National Institute for Health and Care Excellence

Final

Falls: assessment and prevention in older people and people 50 and over at higher risk

Economic model report

NICE guideline NG249

Economic report underpinning recommendations

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Final

Developed by NICE

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HE1 Methods

HE1.1 Model overview

The objective of this analysis was to compare the expected benefits and costs of home hazard assessment and modifications (HAM) being done by an occupational therapist (OT) compared to standard care.

HE1.1.1 Population(s)

The population of interest was people at an increased risk of falling over 65 years living in the community (that is, not residential care or a hospital). Men and women were modelled separately because of the differences in the baseline risk of falls. Also, the Guideline Development Group (GDG) advised that females are at a higher risk of severe impact from falls due to increased prevalence of osteoporosis, leading to a higher risk of fractures.

HE1.1.2 Interventions

The model assessed whether it is cost effective for HAM to be given by an OT compared to standard care which comprised HAM undertaken by a mixture of OTs and other personnel (OP). OP could be, for example, OT technician who is less qualified and with a lower pay grade.

HE1.1.3 Type of evaluation, time horizon, perspective

The analysis measures outcomes as the expected number of quality adjusted life years (QALYs), and the results are presented using incremental cost-effectiveness ratios (ICERs) that express the cost per QALY gain of using a specific follow up regime compared to the next best alternative.

The model has a lifetime horizon, to reflect all important differences in costs and outcomes between the interventions being compared.

The analysis was done from the perspective of the NHS and Personal Social Services (PSS) in the United Kingdom.

HE1.1.4 Discounting

The analysis discounts all costs and QALYs at a rate of 3.5% per year, as required by Developing NICE guidelines: the manual (NICE 2024).

HE1.2 Model structure

A Markov model was constructed in Microsoft Excel for people over 65 years at an increased risk of falling. Men and women were modelled separately because of the differences in the baseline risk of falls. The committee also advised that the impact of a fall is often more severe for females because of a higher level of osteoporosis and, therefore, an increased risk of fracture. The different health states and their definitions are shown in Table HE001.

Table HE001: Modelled health states

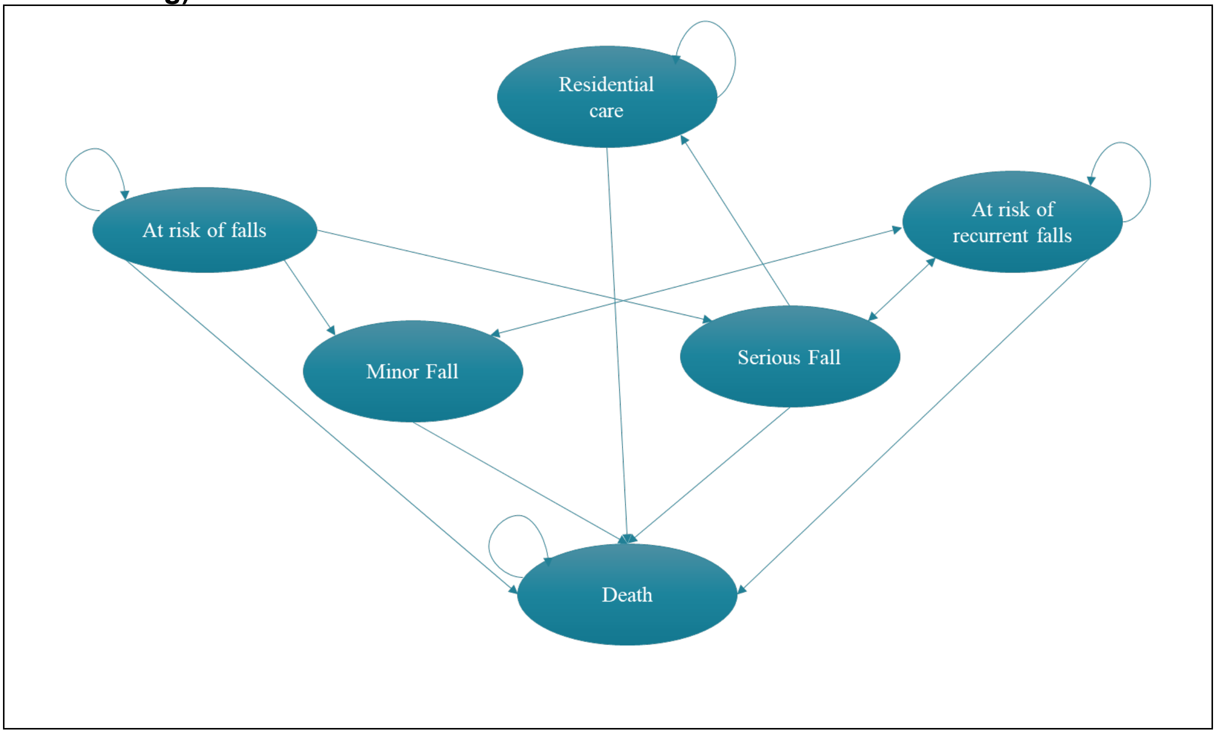
Health state	Definition
At risk of falls	Person has never had a fall
At risk of recurrent falls	Person has had at least one fall (serious or minor)

Health state	Definition
Minor fall	Person has fallen but it did not need medical intervention
Serious fall	Person has fallen and it needed medical intervention
Residential care	Person has moved into a residential care home or hospital because of a serious fall
Death	Person has died

Figure HE001 provides a schematic depiction of the model structure. The Markov model starts with everyone in the “At risk of falls” health state. From there, people can have a minor fall, a serious fall or die.

- If the person has had a minor fall, they could then move to “At risk of recurrent falls” or “Death”.
- If the person has had a serious fall, then they could move to either “At risk of recurrent falls”, “Residential care” or “Death”.
- People could stay in “Minor fall” or “Serious fall” health states for one cycle (1 year) only before moving to the “At risk of recurrent falls” health state. “At risk of recurrent falls” health state is similar to the “At risk of falls” state. However, people in this health state already had a fall. Therefore, having this health state allows the application of different probabilities of experiencing another fall than those from the “At risk of falls” state.
- “Death” is an absorbing state, which means that at the end of the model, everyone finishes in this state.

Figure HE001: Schematic of Markov model (arrows indicate movement within the model, circular arrows show where people can remain for more than one cycle before transitioning)



HE1.3 Model parameterisation

Identifying sources of parameters

Clinical effectiveness data associated with an intervention, that is, the reduction in the rate of falls, came from the systematic review done for this research question (see below). Most of the other model parameters were identified through informal searches that aimed to satisfy the principle of 'saturation' (that is, to 'identify the breadth of information needs relevant to a model and sufficient information such that further efforts to identify more information would add nothing to the analysis' [Kaltenthaler et al., 2011]). We conducted searches in various general databases, including Medline (via PubMed), the Cochrane Database of Systematic Reviews and GoogleScholar.

When searching for quality of life, resource-use and cost parameters in particular, we conducted searches in specific databases designed for this purpose, the CEA (Cost-Effectiveness Analysis) Registry and the NHS Economic Evaluation Database (NHS EED) for example.

We asked the GDG to identify papers of relevance. We reviewed the sources of parameters used in the published cost-utility analyses (CUAs) identified in our systematic review of economic evidence; during the review, we also retrieved articles that did not meet the formal inclusion criteria but appeared to be promising sources of evidence for our model. We studied the reference lists of articles retrieved through any of these approaches to identify any further publications of interest.

In cases where there was paucity of published literature for values essential to parameterise key aspects of the model, we obtained data from unpublished sources; further details are provided below.

