

REVIEW

People with Parkinson's disease and housing issues: A scoping review

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Abstract

Background and Aims: There is evidence that housing issues are associated with health outcomes as people age, but little is known in this respect regarding the specific population of people with Parkinson's disease (PD). The objective of this literature review was to identify and analyze the knowledge gap concerning people with PD and housing issues.

Methods: Applying established guidelines for scoping reviews, a systematic literature search was done in relevant databases applying the following inclusion criteria: empirical studies including human participants with PD, addressing housing in the objective, hypothesis or research questions, and published in English in peer-reviewed journals. Data were analyzed using a framework of domains, factors, and variables influencing housing decisions among older people.

Results: Twelve publications were identified, originating from a few researchers and with very different scopes. While the social dimension was scarcely attended to, the publications addressed all six domains of the analytical framework and 30% of the variables specified therein, but many were only used for descriptive purposes.

Conclusion: This scoping review reveals that there is a substantial knowledge gap regarding people with PD and housing issues. The knowledge gap is most evident in the social dimension, while the studies identified provide more information relating to the health dimension than what is the case in research on housing targeting the general aging population. Because society urgently needs evidence to support the development of housing policies and provide suitable housing for this vulnerable population, more research targeting people with PD and housing issues is warranted.

KEYWORDS

environment, frail older adult, PRISMA-ScR checklist, review literature as topic

1 | INTRODUCTION

Research on Parkinson's disease (PD) is a strong and progressive field of inquiry, producing an impressive number of original publications

annually. Much is known about PD etiology, disease mechanisms, medical treatments, care and rehabilitation, and the consequences of the disease on the patient or PD population levels. There is a growing body of literature regarding the impact and consequences of living

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and aging with PD,¹⁻⁵ including studies that describe how gait and balance problems interact with environmental demands.⁶⁻⁸ However, to the best of our knowledge, little is known about people with PD and housing issues.

For example, in their systematic review of health-related quality of life (QoL) among people with PD, based on the International Classification of Functioning, Disability and Health (ICF),⁹ van Uem et al¹⁰ found that the body functions and structures domain were most often investigated compared to, for example, environmental factors and participation in societal roles. Their conclusion was that there is an imbalance between what is most extensively investigated and what are the most relevant features for health-related QoL in PD. Albeit the housing environment is known as the major arena of daily life, particularly in later life and with implications for QoL,¹¹ housing was not even mentioned in van Uem et al's review.

Because people remain living in their ordinary homes despite health decline and disability,¹² housing issues are important for the situation of people with PD. According to a prior study, people with PD express a strong desire to remain in their homes for as long as possible¹³ and in most Western countries the principle of having people aging in place prevails.¹⁴ As identified in a review of the aging literature more than 10 years ago¹⁵ there is evidence that housing is associated with health outcomes as people age, with support for causal effects between housing and disability-related outcomes such as ADL dependence. However, little is known about such associations in disease-specific population segments. According to the current housing and health guidelines of the World Health Organization,¹⁶ the home setting is becoming increasingly important to health, not the least due to demographic changes with higher proportions of people living into higher ages, with diseases and disabilities. People diagnosed with PD live 15-20 years with the disease, with major consequences for their daily lives over the course of disease progression. Importantly, activities of daily living are affected early on and already in de novo PD, especially so for those with the postural instability and gait difficulty subtype (PIGD).¹⁷ Despite this, few PD studies have addressed housing issues.

Accordingly, the objective of this literature review was to identify and analyze the knowledge gap concerning people with PD and housing issues. The research questions guiding the analysis were

- What is known from existing scientific literature focusing on housing and people with PD?
- What domains, factors, and variables of housing were addressed in such research?

2 | METHOD

Targeting a study area, which we knew had been scarcely addressed in PD research, for this study we adopted a scoping review approach.^{18,19} As recommended for scoping reviews, we used the structured approach for literature search applied in systematic reviews.²⁰ Following this, we chartered the results of individual

studies and categorized the domains of housing addressed in the publications identified according to a multifaceted framework of dimensions, factors, and variables.²¹

2.1 | Eligibility criteria

We included reports of the results of empirical studies and literature reviews of such research with human study participants with PD or parkinsonism, published in English in peer-reviewed scientific journals. The search period was Jan 1, 2005 to May 25, 2020. To include research representing the full span of people with Parkinson's disease, no age limits regarding study participants were applied. The publications included had to explicitly address housing issues in the hypotheses, study objectives or research questions. Aspects of housing were used as inclusion criteria and included housing adaptations/home modifications, objective aspects such as housing design, environmental barriers and accessibility; perceived aspects such as housing satisfaction, usability, meaning of home; housing planning and provision; relocation; economic and social aspects related to housing. Studies with housing solely mentioned as the setting for medical treatments, observations, interventions, and care provision were excluded, as were studies focusing only on assistive devices or other technical equipment.

