EBSCO)

❖ "Anywhere except full text" (ProQuest)

❖ "Title abstract keyword" (Cochrane)

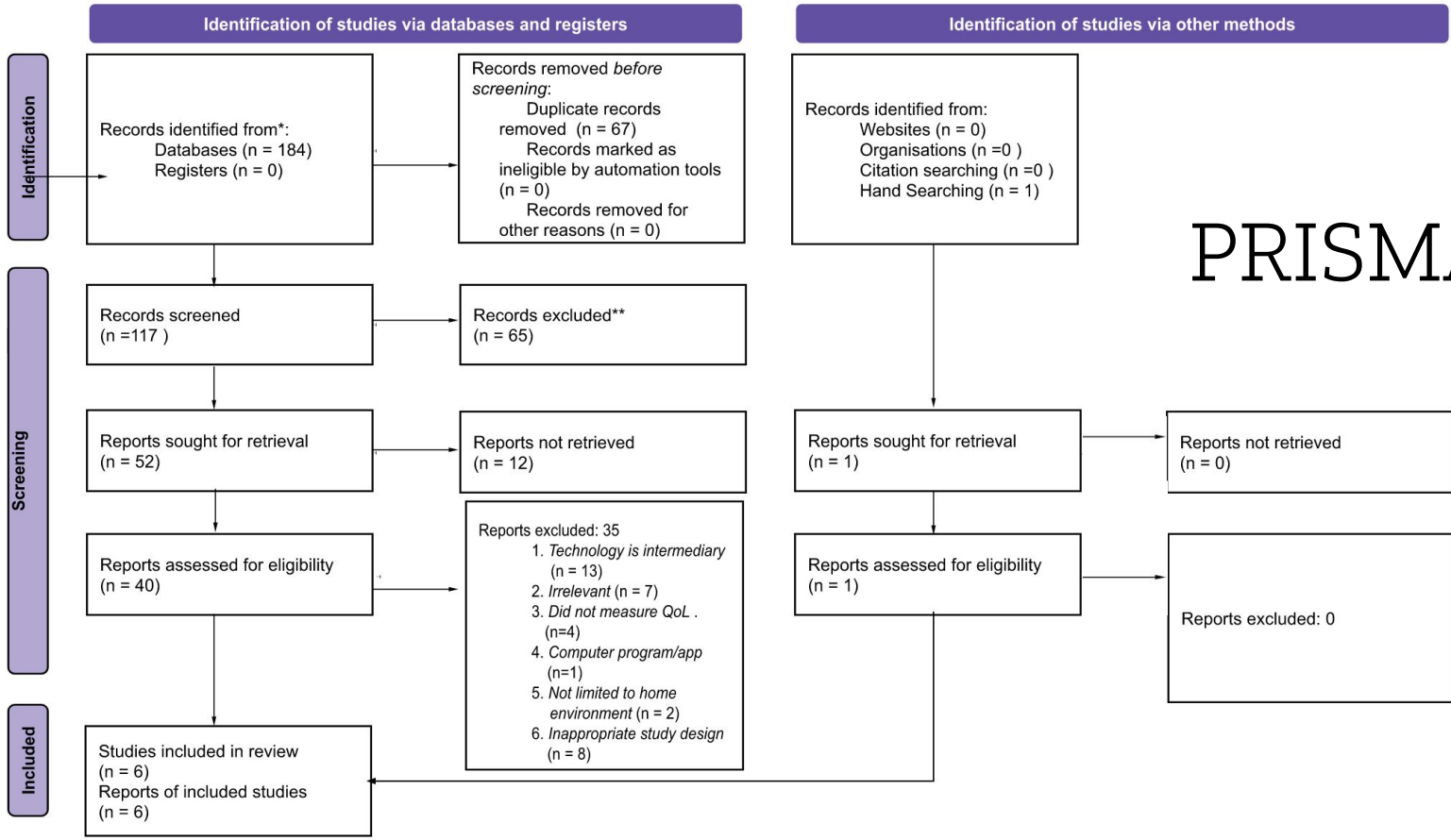# Selection Criteria

❖ Home-dwelling people with Parkinson's

❖ Assistive technology used daily at home

❖ QoL outcomes: physical *or* cognitive

❖ Qualitative and/or quantitative

Results

Identification of studies via databases and registers

Identification of studies via other methods

Identification

Records identified from*:
Databases (n = 184)
Registers (n = 0)

Records removed *before screening*:
  Duplicate records removed (n = 67)
  Records marked as ineligible by automation tools (n = 0)
  Records removed for other reasons (n = 0)

Records identified from:
  Websites (n = 0)
  Organisations (n =0)
  Citation searching (n =0)
  Hand Searching (n = 1)

PRISMA

Screening

Records screened
(n =117)

Records excluded**
(n = 65)

Reports sought for retrieval
(n = 52)

Reports not retrieved
(n = 12)

Reports sought for retrieval
(n = 1)

Reports not retrieved
(n = 0)

Reports assessed for eligibility
(n = 40)

Reports excluded: 35
  1. *Technology is intermediary* (n = 13)
  2. *Irrelevant* (n = 7)
  3. *Did not measure QoL .* (n=4)
  4. *Computer program/app* (n=1)
  5. *Not limited to home environment* (n = 2)
  6. *Inappropriate study design* (n = 8)

Reports assessed for eligibility
(n = 1)

Reports excluded: 0

Included

Studies included in review
(n = 6)
Reports of included studies
(n = 6)

Results

❖ There were 185 articles screened for eligibility.