Selecting parameters

Our overriding selection criteria were as follows:

- The selected studies should report outcomes that correspond as closely as possible to the health states and events simulated in the model.
- The selected studies should report a population that closely matches the UK population (ideally, they should come from the UK population).
- All other things being equal, we preferred more powerful studies (based on sample size and/or number of events).
- Where there was no reason to discriminate between multiple possible sources for a given parameter, we gave consideration to quantitative synthesis (meta-analysis), to provide a single summary estimate.

HE1.4 Parameters

HE1.4.1 Cohort parameters

HE1.4.1.1 Starting demographics and characteristics

The starting age of people in the model was 65 years which is in line with the guideline definition of population to be covered. It considers people who are at an increased risk of falls defined by at least one fall in the past 12 months. The analysis was run for males and females separately to capture differences in baseline falls risk and severity of falls.

HE1.4.2 Baseline risk of falls data

The baseline risks of falls were obtained from Kwon 2022, which used the English Longitudinal Study of Aging (ELSA) data. The committee suggested the ELSA study as it is about aging in England and collects data from people over 50 years which is similar to the population considered in this analysis. It provided the required probabilities to populate an economic model, including people in the community experiencing varying severity falls, that is, those that needed medical attention and those that did not, as well as recurrent falls. The data was also split by sex and age. The data for major falls was used as an equivalent to serious falls.

However, the ELSA data is for all people over 50 years, not just those who are at increased risk of falls. This means that the baseline number of falls may have been underestimated. However, this was addressed in the sensitivity analysis, where the probabilities of baseline falls were varied.

The baseline risks of falls are summarised in Table HE002 for minor falls and Table HE003 for serious falls.

Table HE002: Baseline risks of minor falls for the general population residing in the community stratified by age, sex and type of fall (Kwon 2022)

Type of fall by age	Annual Probability (Male)	Annual Probability (Female)
Minor fall (65-69)	0.077	0.117
Minor fall (70-74)	0.110	0.117
Minor fall (75-79)	0.105	0.113
Minor fall (80-84)	0.149	0.122
Minor fall (85-89)	0.108	0.138
Minor fall (90+)	0.143	0.093
Recurrent minor falls (65-69)	0.084	0.082
Recurrent minor falls (70-74)	0.064	0.087
Recurrent minor falls (75-79)	0.078	0.094
Recurrent minor falls (80-84)	0.116	0.111
Recurrent minor falls (85-89)	0.115	0.087
Recurrent minor falls (90+)	0.187	0.128

Table HE003: Baseline risk of major falls for the general population residing in the community stratified by age, sex and type of fall (Kwon 2022)

Type of fall by age	Annual Probability (Male)	Annual Probability (Female)
Major fall (65-69)	0.022	0.048
Major fall (70-74)	0.029	0.040
Major fall (75-79)	0.049	0.066
Major fall (80-84)	0.040	0.083
Major fall (85-89)	0.062	0.092
Major fall (90+)	0.033	0.047
Recurrent major falls (65-69)	0.013	0.030
Recurrent major falls (70-74)	0.021	0.031
Recurrent major falls (75-79)	0.025	0.045

Type of fall by age	Annual Probability (Male)	Annual Probability (Female)
Recurrent major falls (80-84)	0.033	0.062
Recurrent major falls (85-89)	0.069	0.067
Recurrent major falls (90+)	0.033	0.076

HE1.4.3 Treatment effects

The treatment effect of using an OT (vs standard care) to undertake HAM was obtained from the systematic review undertaken for this review question. The estimate was based on a meta-analysis of all available data. The relative risk of fall reduction for OT (versus standard care) was found to be 0.68.

There was no data on how long the treatment effect would last. The GDG explained that it depends on many factors including the patient's diagnosis, the environmental factors, the patient's social situation and the housing needs. The GDG discussed that some interventions would last a patient's lifetime. However, if a patient's health changes, the intervention may no longer help. Given the uncertainty around this model input and to be conservative, the GDG agreed that the treatment effect lasting for two years should be modelled in the base case analysis. However, the GDG noted that it would be important to test this assumption in the sensitivity analysis, where the modelled treatment effect duration would be longer.

HE1.4.4 Other clinical inputs

In the model, if a person has had a serious fall, they could move to a "Residential care" state. In practice, people can move into a residential home for multiple reasons, including dementia or difficulty supporting themselves, and it is not necessarily a fall that has caused them to move. However, this model is addressing falls and the ability to prevent them, and therefore, this probability should capture only people moving into residential care homes because of a fall.

The probability of moving into a care home because of a fall was obtained from the Return on Investment tool (RoIT). The RoIT was built by Public Health England (PHE) to assess the cost effectiveness and potential return on investment (ROI) for falls prevention programmes aimed at elderly people based in the community (PHE 2018). The analysis took an NHS and PSS perspective using a 2-year time horizon and modelled the general population over 65 years living in the community. PHE used two expert groups to advise, comment and provide feedback on the assumptions, data sources and report.

The probability of moving from a serious fall to residential care was estimated as a combination of people admitted to a long stay geriatric ward (5.69%), discharged to an NHS care home (1.46%), discharged to a local authority residential home (0.56%), and discharged to a non-NHS care home (1.56%) for a total of 9.3%. It was further modelled that discharge to usual residence (88.34%) was equivalent to moving from serious falls to a "Risk of recurrent falls" state in the model.

While it is also acknowledged that people in residential homes can have repeat falls, this is a different environment where they will not benefit from the modifications prescribed in the community. Therefore, the benefits of the HAM are no longer applicable. Thus, within this model, it is assumed that once a person moves into residential care, they will stay in that health state until they die. The impact of this assumption was tested in the sensitivity analysis, for example, by excluding transitions to this state and setting the residential care costs to zero.

Also, to simplify the modelling it was assumed that people could only transition to the "Residential care" state through the "Serious Fall" state. In practice, people could move to "Residential care" following, for example, a minor fall. However, this is unlikely to be a common scenario. To test the impact of this assumption, the probability of moving into residential care was varied in sensitivity analysis.

HE1.4.5 Mortality data

Background mortality was obtained from the Office for National Statistics (ONS, 2024). Data for the years 2018 to 2020 was used rather than the latest data for 2020 to 2022, because Covid 19 caused a spike in the number of deaths, especially in the older population, which is being modelled.

For mortality in residential care setting, the mortality statistics in care home residents in England and Wales was used (Carehome 2023). The latest data was 2022, and it was checked to ensure that it was back to pre-pandemic levels and, therefore, not affected by Covid 19.

Mortality for people who had had a serious fall, a combination of background mortality and the risk of death after a serious fall from the RoIT was used. The RoIT was built by PHE to assess the cost effectiveness and potential return on investment for falls prevention programmes aimed at older people based in the community in the UK (PHE 2018).

HE1.4.6 Quality of life data

There were three different sets of utilities found in the literature, these were from Franklin 2019, Church 2012 and the RoIT 2018. These are summarised in Table HE004.

Franklin 2019 was a Markov model based in the UK assessing the cost effectiveness of fall risk assessment strategies in community-dwelling older people. It used utility values for at risk of falls health state measured using EQ-5D-3L and valued using UK tariff. The decreases in utility values associated with different types of falls were determined based on various published sources.

Church 2012 was also a Markov model based in Australia which assessed multiple fall prevention interventions in older community-dwelling people. It used utility values for at risk of falls health state measured using EQ-5D-3L and valued using UK tariff. The utility decrements from at risk of falls were based on various published sources including Iglesias 2009 for the fear of falling.

RoIT 2018 was a model-based cost effectiveness analysis for falls prevention programmes aimed at older people based in the community. It used utility value for at risk of falls health state measured on EQ-5D-3L and valued using UK tariff. The decrements of all the other health states were then obtained from various published sources (Brazier 2002, Church 2012 and Iglesias 2009). Brazier 2002 was in an osteoporosis population and both Church 2012 and Iglesias 2009 were in the older population.