2.2 | Information sources and search process

The systematic literature search was conducted by the second author (N.A.) in close cooperation with an information specialist at the Faculty of Medicine library, Lund University, Sweden. The following databases were used: Cinahl, PubMed, PsychINFO, and Inspec. The following keywords were used in different combinations: Parkinson's Disease, Parkinson's, Parkinsonian Disorders, Housing, Home, Entrance, Elevator, Bedroom, Kitchen, Environment, and Person-Environment fit. Because different databases use different concepts for the same phenomenon, each specific keyword was modified for the respective database.

2.3 | Study selection

Facilitated by the Rayyan software,²² the publication selection process involved the four authors of this paper. N.A. performed the first title and abstract screening phase to exclude duplicates, publications based on animal or cell studies, studies on other diagnoses than PD, and publication types not intended for inclusion. Next, N.A. and S.I. performed individual screening according to the inclusion and exclusion criteria to identify the sample of publications for the study. A consensus discussion between them resulted in publications selected for inclusion, as well as further screening based on full text readings of publications where this was considered necessary to be able to make a valid assessment. This step also produced a list of

publications where they decided to involve B.S. and M.H.N. in additional full text screening, followed by consensus discussion among all four authors resulting in the final selection of publications (see Figure 1).

2.4 | Data charting and summary of results

From each publication, the first author (S.I.) summarized information pertaining to publication details (authors, year, journal), country where the study was conducted, population, study aim, study design/method, housing aspect in focus, sample size, and main results. She drafted descriptions of the individual studies and their results for presentation in tabular form as well as a summary of the results, subsequently reviewed and refined by the coauthors.

2.5 | Synthesis of domains, factors and variables of housing

We identified a systematic review of factors influencing housing decisions among older adults over the age of 65 with loss of autonomy²¹ as relevant for the purpose of synthesizing the publications focusing on domains, factors, and variables addressed. Reviewing 91 publications from the period 1990 to Feb. 2015, Roy et al presented a multifaceted framework consisting of six dimensions: Socioeconomic and

Health; Psychological and Psychosocial; Social; Built and Natural Environment; Time and Space-time; Economic, each with 2-3 factors specified. On the next level, each factor contained 0-11 variables of interest (76 in total; italicized in forthcoming body of text in the Section 3).

We used this framework as a grid for the synthesis of the publications included in the review. Using the charted data and the original publications the first author (S.I.) produced a first version of the synthesis. In the next phase, another author (M.H.N.) independently identified the domains, factors, and variables of housing according to Roy et al's framework²¹ in the 12 publications, thereby verifying the categorization. An iterative process involving all four authors followed, which resulted in a thematized summary based on the six domains.

3 | RESULTS

3.1 | Selection of publications

The searches identified 1010 publications, and 227 of those were excluded in the title and abstract screening phase because they did not meet the inclusion criteria (Figure 1). The remaining 783 publications were evaluated based on title and abstract screening. Subsequent screening iterations resulted in a final sample of 12 publications.