❖ A total of 6 articles fulfilled all criteria.
  - Three reported on home assistive devices[1-2,5]
  - Three reported on home monitoring devices[6-8]

❖ Sample Size[1-2,5-8]
  - *Range*: 13 - 290 participants
  - *Total*: 452 participants

Methodological Quality

Each article was assessed for methodological quality by two independent reviewers who came to a consensus.

Mixed Methods Appraisal Tool (MMAT)
- ❖ Mixed Methods (n = 1)[2]
- ❖ Quantitative (n = 4)[1,6-8]
- ❖ Qualitative (n = 1)[5]

Levels ranged from 60% - 100%, with an average of 80%

Interventions

Frequency = 1 session - 3x/week[1-2,5-8]

Duration = 1 episode - 1 year[1-2,5-8]

Protocols
- ❖ Survey[2]
- ❖ Simulated training[1]
- ❖ Focus groups[5-6]
- ❖ Patient monitoring[7-8]

Summary of Articles

Author (Year)	Stage of PD	Type of Device	Design
Duffy et al. (2021)[2]	Any Stage	Voice-Assisted Technology (VAT)	*Survey* on attitudes towards the use of VAT.
Latella et al. (2021)[1]	Hoehn & Yahr = <3 Unified PD Rating Scale (UPDRS) = <50	Home Automation (HA)	*Simulated training* within a HA room with specialized adaptive devices.
McNaney et al. (2020)[5]	Any Stage	Assistive technologies (AT) in home (general)	*Focus group* about challenges of PD, non-clinical interventions, and current use of AT in the home.
Amini et al. (2018)[6]	Any Stage	Home-based monitoring system	*Focus group* that discussed a home-based system designed to give visual cues, detect freezing of gait and to detect falls.
Motolese et al. (2020)[7]	Any Stage; non-demented, only	Smartphone app	*Patient monitoring* on compliance, outcomes, and satisfaction with a neurological test-based app.
Cubo et al. (2017)[8]	Advanced PD (>4 motor complications on UPDRS)	Home-based motor monitoring system	*Patient monitoring* on motor function with wireless motion sensor technology.

Results: Home Assistive Devices

❖ Statistically significant increases in QoL with home automation (HA) were found (p<0.001).[1]

❖ Though speech was a reported issue, participants noted success with voice-assisted technologies (VAT).[5]

❖ 63.5% of participants used the speech-to-text functions to cope with symptoms (ie, tremors).[2]

Results: Home Monitoring Devices

❖ Statistically significant improvements with walking were found (p=0.02).[8]

❖ 79.9% of participants either strongly agreed or agreed that it helped improve mobility.[6]

❖ 48% of participants perceived themselves as "safer" or "much safer" with remote patient monitoring.[7]

Conclusions

Conclusions

Moderate to strong evidence supports the use of assistive technology in the home setting to promote the QoL for home-dwelling individuals with Parkinson's.

Home assistive devices (VAT & HA) and home monitoring devices are supported by this evidence.

Future Research

There was no consistent device identified by the studies as being ideal for home-dwelling people with PD.

Limitations

❖ Small sample size[1,5-6]

❖ Large variability in treatment parameters[1-2,5-8]

❖ The use of simulations: imitates home use, not actual home[2,6]

Clinical Relevance

❖ Assistive technology is an option of support for people with Parkinson's struggling at home due to their PD-related symptoms.

❖ Physical therapists should be knowledgeable of these support devices.
  - Identify, introduce, and educate patients

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Questions?

Appendix

Assistive Technologies

Summary of Outcome Measures

█ = Home assistive devices
█ = Home monitoring devices

Author (Year)	Type of Study	Outcome Measures
Duffy et al. (2021)[2]	Mixed Methods	- Descriptive statistics (via survey responses) - Summative content analysis (via survey responses)
Latella et al. (2021)[1]	Quantitative	- Montreal Cognitive Assessment - Frontal Assessment Battery - Weigl Test - Hamilton Rating Scale Depression - Social Adaptation Self-Evaluation Scale - **SF-12 Health Survey** - Activities of Daily Living Scale - Instrumental Activies of Daily LIving Scale
McNaney et al. (2020)[5]	Qualitative	- Inductive thematic analysis (via discussion answers)
Amini et al. (2018)[6]	Quantitative	- Descriptive statistics (via responses to questions)
Motolese et al. (2020)[7]	Quantitative	- Descriptive statistics (via questionnaire answers) - Inferential statistics (via questionnaire answers)
Cubo et al. (2017)[8]	Quantitative	- Non-Motor Symptom Questionnaire - EuroQoL questionnaire - Hospital Anxiety Depression Scale - Scale for Evaluation of Neuropsychiatric Disorders - Parkinson Pyschiatric Rating Scale - Cumulative Illness Rating Scale- Geriatric - Zarit Burden Interview - Quality-Adjusted Life Years - Visual analogue scale (experimental, only) - **Structured questionnaire on motor functions**