Table HE004: Quality of life utilities

Health state	Franklin 2019	Church 2012	RoIT 2018
At risk of falls	0.780	0.731	0.730
At risk of recurrent falls	0.780	0.717	0.685
Minor fall	0.755	0.686	0.699
Serious fall	0.707	0.671	0.670
Residential care	0.684	0.587	0.582
Dead	0.000	0.000	0.000

The GDG were shown all three sets of values and asked which seemed the most representative. They were aware that all the studies used the EQ-5D-3L and UK tariff for at risk of falls state and acknowledged that Church 2012 and the RoIT 2018 values were very similar. They also noted that the RoIT 2018 modelling was based in the UK and was a more recent study. The GDG also noted that Franklin 2019 values were quite different from those of the other two studies. Therefore, they agreed to use the RoIT 2018 values for the baseline analysis and the other two value sets in a sensitivity analysis.

HE1.4.7 Cost and healthcare resource use identification, measurement and valuation

Where possible, we drew resource-use information from the primary evidence-base identified in our systematic review of clinical evidence. In the absence of such data, we attempted to locate published economic evaluations or costing studies providing relevant information. We filled any remaining gaps with estimates from the experts on the guideline committee.

We obtained unit costs for each of the resource use elements from a number of standard sources.

- We use NHS National Cost Collection data 2021/22 (previously known as NHS Reference Costs) as the source of unit costs for inpatient and outpatient procedures as well as hospital stay information.
- We use the annual report on Unit Costs for Health and Social Care by the Personal Social Services Research Unit (Jones 2023) to specify costs for both community and hospital-based healthcare staff.
- Where we cannot source an appropriate unit cost from these sources, we may use values from a relevant published study, in which case we inflate them to current prices using HCIS inflation indices from Unit Costs for Health and Social Care (Jones 2023).

HE1.4.7.1 Direct costs of interventions and prescribed modifications

According to the committee, for the OT arm, the possible bands that could undertake HAM would be bands 5 to 7. For base case analysis, it was assumed that the mid-point, band 6 (£55 per hour, PSSRU, Jones 2023) would be used.

It was further modelled that the length of the intervention was an hour, this is in line with the studies included in the clinical review.

For the OP arm, which represented standard care the GDG explained that a combination of OTs and lower band personnel, for example, an occupational therapy technician would be used to undertake HAM. For the other personnel, band 4 (£37 per hour, PSSRU, Jones 2023) was used. Similarly to the OT arm for the OTs we used band 6 (£55 per hour, PSSRU, Jones 2023).

There was no published data to show the percentage of OT currently undertaking HAM. Therefore, the GDG assumed that 25% of HAM undertaken by OTs and 75% by other lower band personnel would a good approximation of current practice across the country. The value of HAM undertaken by OTs was tested in sensitivity analysis by ranging it between 0% and 90%.

The direct cost of the interventions (that is the cost of seeing the OT or OP) was only applied in the first year, as most people only receive a home assessment once. The GDG discussed the cost of prescribed modifications. It is possible that an OT may recommend more expensive modifications. However, the GDG believed that the benefit of the OT undertaking HAM was their skill, and they may actually recommend a cheaper modification. Therefore, the committee agreed that in the base case analysis the cost of prescribed modifications should be zero and the impact of this assumption should be tested in the sensitivity analysis. Like the HAM assessment cost, any additional costs of the prescribed modifications were added in the first year of the OT arm, only as part of the sensitivity analyses.

HE1.4.7.2 Costs associated with model health states

The committee agreed that people residing in minor falls, at risk and at risk of recurrent falls health states do not need any medical attention and do not incur healthcare costs. Therefore, in the model, only two health states had a cost associated with them: serious fall and residential care.

The cost of a serious fall was based on the RoIT (PHE 2018). The RoIT was a UK-based modelling study that used an NHS and PSS perspective. The serious fall cost estimate in the study comprised 51% of people having a GP visit, 80% having an accident and emergency (A&E) attendance, 61% having an ambulance called, 24.8% having an inpatient stay with a hip fracture and 55.2% having an inpatient stay that did not involve a hip fracture.

The unit cost of a GP visit is £37, comprised of a single consultation lasting 9.22 minutes from PSSRU (Jones 2023). The cost of a single A&E visit was obtained from NHS cost collection 2021/22 and was from the total outpatient attendance (NHS Improvement 2022). The cost of an ambulance was obtained from PSSRU (Jones 2023), it was made up of the weighted average of the ambulance services, calls (£92), hear and treat and refer (£87), see and treat and refer (£276), and see and treat and convey (£367). Both the costs of an inpatient stay, with and without a hip fracture, were from the RoIT report and were uprated to current prices using the EPPI cost converter (CCEMG 2024).

The resource use was combined with the unit cost data to obtain a total cost of £8,849.89 per person experiencing a serious fall. The inputs used to estimate cost of a serious fall are shown in Table HE005.

Table HE005: Cost of a serious fall

Parameter	Input estimate	Source
GP visit unit cost	£37.00	PSSRU, Jones 2023
Proportion of serious falls that involve a GP visit	0.510	RoIT, PHE 2018
A&E attendance unit cost	£144.00	NHS Cost collection
Proportion of serious falls that involve A&E attendance	0.800	RoIT, PHE 2018
Ambulance unit cost	£276.00	PSSRU
Proportion of serious falls that involve and ambulance	0.610	RoIT, PHE 2018
Inpatient stay for a hip fracture	£11,582.00	RoIT, PHE 2018
Proportion of serious falls that involve a hip fracture	0.248	RoIT, PHE 2018
Inpatient stay for non-hip fracture	£10,281.00	RoIT, PHE 2018
Proportion of serious falls that involve an inpatient stay for not hip fracture related injury	0.552	RoIT, PHE 2018
Total cost of a serious fall	£8,849.89	Calculation (using the above estimates of resource use and unit cost data)

Abbreviations: A&E: Accident & Emergency; GP: General Practitioner; PHE: Public Health England; PSSRU: Personal Social Services Research Unit; RoIT: Return on Investment Tool

The GDG explained that following a serious fall people who needed further support may be admitted to either a residential care home or a nursing home. Therefore, the cost of residential care was a combination of nursing home and residential care costs. It was estimated that 28.2% of people would be admitted to a nursing home and 71.8% to residential care (Carehome 2023). These probabilities were combined with the annual costs of each care setting obtained from PSSRU (Jones 2023). This resulted in a total annual cost of £54,669.44. The inputs used to estimate cost of a residential care are shown in Table HE006.

As mentioned in the previous section, to simplify the modelling, it is assumed that once a person moves into the residential care, they will stay in that health state until they die. Given the high costs associated with the residential care the impact of this assumption was tested in the sensitivity analysis, for example, by setting the residential care costs to zero.

Table HE006: Cost of residential care

Parameter	Point estimate	Source
Nursing home annual cost	£65,728.00	PSSRU, Jones 2023
Residential care annual cost	£50,336.00	PSSRU, Jones 2023
Percentage of serious falls receiving further care in nursing home	0.282	Carehome 2023
Percentage of serious falls receiving further care in residential home	0.718	Carehome 2023
Total annual residential care cost	£54,669.44	Calculation (using the above estimates of resource use and unit cost data)

Abbreviations: PSSRU: Personal Social Services Research Unit

HE1.5 Summary of key assumptions

Key assumptions in this model are:

- People modelled are starting at 65 with a history of at least one fall in the past 12 months for example those that have weaker muscles, poor balance or dizziness.
- Standard care includes 25% of OTs undertaking HAM and 75% of OPs undertaking HAM.
- OTs do not in general suggest modifications that are more expensive than those suggested by OPs.
- Minor falls do not need medical attention and therefore do not incur any healthcare costs.
- People within the model only enter residential care via a serious fall health state.
- People who enter residential care state because of a serious fall are assumed to remain in this health state until their death.