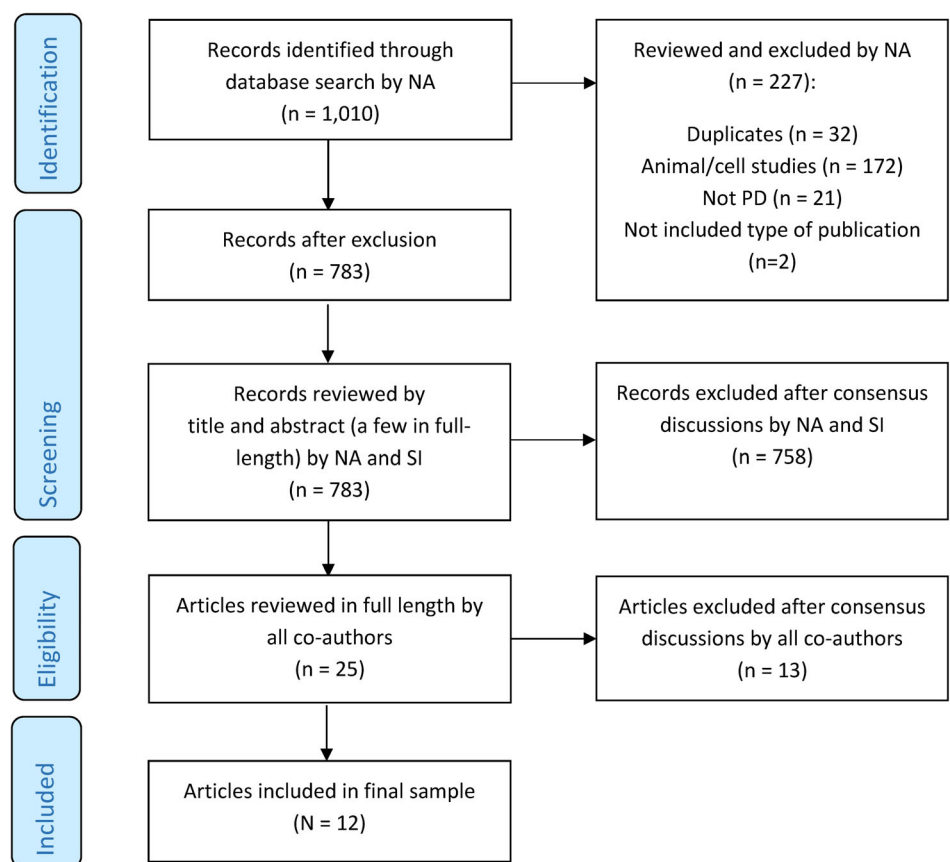


FIGURE 1 PRISMA flow chart illustrating the publication selection procedure

3.2 | Publication and study characteristics

Seven of the publications were produced by a research group in Sweden,²³⁻²⁹ and two by researchers in Thailand^{30,31} involving co-authors from Japan, Canada, and the United Kingdom. The remaining publications originated from Norway,³² the United Kingdom,³³ and the United States.³⁴ Six of the papers were published in neurology journals, including two with PD/Parkinsonism as the specific scope. Four papers were published in journals in geriatrics, one in a journal with a generic life sciences and medicine scope, and one in a journal of economics (Table 1). The study types represented were literature review (n = 1), study protocol (n = 1), methodology study (n = 2), cross-sectional survey (n = 5), longitudinal survey (n = 2), and qualitative observation study (n = 1). In three of the cross-sectional survey studies, a case-control design was used. The study protocol, one of the methodology studies, two of the cross-sectional and one of the longitudinal survey studies emanated from the same longitudinal cohort study from Sweden.

People with PD was the target population of all the studies included, specifically stating that the participants self-reported PD (n = 2) or had a confirmed diagnose (n = 8). For two of the studies, such information was not specified. The total PD sample sizes ranged from N = 5 to N = 1826, while the case-control studies included control samples (N = 60 to N = 864).

The studies conducted in Norway³² and the United States³⁴ aimed to examine the risk for living in or being admitted to nursing homes. The publication by Vossius et al³² included analyzes of related costs, compared with the general population. Shih et al³⁴ had one section focusing on whether PD treatments were related to the risk of nursing home admission. In addition to a study protocol²⁴ including one psychometric study²⁸ the aims of the empirical studies from Sweden^{23,25-27,29} concerned different aspects of housing, framed in the context of environmental gerontology, and related to general as well as PD-specific aspects of health. The methodological study from Thailand³¹ included the development and piloting of a home assessment questionnaire, while the study from the United Kingdom³³ aimed to investigate in-home sensors for data collection about fall risks.

3.3 | Results of the studies

For an overview of the results of individual studies, see Table 1. Summarizing the results reported in the 12 publications included in this review, the results of a few methodology studies of different character have delivered pilot results using a home safety questionnaire focusing on bedroom usability and accessibility among people with PD,³¹ as well as satisfactory results of a psychometric evaluation of an instrument capturing external housing-related control beliefs.²⁸ In addition, there are pilot results from an observational study indicating that in-home sensors may detect instability during everyday activity at home.³³ When it comes to evidence of housing-related interventions targeting people with PD, there is one literature review showing that the evidence of home modifications is weak.³⁰

Representing research using epidemiological approaches, one study shows that people with PD are admitted to nursing homes earlier than those without the disease, with higher societal costs than for older people in general.³² Likewise, another study focusing on nursing home admission showed that nonadvanced as well as advanced PD increase the risk of nursing home admission, mainly driven by the person's functional limitations. Treatments that improve functional status seem to reduce the risk of nursing home admission in non-advanced as well as advanced PD, primarily generated by improved walking ability.³⁴ Moreover, explorative studies focusing on home and health among people aging with PD showed that this population has a more challenging housing situation than older people in general.^{23,25} Subsequently, those studies generated hypotheses for a longitudinal survey study,²⁴ which hitherto has produced knowledge on the complex dynamics of objective and perceived aspects of housing on the one hand and aspects of health on the other,²⁶ with detailed knowledge about environmental barriers and housing accessibility as one facet of the findings.²⁷ Another study from the same project showed that housing-related control beliefs and general self-efficacy play a role in the interaction of housing accessibility and ADL.²⁹

3.4 | Synthesis domains, factors, and variables of housing

3.4.1 | Socioeconomics and health dimension

Descriptive socioeconomic data such as *age* and *gender* were presented in all the publications except for the literature review.³⁰ The variables *occupation* and *education* were included in the Home and Health in PD (HHPD) project from Sweden and reported with some variation across the seven publications included but lacking in the remainder of the sample of publications. The HHPD-based publications and the observational study from the United Kingdom³³ reported information about *household characteristics*. The variable *ethnic background* was presented as part of the sample characteristics in the study on risk for nursing home admission in the United States³⁴ Overall, data on *income* were lacking (see Table 2).