HE1.6 Subgroup analyses

No subgroups were investigated. However, males and females were analysed separately.

HE1.7 Sensitivity analyses

HE1.7.1 Deterministic sensitivity analyses

We completed deterministic sensitivity analyses to find out which parameters had the biggest impact on the results. In particular, we wanted to find out if changing any parameter would change the conclusions about which approach to HAM was the most cost effective. The model parameter value ranges that we explored in the sensitivity analyses were informed by the reported confidence intervals and the GDG committee expert opinion. Where data was not available, for example, if we were not able to obtain a standard deviation for the parameter, then ± 20% of the point average was used as the standard error.

The following deterministic sensitivity analyses were undertaken:

- Varying the baseline falls probabilities.
- Varying the size of treatment effect, that is, the relative risk of falls for HAM by OTs compared to standard care.
- Varying the duration of treatment effect.
- Varying the proportion of OT assessors in standard care arm.
- Incorporating an additional one-off cost of additional home modifications prescribed to the OT arm.
- Varying the band of OT and OP.
- Varying the cost of a serious fall.
- Varying residential care costs.
- Using different utility values.

Table HE007 provides a summary of all one-way deterministic sensitivity analyses done, including the values that were tested.

Table HE007: Summary of deterministic sensitivity analyses undertaken including point estimates, values or ranges tested

Parameter	Original point estimate	Values tested in sensitivity analyses
Changing proportion of standard care HAM that has OT input (OT=0%)	25%	0-90%
Changing utility data source	RoIT 2018 (see Table HE004)	Church 2012 and Franklin 2019 (see Table HE004)
Including one-off extra cost of prescribed adaptations	£0	£150
Changing cost of a serious fall	£8,849.87	£4,424.94 and £17,699.76
Changing band of OT	£55/hour (band 6)	£42/hour (band 5) and £66/hour (band 7)
Changing residential care cost	£54,669.44	£0.00
Changing baseline data	See Table HE002 and Table HE003	Multiplier of 0.5 to 2*
Changing the cost of OP (as suggested by the GDG)	£37/hour	£20/hour
Adjusting baseline falls rates using Wang 2023*	1	2.10 (this was estimated as the proportion of falls in high vs. low-risk groups)

Abbreviations: GDG: Guideline development group; HAM: Home hazard assessment and modifications; OP: Other personnel; OT: Occupational therapist; RoIT: Return on investment tool
**This variable is used to multiply all the baseline falls data for example 2 means that every value of the baseline falls rate is multiplied by 2.*

HE1.7.2 Scenario analyses

Similarly to the deterministic sensitivity we tested which combination of parameters had the biggest impact on the results. In particular, we wanted to find out if changing any parameter would change the result of which approach to HAM was the most cost effective.

The following two-way deterministic sensitivity analyses were undertaken:

- Varying baseline risk of falls and relative risk of falls for HAM by OTs compared to control.
- Varying the duration of intervention effect and intervention cost, that is, the band of OTs undertaking HAM.
- Varying the duration of intervention effect and the composition of personnel undertaking HAM in the standard care arm.
- Varying the duration of intervention effect and using the probabilities of recurrent falls in people at risk of a first fall.

We have also explored a scenario analysis where we set key model inputs to favour standard care approach to HAM (the most pessimistic view). It included:

- Setting the duration of treatment effect to 1 year
- Halving all baseline fall probabilities
- Increasing cost of an OT from £55 (band 6) to £66 (band 7)
- Reducing the proportion of OT assessors in the OP arm to 0%
- Adding an additional one-off cost of prescribed modifications (£150) to the OT arm
- Halving both cost of a serious fall and cost of residential care.

HE1.7.3 Probabilistic sensitivity analyses

We configured the models to perform probabilistic sensitivity analysis (PSA) to quantify uncertainty in the true values of input parameters. We specified probability distributions for all input variables with the exception of staff costs (hourly rate of OT and OP) this is because these costs are fixed and known within the NHS.

We decided the type of distribution with reference to the properties of data of that type (for example, we use beta distributions for probabilities that are bounded between 0 and 1 and we use gamma distributions for cost parameters that cannot be negative). Where possible, we parameterised each distribution using dispersion data from the source from which the value was obtained; where no such data were available, we considered applying plausible ranges based on committee advice and the usual properties of similar data.

For the PSA, the utilities of the health states needed to stay in the same rank order. For example, the utility of a serious fall always had to remain lower than the utility of a minor fall. This is important because the identified utility values for different health states were similar and in PSA it was possible for the utilities to be ranked in an illogical way. For example, in some PSA iterations, utility values for a minor fall could be lower than those for a severe fall.

To ensure the logical ordering of utility values, the difference between each ranked consecutive pairs of utility values were estimated. These differences were then made probabilistic using the beta distribution. Following this, the probabilistic decrements were subtracted consecutively starting from the highest-ranking utility value, that is, the at risk of the fall. See Table HE023.

HE1.7.4 Summary of model inputs including details of the distributions and parameters used in probabilistic sensitivity analysis

All parameters used in the model are summarised in Table HE008 to Table HE023, including details of the distributions and parameters used in probabilistic sensitivity analysis.

- Table HE008 shows the model’s global settings.
- Table HE009 shows age-related baseline probabilities of minor falls for males.
- Table HE010 shows age-related baseline probabilities of minor falls for females.

- Table HE011 shows age-related baseline probabilities for recurrent minor falls for males.
- Table HE012 shows age-related baseline probabilities for recurrent minor falls for females.
- Table HE013 shows age-related baseline probabilities for serious falls for males.
- Table HE014 shows age-related baseline probabilities for serious falls for females.
- Table HE015 shows age-related baseline probabilities for recurrent serious falls in males.
- Table HE016 shows age-related baseline probabilities for recurrent serious falls in females.
- Table HE017 shows age-related transition probabilities after a serious fall for both males and females.
- Table HE018 shows the clinical effectiveness of HAM.
- Table HE019 shows the mortality inputs.
- Table HE020 shows the cost of the intervention.
- Table HE021 shows the cost of a serious fall.
- Table HE022 shows the cost of a residential home.
- Table HE023 shows the utility values.

Table HE008: Model global settings including probabilistic sensitivity analysis distributions and parameters

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
Starting cohort age (years)	65	N/A	N/A	N/A
Discount rate (QALYs)	3.5%	N/A	N/A	NICE reference case (NICE 2024)
Discount rate (Costs)	3.5%	N/A	N/A	NICE reference case (NICE 2024)

Abbreviations: N/A: Not applicable; QALY: Quality-adjusted life year

Table HE009: Baseline probabilities of minor falls for males

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
Minor fall (65-69)	0.077	Beta	α=111; β=1336	Kwon 2022
Minor fall (70-74)	0.110	Beta	α=145; β=1171	Kwon 2022
Minor fall (75-79)	0.105	Beta	α=97; β=824	Kwon 2022
Minor fall (80-84)	0.149	Beta	α=81; β=463	Kwon 2022
Minor fall (85-89)	0.108	Beta	α=28; β=232	Kwon 2022
Minor fall (90+)	0.143	Beta	α=13; β=78	Kwon 2022

Table HE010: Baseline probabilities of minor falls for females including probabilistic sensitivity analysis distributions and parameters

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
Minor fall (65-69)	0.117	Beta	α=186; β=1403	Kwon 2022
Minor fall (70-74)	0.117	Beta	α=176; β=1322	Kwon 2022

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
Minor fall (75-79)	0.113	Beta	α=119; β=933	Kwon 2022
Minor fall (80-84)	0.122	Beta	α=85; β=610	Kwon 2022
Minor fall (85-89)	0.138	Beta	α=60; β=375	Kwon 2022
Minor fall (90+)	0.093	Beta	α=16; β=156	Kwon 2022

Table HE011: Baseline probabilities of recurrent minor falls for males including probabilistic sensitivity analysis distributions and parameters

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
Recurrent minor falls (65-69)	0.084	Beta	α=121; β=1326	Kwon 2022
Recurrent minor falls (70-74)	0.064	Beta	α=84; β=1232	Kwon 2022
Recurrent minor falls (75-79)	0.078	Beta	α=72; β=849	Kwon 2022
Recurrent minor falls (80-84)	0.116	Beta	α=63; β=481	Kwon 2022
Recurrent minor falls (85-89)	0.115	Beta	α=30; β=230	Kwon 2022
Recurrent minor falls (90+)	0.187	Beta	α=17 β=74	Kwon 2022

Table HE012: Baseline probabilities of recurrent minor falls for females including probabilistic sensitivity analysis distributions and parameters

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
Recurrent minor falls (65-69)	0.082	Beta	α=131; β=1458	Kwon 2022
Recurrent minor falls (70-74)	0.087	Beta	α=130; β=1368	Kwon 2022
Recurrent minor falls (75-79)	0.094	Beta	α=99; β=953	Kwon 2022
Recurrent minor falls (80-84)	0.111	Beta	α=77; β=618	Kwon 2022
Recurrent minor falls (85-89)	0.087	Beta	α=38; β=397	Kwon 2022
Recurrent minor falls (90+)	0.128	Beta	α=22; β=150	Kwon 2022

Table HE013: Baseline probabilities of major fall in males including probabilistic sensitivity analysis distributions and parameters

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
Major fall (65-69)	0.022	Beta	α=32; β=1415	Kwon 2022
Major fall (70-74)	0.029	Beta	α=38; β=1278	Kwon 2022
Major fall (75-79)	0.049	Beta	α=45; β=876	Kwon 2022
Major fall (80-84)	0.040	Beta	α=22; β=522	Kwon 2022
Major fall (85-89)	0.062	Beta	α=16; β=244	Kwon 2022
Major fall (90+)	0.033	Beta	α=3; β=88	Kwon 2022

Table HE014: Baseline probabilities of major fall in females including probabilistic sensitivity analysis distributions and parameters

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
Major fall (65-69)	0.048	Beta	α=77; β=1512	Kwon 2022
Major fall (70-74)	0.040	Beta	α=60; β=1438	Kwon 2022
Major fall (75-79)	0.066	Beta	α=69; β=983	Kwon 2022
Major fall (80-84)	0.083	Beta	α=58; β=637	Kwon 2022
Major fall (85-89)	0.092	Beta	α=40; β=395	Kwon 2022
Major fall (90+)	0.047	Beta	α=8; β=164	Kwon 2022

Table HE015: Baseline probabilities of recurrent major falls in males including probabilistic sensitivity analysis distributions and parameters

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
Recurrent major falls (65-69)	0.013	Beta	α=19; β=1428	Kwon 2022
Recurrent major falls (70-74)	0.021	Beta	α=28; β=1288	Kwon 2022
Recurrent major falls (75-79)	0.025	Beta	α=23; β=898	Kwon 2022
Recurrent major falls (80-84)	0.033	Beta	α=18; β=526	Kwon 2022
Recurrent major falls (85-89)	0.069	Beta	α=18; β=242	Kwon 2022
Recurrent major falls (90+)	0.033	Beta	α=3; β=88	Kwon 2022

Table HE016: Baseline probabilities of recurrent major falls in females including probabilistic sensitivity analysis distributions and parameters

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
Recurrent major falls (65-69)	0.030	Beta	α=48; β=1541	Kwon 2022
Recurrent major falls (70-74)	0.031	Beta	α=47; β=1451	Kwon 2022
Recurrent major falls (75-79)	0.045	Beta	α=47; β=1005	Kwon 2022
Recurrent major falls (80-84)	0.062	Beta	α=43; β=652	Kwon 2022
Recurrent major falls (85-89)	0.067	Beta	α=29; β=406	Kwon 2022
Recurrent major falls (90+)	0.076	Beta	α=13; β=159	Kwon 2022

Table HE017: Transition probabilities after a serious fall including probabilistic sensitivity analysis distributions and parameters

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
‘Serious fall’ to ‘At risk of recurrent falls’ state	0.883 less age-related background mortality probability	N/A	N/A	RoIT, PHE 2018

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
‘Serious fall’ to ‘Residential care’ state	0.093	Beta	α=23; β=221	RoIT, PHE 2018
‘Serious fall’ to ‘Dead’ state	0.024 plus background mortality	Beta	α=24; β=991	RoIT, PHE 2018

Abbreviations: N/A: Not applicable; PHE: Public health England; RoIT: Return on investment tool

Table HE018: Effectiveness of HAM when given by an OT versus standard care (mix of OT and OP) including probabilistic sensitivity analysis distributions and parameters

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
Relative risk of minor/serious falls of HAM by OT versus HAM by a mix of OT and OP	0.680	Lognormal	μ=-0.39; σ=0.47	Clinical review undertaken for this guideline

Abbreviations: HAM: Home hazard assessment and modifications; OT: Occupational therapist; OP: Other personnel

Table HE019: Mortality data including probabilistic sensitivity analysis distributions and parameters

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
Annual probability of death in a residential care setting (Male 65-74)	0.247	Beta	α=3471; β=10579	Carehome 2023
Annual probability of death in a residential care setting (Male 75-84)	0.494	Beta	α=7366; β=7547	Carehome 2023
Annual probability of death in a residential care setting (Male 85+)	0.809	Beta	α=5063; β=1194	Carehome 2023
Annual probability of death in a residential care setting (Female 65-74)	0.214	Beta	α=2972; β=10934	Carehome 2023
Annual probability of death in a residential care setting (Female 75-84)	0.343	Beta	α=11195; β=21461	Carehome 2023
Residential care setting annual death probability (Female 85+)	0.486	Beta	α=29295; β=30937	Carehome 2023
Background age and gender-related mortality	Variable	N/A	N/A	Carehome 2023

Abbreviations: N/A: Not applicable; ONS: Office for National Statistics

Table HE020: HAM intervention costs including probabilistic sensitivity analysis distributions and parameters

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
Occupational therapist band 6 (per hour)	£55	Fixed	N/A	PSSRU, Jones 2023
Other personnel band 4 (per hour)	£37	Fixed	N/A	PSSRU, Jones 2023
Proportion of standard care that has OT input	0.250	Uniform	Min=0; Max=1	GDG Assumption
Additional cost of prescribed modifications	0.000	N/A	N/A	Testing parameter

Abbreviations: GDG: Guideline Development Group; HAM: Home hazard assessment and modifications; N/A: Not applicable; OT: Occupational therapist; PSSRU: Personal Social Services Research Unit

Table HE021: Cost of a serious fall including probabilistic sensitivity analysis distributions and parameters