Under the health and medical factor *physical limitations* and *health status* variables were reported in all the empirical studies. The vast majority focused on PD-specific participant characteristics such as PD duration and HY stages. While not a variable in the analytical framework, information about cognitive functioning was included in all the empirical studies but one,³⁴ assessed with established instruments or reported in a narrative manner. In most of them, additional information on health status such as comorbidities, ADL, falls or fear of falling, and non-motor PD symptoms was reported. The studies from Sweden included the most comprehensive set of PD-specific as well as generic health factors, categorized according to the ICF.⁹ The study from the United States³⁴ presented a lot of details regarding ADL and on effects of a specific PD pharmaceutical treatment (ie, levodopa-carbidopa intestinal gel, LCIG).

TABLE 1 Characteristics and summaries of results of the studies included in the review, N = 12

Citation ^a	Reference no.	Country	Population	Study aim	Study design/ method	Housing aspect in focus	Total sample, N	Participants with PD, N	Summary of results
Vossius et al. 2009, in <i>European Journal of Neurology</i>	32	Norway	Persons with diagnosed PD	Examine RR for living in nursing homes and ascertain society's costs related to nursing home placement	Cross-sectional; case-control 1:8	NHA; cost for nursing home placement	972	108	Persons with PD were admitted to nursing homes earlier than controls; their RR for living in a nursing home was 5.0 (baseline) and 4.8 (follow-up), and they caused 4.8 higher costs for nursing home placement.
Nilsson et al. 2013 ^b , in <i>Parkinson's Disease</i>	23	Sweden	Persons with self-reported PD	Explore whether aspects of housing and health among very old people with PD differ from matched controls	Cross-sectional; case-control 1:3	Environmental barriers, accessibility, housing satisfaction, MOH, external HCB	80	20	No. of environmental barriers did not differ, but people with PD lived in housing with more accessibility problems and perceived their homes as less usable in relation to activities.
Nilsson & Iwarsson 2013 ^b , in <i>BMC Neurology</i>	24	Sweden	Persons with diagnosed PD	Generate knowledge on home and health dynamics, with explicit attention to PD symptomatology	Study protocol for longitudinal cohort survey study	Environmental barriers, accessibility, housing satisfaction, MOH, external HCB	250 (target N)	250 (target N)	N.A.
Slaug et al. 2013 ^b , in <i>Aging Clinical and Experimental Research</i>	25	Sweden	Persons with self-reported PD	Disentangle the contribution of the personal and environmental components of P-E fit problems among very old people and matched controls, and quantify and specify possible interventions	Cross-sectional; case-control 1:3	Environmental barriers, accessibility	80	20	People with PD were subjected to more accessibility problems though the no. of environmental barriers did not differ from controls. The most severe accessibility problems were located to exterior surroundings, for example, no/few seating places and high kerbs.
Bhidayasiri et al. 2015 ^c , in <i>Parkinsonism and Related Disorders</i>	30	Thailand	People with PD	Explore existing evidence on housing adaptations in PD	Systematic literature review	Housing adaptation	8	N.A.	Three studies from Sweden (two marked in this table) explored housing aspects but not housing adaptations and in five such adaptations were part of complex interventions and not possible to draw specific conclusions from.

(Continues)

TABLE 1 (Continued)

Citation ^a	Reference no.	Country	Population	Study aim	Study design/method	Housing aspect in focus	Total sample, N	Participants with PD, N	Summary of results
Nilsson et al. 2016 ^b , in <i>BMC Geriatrics</i>	26	Sweden	Persons with diagnosed PD	Explore the association between aspects of health and aspects of housing	Cross-sectional survey study; canonical correlation	Environmental barriers, usability, MOH, external HCB	231	231	External control beliefs and behavioral aspects of MOH contributed the most to the housing variate; ADL and functional limitations contributed the most to the health variate.
Stack et al. 2016, in <i>BioMed Research International</i>	33	United Kingdom	Persons with PD	Observe people in their homes to identify type and location of sensors capable of monitoring mobility and balance	Qualitative observation study; ethnography	Locations of falls and fear of falling events; locations of cameras and sensors	5	5	Unobtrusive sensors were acceptable to participants and detected instability during everyday activity at home. Monitoring routes between chairs and stairs can give information without invading privacy.
Slaug et al. 2017 ^b , in <i>Acta Neurologica Scandinavica</i>	27	Sweden	Persons with diagnosed PD	Analyse potential impact of improved functional ability on housing accessibility problems	Cross-sectional survey study; simulation	Environmental barriers, accessibility	253	253	Accessibility differed in relation to Hoehn & Yahr stages. Balance problems and use of walking devices contributed the most to accessibility problems, environmental barriers to a lesser extent. The most problematic barriers were lack of grab bars at shower/bath/toilet and high kitchen cupboards.
Bhidayasiri et al. 2018 ^c , in <i>Frontiers in Neurology</i>	31	Thailand	Persons with diagnosed PD	Examine the bedroom environment of people with PD and pilot a scored questionnaire to identify environmental barriers and propose adaptations.	Instrument development; psychometric evaluation; pilot study	Accessibility, usability, home safety	5	5	Acceptable utility, content validity and internal consistency of the questionnaire.
Andersson et al. 2020 ^b , in <i>Aging Clinical and Experimental Research</i>	28	Sweden	Persons with diagnosed PD	Evaluate psychometric properties of the external HCB Questionnaire (HCQ)	Psychometric evaluation, based on cross-sectional survey data	External HCB	245	245	A 14-item version of the external HCQ is sufficiently reliable and valid for use in PD.

TABLE 1 (Continued)

Citation ^a	Reference no.	Country	Population	Study aim	Study design/method	Housing aspect in focus	Total sample, N	Participants with PD, N	Summary of results
Gefenaiite et al. 2020 ^b , in <i>BMC Geriatrics</i>	29	Sweden	Persons with diagnosed PD	Assess the role of external HCB and general self-efficacy (GSE) on the association between housing accessibility and ADL	Longitudinal survey study; multivariable regression	Accessibility, external HCB	130	130	Statistically significant interactions between accessibility and GSE on ADL and accessibility and external HCB on PD-specific ADL. Stratifying by GSE accessibility problems led to more ADL dependence/difficulty in participants with low GSE. Stratifying by external HCB, accessibility increased dependence/difficulty in PD-specific ADL in participants with low external HCB.
Shih et al. 2020, in <i>Journal of Medical Economics</i>	34	United States	Persons with diagnosed PD	Examine the relationship between functional status limitations and NHA risk; and quantify the effect of advanced PD treatment relative to the standard of care on reducing NHA risk.	Phase 1: Longitudinal; logit model; subgroup comparisons Phase 2: Comparisons between experimental and control groups from a previous randomized controlled trial	NHA	Phase 1: 1826 Phase 2: 66	Phase 1: 1826 Phase 2: 66	Functional status limitations significantly increase NHA risk among persons with nonadvanced as well as advanced PD, relative to persons without PD. Treatments that improve functional status seem to reduce the risk of NHA in nonadvanced as well as advanced PD, primarily generated by reduction in difficulty in walking.

Note: All studies reported were implemented in community settings.

Abbreviations: ADL, activities of daily living; HCB, housing-related control beliefs; MOH, meaning of home; NHA, nursing home admission; PD, Parkinson's disease; RR, relative risk.

^a Listed in chronological order. ^b, ^c From the same research group.

TABLE 2 Overview of dimensions, factors, and variables used as a grid for the identification of knowledge gaps²¹

Dimension, N = 6 ^a	Factor, N = 17 ^a	No. of variables per factor, N = 76	No. of variables represented in the material, N = 23 ^b
Socioeconomics and health	Health and medical	2	2
	Socioeconomic characteristics	7	6
Psychological and psychosocial	Cognitive	1	0
	Affect	11	4
	Place of identity	4	0
Social	Social network influence	2	0
	Help and support	5	0
	Place of socialization	5	0
Built and natural environment	Physical ambiances	0	0
	Neighbourhood characteristics	9	1
	Dwelling characteristics	5	1
	Ergonomics and functionality	3	1
Time and space-time	Residential trajectory	5	4
	Context of decision	3	0
	Daily mobility	4	2
Economic	Personal	4	1
	Dwelling	6	1

^aBolded italics used to mark knowledge gaps: Dimension/factor not represented in the material.

^bIn the body of text in the Results section, variables are italicised.

3.4.2 | Psychological and psychosocial dimension

The studies from Sweden included factors such as meaning of home and external housing-related control beliefs, that is, concepts that include variables *satisfaction*, *control*, and *purpose in life* within the affect factor in this domain. In addition, the study protocol from Sweden²⁴ included the variable *security*, which was addressed in the study about in-home sensors³³ and bedroom usability and accessibility as well.³¹ As defined in the analytical framework, the cognitive factor is about having knowledge of housing options, which was not addressed in any of the studies included. None of the studies related to the place of identity factor.

3.4.3 | Social dimension

The study protocol from Sweden²⁴ addressed the factors health and support as well as place and socialization, but none of the variables specified in the framework were included. For example, related but not representing any of the specific variables, the project described contained a variable labeled together-oriented participation, which included questions about social activities and whether activities were conducted alone or together with others. None of the empirical studies nor the literature review³⁰ addressed any of the factors or variables included in the social domain.