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
GP visit	£37	N/A	N/A	PSSRU, Jones 2023
Proportion of serious falls that involve a GP visit	0.510	N/A	N/A	RoIT, PHE 2018
A+E attendance	£144	N/A	N/A	NHS Cost collection 2023
Proportion of serious falls that involve A+E attendance	0.800	N/A	N/A	RoIT, PHE 2018
Ambulance	£276	N/A	N/A	PSSRU, Jones 2023
Proportion of serious falls that involve and ambulance	0.610	N/A	N/A	RoIT, PHE 2018
Inpatient stay - Hip fracture	£11,582	N/A	N/A	RoIT, PHE 2018
Proportion of serious falls that involve a hip fracture	0.248	N/A	N/A	RoIT, PHE 2018
Inpatient stay – non-hip fracture	£10,281	N/A	N/A	RoIT, PHE 2018
Proportion of serious falls that involve an inpatient stay (not a hip fracture	0.552	N/A	N/A	RoIT, PHE 2018
Weighted average total cost of a serious fall	£8,850	Gamma	α=25; β=354	Calculation

Abbreviations: A+E: Accident and emergency; GP: General practitioner; N/A: Not applicable; NHS: National Health Service; PHE: Public Health England; PSSRU: Personal Social Services Research Unit; RoIT: Return on investment tool

Table HE022: Cost of residential care including probabilistic sensitivity analysis distributions and parameters

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
Nursing home cost per annum	£65,728	N/A	N/A	PSSRU, Jones 2023
Residential care cost per annum	£50,336	N/A	N/A	PSSRU, Jones 2023
Percentage of people receiving care in nursing home	0.282	N/A	N/A	Carehome 2023
Percentage of people receiving care in residential care home	0.718	N/A	N/A	Carehome 2023
Weighted average total costs of residential care	£54,669	Gamma	α=25; β=2187	Calculation

Abbreviations: N/A: Not applicable; PSSRU: Personal Social Services Research Unit

Table HE023: Utility values including probabilistic sensitivity analysis distributions and parameters

Parameter	Point estimate	Probabilistic analysis distribution	Probabilistic analysis parameters	Source
At risk of falls	0.730	N/A	N/A	RoIT, PHE 2018
At risk of recurrent falls	0.699	N/A	N/A	RoIT, PHE 2018
Minor fall	0.685	N/A	N/A	RoIT, PHE 2018
Serious fall	0.670	N/A	N/A	RoIT, PHE 2018
Residential care	0.582	N/A	N/A	RoIT, PHE 2018
Dead	0.000	N/A	N/A	RoIT, PHE 2018
Utility Decrement 1*	0.031	Beta	α=0.09; β=0.343	Calculation
Utility Decrement 2	0.014	Beta	α=0.02; β=0.712	Calculation
Utility Decrement 3	0.015	Beta	α=0.024; β=0.637	Calculation
Utility Decrement 4	0.088	Beta	α=0.944; β=0.093	Calculation

Abbreviations: N/A: Not applicable; PHE: Public Health England; RoIT: Return on investment tool
** This utility decrement is estimated as the difference between utility values for the 'At risk of falls' and 'At risk of recurrent falls' health states. As described in the section HE1.7.3, the distribution parameters around decrements were estimated using variation/dispersion data reported for associated utility values that informed these decrements.*

HE2 Results

HE2.1 Base-case results

For both males and females using an OT to undertake HAM dominates standard care, that is, where HAM are undertaken by a mix of OPs and OTs. This means that using an OT to undertake HAM is less costly and more effective than using a mix of OPs and OTs. The cost savings and QALY gains of HAM undertaken by OTs is larger in females than males. This is because females have higher baseline risk of falls and therefore with the intervention there is a larger number of falls avoided in females. Also, there is a higher prevalence of osteoporosis among females, and they are more likely to experience severe falls resulting in fractures which are costly to manage. The results for males are shown in Table HE025.

Table HE024 and for females in Table HE025.

Table HE024: Base-case deterministic results for males (strategies in ascending order of mean cost)

Strategy	Absolute lifetime		Incremental lifetime			NMB (95% CI) £20,000 per QALY
	Costs	QALYs	Costs	QALYs	ICER	
HAM by other personnel (mix of OT and OP)	£6,392	6.899	-	-	-	£131,582
HAM by occupational therapist	£6,165	6.916	-£227	0.017	Dominates*	£132,158

Abbreviations: HAM: Home Assessment and Modification; OP: Other personnel; OT: Occupational Therapist; QALY: Quality Adjusted Life Year; ICER: Incremental Cost-effectiveness Ratio; NMB: Net Monetary Benefit; CI: Confidence Interval

** Dominates: less costly and more effective*

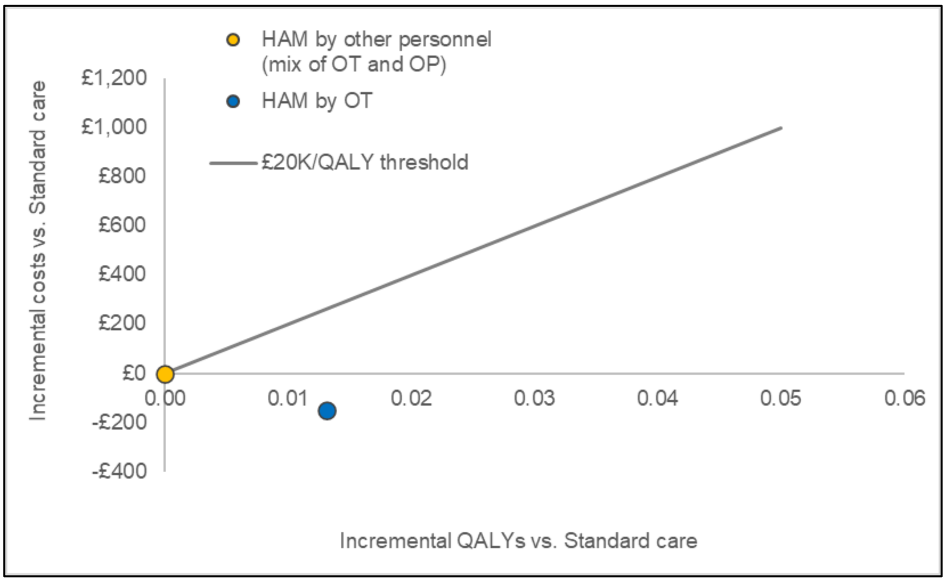
Table HE025: Base-case deterministic fully incremental cost-utility analysis results for females (strategies in ascending order of mean cost)

Strategy	Absolute lifetime		Incremental lifetime			NMB (95% CI) £20,000 per QALY
	Costs	QALYs	Costs	QALYs	ICER	
HAM by other personnel (mix of OT and OP)	£12,911	6.988	-	-	-	£126,857
HAM by OT	£12,401	7.016	-£510	0.028	Dominates*	£127,929

Abbreviations: HAM: Home Assessment and Modification; OP: Other personnel; OT: Occupational Therapist; QALY: Quality Adjusted Life Year; ICER: Incremental Cost-effectiveness Ratio; NMB: Net Monetary Benefit; CI: Confidence Interval
** Dominates: less costly and more effective*

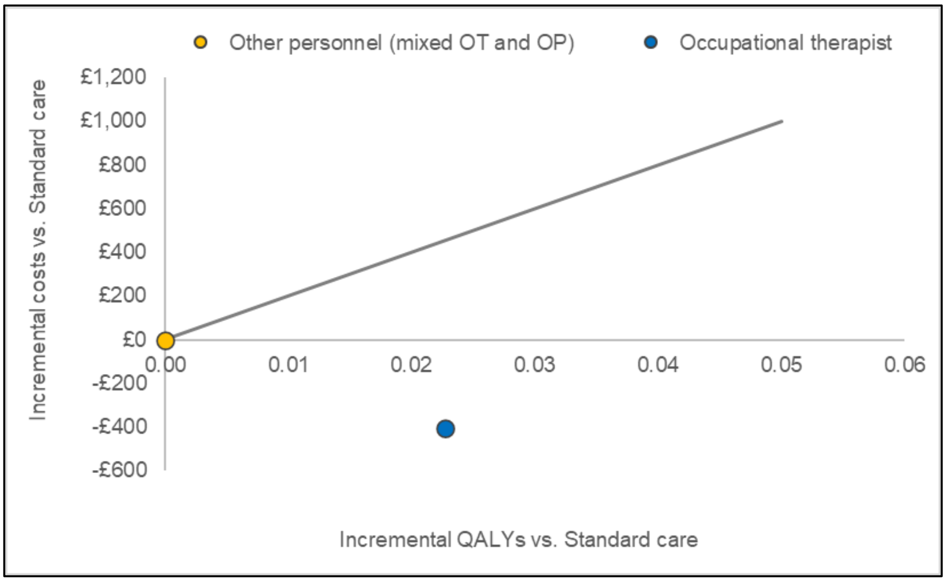
Figure HE002 and Figure HE003 show that HAM undertaken by OTs is in the southeast quadrant of the cost-effectiveness plane for males and females and is well below the lower NICE cost effectiveness threshold of £20,000 per QALY gained (grey line).