3.4.4 | Built and natural environment dimension

All but the report of the observational study on in-home sensors³³ and the study about nursing home placement³² addressed factors in the built and natural environment domain, concentrated to physical ambiances, ergonomics and functionality, and dwelling characteristics (see Table 2). The studies from Sweden were based on detailed data on physical ambiances, labelled as the environmental component of housing accessibility, and operationalized as physical environmental barriers. As to ergonomics and functionality, questions about *adapted dwellings* were included in the HHPD project study protocol,²⁴ and prevalence was reported among the sample characteristics in three²⁷⁻²⁹ of the empirical publications that followed. According to the conclusions of the literature review on home modifications,³⁰ it is seldom possible to tease out information about the adaptations per se because they commonly are one among several facets of multifactorial interventions in the home setting. In the paper exploring bedroom usability with a methodological stance in Thailand,³¹ dwelling characteristics were presented in the form of architectural drawings, and *building type* was included in the study protocol²⁴ and reported among the sample characteristics in four of the empirical studies from Sweden.^{23,25,26,28} Regarding neighborhood characteristics, the only variable addressed was *geographic location*, reported among the sample characteristics (rural/semi-urban/urban) in two of the studies from Sweden^{27,28} but not used in any analyzes.

3.4.5 | Time and space-time dimension

Representing the residential trajectory factor, the descriptive *years in dwelling* variable is included in the HHPD project²⁴ and was reported among the sample characteristics in one of the cross-sectional studies from Sweden. *Coping strategies, attachment, and residential experiences* can be viewed as included in the perceived aspects of housing addressed in the HHPD project²⁴ that were used in the analyzes in four of these studies including such data.^{23,26,28,29} Among the publications reviewed, particularly the observational study on in-home sensors³³ targeted daily mobility. As daily mobility is one of the factors in this domain, including the variables *personal care and domestic activities*, there is overlap with ADL (categorized to the socioeconomic and health dimension). The studies on nursing home placement/admission^{32,34} are potentially but not explicitly related to the factor context of decision, but none of the variables within this was represented there.

3.4.6 | Economic dimension

The variable *tenure status*, within the personal economic factor, was reported as part of the sample characteristics in one of the publications from Sweden.²⁸ The study on nursing home placement in Norway³² to a large extent targeted economy, focusing on the variable *relocation cost* on the societal level, which is included in the dwelling economics factor. While only briefly touched upon, costs related to nursing home admission were discussed in the study from the US³⁴ as well.

3.4.7 | Summary of synthesis

Five of the six domains of housing were represented in this material, that is, all but the social dimension (see Table 2). Thus, the factors social network and influence, help and support, and place of socialization were not represented in any of the 12 publications. In the psychological and psychosocial dimension, the affect factor was represented, but not the cognitive and place of identity factors. As to the time and space-time dimension, none of the publications in the sample contained any information in the context of decision factor. On the level of variables, 23 of the 76 variables (30%) included in the analytical framework were represented in the sample of publications.

4 | DISCUSSION

The results of this scoping review of the scientific literature on people with PD and housing reveal that there is a substantial knowledge gap on such issues. The specific knowledge gaps are identified by our analysis of to what extent the domains, factors, and variables known to deserve attention in research on housing²¹ have been addressed in PD research. The few publications found originate from only few

researchers and research teams, situated in Scandinavia, Thailand, the United Kingdom, and the United States, and the studies are very different in scope and study designs. While two factors in the social domain are represented in the study protocol publication²⁴ included in our review, it is noteworthy that this domain is not represented at all in the empirical or review publications from the latest 15-year period included in the present review. However, it should be noted that numerous studies have shown that social support is of importance for people with PD in relation to activities and participation,³⁵⁻³⁷ albeit not focusing on housing issues.

As to the coverage of domains, factors, and variables, it should be kept in mind that the majority of those represented in the sample of publications in our review were merely used as descriptive variables and not as part of the analyzes toward the study objective. This applies primarily to variables under the socioeconomic characteristics factor in the socioeconomic and health dimension, but also to variables such as building type, adapted dwelling, and geographic location in the built and natural environment dimension and to a few in the time and space-time as well as the economic dimension. When it comes to variables under the health and medical factor in the socioeconomic and health dimension, most publications in our sample contained numerous variables beyond those specified in the analytical framework, such as PD severity stage, incidence of falls, use of medications, and other PD-specific characteristics. Together with the personal care and domestic activities variables under the factor daily mobility in the time and space-time dimension, such variables represent those most used in the analyzes performed toward the study aims in our sample of publications. That is, prior research on people with PD and housing issues has focused on the health and medical factor in a more detailed and qualified manner than studies in the aging and housing realm, which was the basis for Roy et al's framework.²¹ The study on effects of functional status impairment and medication on nursing home admission risk³⁴ is one example of such research. On the other hand, the analysis based on Roy et al's framework shows that the substantial knowledge gap regarding people with PD and housing concerns not only the social, psychological, and psychosocial dimensions but also the built and natural, time, and space-time and economic dimensions of this multifaceted field of inquiry.

While limited in volume, a recurring research interest identified in the present literature review relates to the built and natural environment domain, in terms of the ergonomics and functionality, and physical ambiances factors. An explicit focus on housing accessibility and housing adaptations was identified in four of the publications,^{25,27,30,31} while accessibility was used as a variable in several others.^{23,24,26,29} Thus, this is another example where the analytical framework used was not sufficiently detailed for research about people with PD and housing, manifested by the fact that the physical ambience factor did not contain any specific variables such as design features, environmental barriers, and accessibility problems.

Going beyond the specific focus on housing, there is PD research focusing on the built and natural environment dimension in a broader sense, which was out of the scope of the present study. Published shortly after the search period for our review, a systematic review of

the role of architecture and design in the management of PD caught our interest.³⁸ In that context the built and natural environment dimension seems to be more prominent than in the publications with a specific focus on housing included in the present review. Ramos et al show that design features such as pavement characteristics in terms of unstable surfaces and level differences are major causes of falling. Obstacles on the ground and confined spaces disturb gait and increase postural instability, resulting in decreased mobility. However, like in our review, the authors concluded that far from all aspects that should be considered in their focus area—that is, architecture and design variables—were assessed in the 36 studies included in their review.

Relating the results of the 12 studies included in the present review to the existing knowledge on housing for the aging population in general, as demonstrated by the framework we used for the analysis,²¹ such research encompasses a wider range of topics. Research within environmental gerontology³⁹ is explicitly multi- and interdisciplinary in nature and engages scholars from many different disciplines. Synthesized findings from a cross-national European project⁴⁰ underpinned by environmental gerontology highlight the complex interactions between objective and perceived aspects of housing and aspects of health in very old age, which is in line with the PD study from Sweden²⁶ showing that ADL dependence plays an important role in such dynamics. A similarity between older adults in general and people with PD is that environmental barriers as such do not contribute significantly to correlations between housing and health variables unless they are juxtaposed with the functional capacity of the individual.²⁶ An important difference is that perceptions of external housing-related control beliefs are specifically important among people with PD [26], but longitudinal studies such as one of those included in this review²⁹ are warranted to increase the understanding of such associations. Among very old adults, independence in daily activity is influenced by the sociocultural care and service context and a familiar and safe neighborhood, social network, and a good supply of services are important to perceptions of participation.⁴⁰ Because of the paucity of PD studies including such factors and variables in relation to housing, there is a notable research gap in this respect.

Moreover, the priority areas in the WHO housing and health guidelines¹⁶ include factors of high relevance for the PD population such as the need for more attention to injury hazards in the home and accessibility for people with functional impairments. Including variables such as high/low indoor temperature, tobacco smoke, noise, water, and air quality, the guidelines extend beyond what was covered by Roy et al's multifaceted framework²¹ and current research on aging and housing, which illustrates the potential broadness of housing research and the paucity of research regarding PD in this respect.

Turning to the intervention labelled housing adaptations or home modifications, which is common in PD practice contexts, an important conclusion of the literature review³⁰ included in our sample of publications is that it is difficult to tease out the specific effect of this facet of the multi-component interventions provided. This was confirmed during the selection process for our review, as numerous publications did report on interventions including housing adaptations or home

modifications,^{41–43} but without any reference to housing in the study objectives and research questions. Accordingly, such publications were not included in our review, but a common trait of those is that even if housing adaptation/home modification was part of the interventions, this was not described in any detail. Consequently, these studies did not contribute with knowledge about possible effects of housing adaptations/home modifications. Reducing and specifying such interventions to home safety modification, the WHO housing and health guidelines¹⁶ show that the existing evidence is moderately supporting the hypothesis that home safety programs prevent falls and injuries.

Given that falls and recurrent falls are common and serious for the PD population,⁴⁴ existing research on falls could benefit from studies focusing explicitly on housing issues. During the selection process we reviewed many PD-studies focusing on falls, gait and related factors, but in most of those housing variables were at best made note of as a side finding. However, while not fulfilling our inclusion criteria several studies reported detailed and interesting results regarding physical ambiances, dwelling characteristics, ergonomics, and functionality. For example, while not addressing anything about housing in the study objective, Ashburn et al⁶ reported interesting results about fall circumstances, including details about housing areas and features where falls had occurred. Moreover, Lamont et al⁸ found that there are differences between falls at home and in the community among people with PD. Postural transitions, such as moving between sitting and standing, frequently contributed to falls in the home environment, as did anticipated (eg, opening a door) as well as unanticipated physical loads. Adding to this, in a recent qualitative study focusing on environments in a general manner rather than on housing, Parry et al⁴⁵ reported that familiarity and meaning related to home are important for how people with PD experience walking in everyday environments. These examples indicate that there is a growing interest about housing issues in PD research, but efforts are needed to focus and strengthen this line of research.