Figure HE002: Cost–effectiveness plane using deterministic lifetime costs and QALYs for males including NICE lower cost effectiveness threshold of £20,000 per QALY gained (grey line)



Abbreviations: OP: Other personnel; OT: Occupational Therapist; QALY: Quality Adjusted Life Year

Figure HE003: Cost–effectiveness plane using deterministic lifetime costs and QALYs for females including NICE lower cost effectiveness threshold of £20,000 per QALY gained (grey line)



Abbreviations: OP: Other personnel; OT: Occupational Therapist; QALY: Quality Adjusted Life Year

HE2.2 Sensitivity analysis

HE2.2.1 Deterministic sensitivity analysis

The sensitivity analysis tested multiple parameters in the model including the values that were agreed using the GDG's consensus. One of the key parameters was baseline falls probabilities. As explained in previous sections, the ELSA data that was used to estimate baseline probabilities of falls was for all people over 50 years, not just those who are at increased risk of falls. This means that the baseline number of falls may have been underestimated. However, in the sensitivity analysis, where these probabilities were varied by as much as 200% the conclusions remained unchanged. This could be explained by HAM undertaken by OTs being a low-cost intervention with the potential to avert expensive outcomes.

Another key model input which was based on the consensus was the proportion of HAM currently undertaken by OTs. This was tested for as wide a range of values as possible, from 0% to 90%, that is, in standard care arm the proportion of HAM assessors were modelled to range between the two extremes, 100% OPs to 90% OTs and 10% OPs. However, the conclusions were unchanged when varying this model input. This could be explained by small differences in unit costs between OTs and OPs, and the high potential for HAM undertaken by OTs to avert costly outcomes.

Overall, the findings were very robust to changes in key model inputs. In all deterministic sensitivity analyses, HAM undertaken by OT remained the dominant option when compared to HAM undertaken by a mixture of OT and OP, that is HAM by OT is less costly and more effective. This was true for both males and females. These findings could be explained by HAM undertaken by OTs being a very effective intervention with low intervention costs. The deterministic sensitivity analyses undertaken are summarised in Table HE026. An explanation of the parameters varied can be found in section HE1.7.1.

Table HE026: Deterministic one-way sensitivity analyses

Parameter	Base case value	Values or ranges tested	ICER (cost per QALY) for males and females
Proportion of standard care that has HAM undertaken by OTs	25%	0-90%	OT dominates*
Relative risk for falls of HAM by OTs versus standard care	0.68	95% CI: 0.51 to 0.91	OT dominates
Duration of treatment effect (years)	2	1 to 30	OT dominates
Utility source: 2 (Church 2012)	See Table HE004	See Table HE004	OT dominates
Utility source: 1 (Franklin 2019)	See Table HE004	See Table HE004	OT dominates
Additional cost of adaptations prescribed in the HAM by OT arm (one off cost)	£0	£150	OT dominates
Cost of a serious fall (per annum)	£8,850	£4,425 to £17,700	OT dominates
Band 5 OT	£55 (Band 6)	£42	OT dominates
Band 7 OT	£55 (Band 6)	£66	OT dominates
Residential care cost (annual)	£54,669	£0	OT dominates
Annual baseline falls probabilities	See Table HE002 and Table HE003	0-200%	OT dominates
Cost of OP (per hour)	£37	£20	OT dominates
Adjusting baseline falls rates using data in Wang 2023	See Table HE002 and Table HE003	2.10 (this was estimated as the proportion of falls in high vs. low-risk groups)	OT dominates

Parameter	Base case value	Values or ranges tested	ICER (cost per QALY) for males and females
Doubling probability of moving to residential care	0.093	0.186	OT dominates

Abbreviations: HAM: Home Assessment and Modification; ICER: Incremental Cost-Effectiveness Ratio; OP: Other personnel; OT: Occupational Therapist; QALY: Quality Adjusted Life Years

** Dominates: less costly and more effective*

Given uncertainty in some key model inputs, we have undertaken a range of two-way sensitivity analyses in which two model inputs were varied simultaneously. As mentioned above, there was uncertainty about how applicable the baseline data was for the modelled population. Also, there was uncertainty about the composition of the standard care, that is what proportion of HAM assessors are currently OTs. The composition of standard care may impact the modelled intervention's average effectiveness. Therefore, we have undertaken a two-way sensitivity analysis where these two key model inputs were varied simultaneously. For example, we doubled all annual baseline risk of falls probabilities and varied the effectiveness of HAM undertaken by OTs. The analysis showed that the findings were robust to simultaneous changes in these key model inputs and the conclusions remained unchanged.

Similarly, there was uncertainty in how long the effect of HAM assessment would last. Therefore, we simultaneously varied both the duration of HAM assessment effect and the proportion of OTs currently undertaking HAM assessment. Again, the findings were robust to the simultaneous variation in these two key model inputs. Likewise, in all other two-way sensitivity analyses, HAM by OTs remained the dominant option, that is HAM by OTs was less costly and more effective than HAM by a mix of OTs and OPs.

All two-way sensitivity analyses are summarised in Table HE027.

Table HE027: Two-way sensitivity analyses

Parameter	ICER, cost per QALY (Male and Female)	INMB*, HAM by OT vs SC (Male)	INMB*, HAM by OT vs SC (Female)
Base case results	OT Dominates	£576	£1,072
Intervention effect duration (5 years) and unit cost of OT (£42)	OT Dominates	£1,241	£2,101
Intervention effect duration (1 year) and unit cost of OT (£66)	OT Dominates	£294	£566
Intervention effect duration (1 year) and composition of SC (OP 100%, OT 0%)	OT Dominates	£298	£569
Intervention effect duration (1 year) and composition of SC (OP 50%, OT 50%)	OT Dominates	£307	£578
Intervention effect duration (1 year) and composition of SC (OP 10%, OT 90%)	OT Dominates	£314	£569
Intervention effect duration (5 years) and composition of SC (OP 100%, OT 0%)	OT Dominates	£1,227	£2,086
Intervention effect duration (5 years) and composition of SC (OP 50%, OT 50%)	OT Dominates	£1,236	£2,095