Published during recent years, several literature reviews focused on environmental factors (including housing) among people with stroke or dementia. A review by Jellema et al⁴⁶ found that mostly sociocultural factors were studied; although the importance of accessible environments was mentioned, housing was barely touched upon. Another review⁴⁷ highlighted that despite the shift toward home-based care, findings related to the physical environment of the home are treated as side findings. Moreover, information relating to the psychological and psychosocial dimension was absent, which is in line with our findings. Concentrating their review of the role of the home environment in dementia care and support to qualitative studies (N = 40), Soilemezi et al⁴⁸ concluded that the home is an important setting, which changes along with the changing nature of dementia disorders. Therefore, the home environment must be flexible to accommodate changes and challenges along the course of the disease. While not touched upon in any of the publications, we found and thus adding to the existing knowledge gap, this is a recommendation that could be relevant for the PD population as well.

As to studies on relocation, existing PD research with an explicit focus on housing has concentrated on nursing home admission,^{32,34} but there are PD studies touching upon relocation that did not fulfil our inclusion criteria. For example, several studies addressed issues that relate to relocation to nursing homes such as predictive factors and the decision process, albeit framed in the context of care^{13,49,50} and not explicitly focusing on housing issues. The body of recent literature on relocation is limited regarding aging populations in general as well, with interest for moves to special forms of housing at the core (see for example, reference no 51). That is similar to the limited research targeting PD and relocation. For example, a British panel study showed that moving to residential housing was associated with higher mortality in the next 12 months in people 65+, especially in men.⁵² Comparing people remaining in ordinary housing with those moving to special housing, those who did not move were initially better off. After 3 months, the difference decreased due to improvement among the movers, mostly in depression and self-rated health.⁵³ In a qualitative study including older people in Australia, reasons to move reflect the urge to maintain independence, stay in control and avoid loneliness, and that having control over relocation decisions and being proactive contribute to positive adjustment.⁵⁴ Such dimensions need more attention in PD research. On the other hand, health and medical factors related to relocation are sometimes lacking in aging research, not the least when it comes to specific attention to different diagnoses and disabilities. In this respect, Roy et al's framework shows that there are knowledge gaps in studies that focus on older people in general as well.

4.1 | Strengths and limitations

Systematic literature search is a notable challenge, but the engagement of an information specialist and an author constellation representing different disciplines (ie, gerontology, occupational therapy, physiotherapy, PD research, public health) placed us in a strong position to plan for and execute an efficient search strategy. However, despite our efforts, we experienced difficulties and there likely are publications existing that were not identified during the iterative process.

Because the framework published by Roy et al²¹ focused on domains, factors, and variables important to address in research on frail older adults' housing decisions, it was not perfectly suited for our purposes. It should be kept in mind that Roy et al excluded studies that involved people with cognitive impairments, which is common in PD.⁵⁵ Moreover, the cognitive factor was defined differently than in PD research and related to knowledge rather than categorized to the health dimension. Another example of a definition diverging from what is common in PD research is that daily mobility, including the variables personal care and domestic activities, was categorized as a factor under the time and space-time dimension rather than included in the health dimension. Overall, we noted that aging research targeting housing as represented in Roy et al's review²¹ lacks the level of detail regarding the health and medical factor, which is notably more developed in the PD-field. Further, while most people with PD are older adults the PD population includes younger people as well,

but Roy et al's framework is based on research including people over the age of 65. Still, the framework we used worked well to analyze and synthesize to what extent the scattered sample of publications covered what is considered as useful to address in research on PD and housing issues.

The fact that seven of the publications in the sample of this scoping review emanated from our research team was an unforeseen challenge, which induced potential bias. Throughout the process, the team of authors made every effort to keep an objective distance to the material, and because no quality assessment was performed, we minimized the risk of biased results and conclusions.

5 | CONCLUSION

Despite the fact that housing is a major arena for daily life, not the least in later life and for people aging with progressive disease and disabilities, little is known about people with PD and their housing situation. Globally, only a few researchers have published the results of scientific studies in this specific area of inquiry. The knowledge gap is most evident in the social dimension of housing, while the studies identified provide more information relating to the health dimension than what is the case in research on housing targeting the general aging population. Because society urgently needs evidence to support the development of housing policies and provide suitable housing for this vulnerable population, more research targeting people with PD and housing issues is warranted.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

AUTHOR CONTRIBUTIONS

Conceptualization: Susanne Iwarsson, Nilla Andersson, Maria H. Nilsson, Björn Slaug. Formal Analysis: Susanne Iwarsson.

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All authors have read and approved the final version of the manuscript.

Lead author Susanne Iwarsson had full access to all of the data in this study and takes complete responsibility for the integrity of the data and the accuracy of the data analysis.

TRANSPARENCY STATEMENT

Lead author Susanne Iwarsson affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

DATA AVAILABILITY STATEMENT

All the publications reviewed in this study are available as online sources. The authors confirm that the data supporting the findings of this study are available within the paper.

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