Parameter	ICER, cost per QALY (Male and Female)	INMB*, HAM by OT vs SC (Male)	INMB*, HAM by OT vs SC (Female)
Intervention effect duration (5 years) and composition of SC (OP 10%, OT 90%)	OT Dominates	£1,243	£2,103
Recurrent baseline falls probabilities used for all falls and intervention effect duration (1 year)	OT Dominates	£263	£458
Recurrent baseline falls probabilities used for all falls and intervention effect duration (5 years)	OT Dominates	£1,085	£1,789
Doubled annual baseline risk of falls probabilities and HAM by OTs effectiveness RR at 0.51	OT Dominates	£1,382	£2,418
Doubled annual baseline risk of falls probabilities and HAM by OT effectiveness RR at 0.60	OT Dominates	£1,115	£1,940
Doubled annual baseline risk of falls probabilities and HAM by OT effectiveness RR at 0.70	OT Dominates	£824	£1,425
Doubled annual baseline risk of falls probabilities and HAM by OT effectiveness RR at 0.80	OT Dominates	£539	£1,228
Doubled annual baseline risk of falls probabilities and HAM by OT effectiveness RR at 0.91	OT Dominates	£232	£402

Abbreviations: HAM: Hazard and Modification, ICER: Incremental Cost-Effectiveness Ratio, INMB: Incremental Net Monetary Benefit, OP: Other personnel, OT: Occupational Therapist, QALY: Quality Adjusted Life Years, RR: Relative Risk, SC: Standard Care

**The higher the INMB the more favourable HAM undertaken by OTs (versus SC) are.*

HE2.2.2 Scenario analysis

In the most pessimistic scenario (as described in section HE1.7.2) the ICER of HAM by OTs (versus HAM by a mix of OTs and OPs) in males was £23,541 per QALY gained which is above the lower NICE cost-effectiveness threshold of £20,000 per QALY and would not be seen as a cost-effective option. The ICER of HAM by OTs (versus HAM by a mix of OTs and OPs) in females was £9,514 per QALY gained which is below the lower NICE cost-effectiveness threshold of £20,000 per QALY. The reason why HAM by OTs is more cost effective in females than males is because the number of falls in females is higher at baseline and therefore the number of potential falls that can be prevented is also higher.

HE2.2.3 Probabilistic sensitivity analysis

The probabilistic results were very similar to deterministic results. For both males and females using OTs to undertake HAM dominates HAM by a mix of OPs and OTs. This means that using an OTs to undertake HAM is less costly and more effective than using a mix of OTs and OPs. The results for males are shown in Table HE028 and for females in Table HE029.

Table HE028: Probabilistic results for males (strategies in ascending order of mean cost), 10,000 iterations

Strategy	Absolute lifetime		Incremental lifetime			NMB (95% CI) using £20,000 per QALY NICE cost-effectiveness threshold
	Costs	QALYs	Costs	QALYs	ICER	
HAM by other personnel (mix of OT and OP)	£6,348	6.899	-	-	-	£131,624 (£128,674 to £133,908)
HAM by OT	£6,154	6.912	-£193	0.014	Dominates*	£132,092 (£128,490 to £134,593)

Abbreviations: HAM: Hazard and Modification, ICER: Incremental Cost-Effectiveness Ratio, NMB: Net Monetary Benefit, OP: Other personnel, OT: Occupational Therapist, QALY: Quality Adjusted Life Years
** Dominates: less costly and more effective*

Table HE029: Probabilistic results for females (strategies in ascending order of mean cost), 10,000 iterations

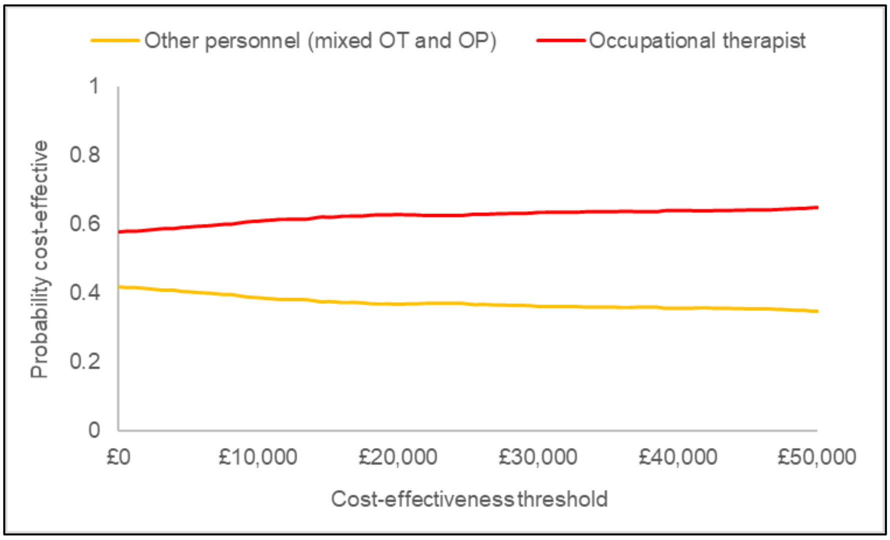
Strategy	Absolute lifetime		Incremental lifetime			NMB (95% CI) using £20,000 per QALY NICE cost-effectiveness threshold
	Costs	QALYs	Costs	QALYs	ICER	
HAM by other personnel (mix of OT and OP)	£12,864	6.989	-	-	-	£126,936 (£121,204 to £131,534)
HAM by OT	£12,494	7.010	-£370	0.021	Dominates*	£127,711 (£121,033 to £132,579)

Abbreviations: HAM: Hazard and Modification, ICER: Incremental Cost-Effectiveness Ratio, NMB: Net Monetary Benefit, OP: Other personnel, OT: Occupational Therapist, QALY: Quality Adjusted Life Years

** Dominates: less costly and more effective*

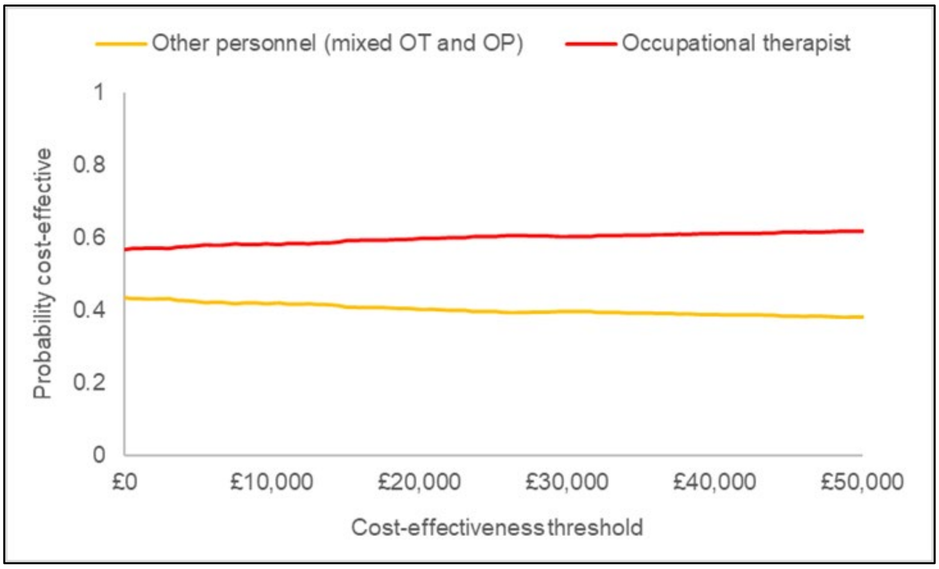
The cost effectiveness acceptability curves for both males and females (Figure HE004 and Figure HE005**.**) showed that the probability of HAM undertaken by OTs being cost effective over thresholds ranging from £0 to £50,000 was approximately 60%. The reason that the probability of being cost effective is not higher is likely to be because of very small differences in costs and QALYs between the two approaches to HAM.

Figure HE004: Base-case probabilistic results – cost effectiveness acceptability curve (CEAC), Male



Abbreviations: OP: Other personnel, OT: Occupational Therapist

Figure HE005: Base-case probabilistic results – cost effectiveness acceptability curve (CEAC), Female



Abbreviations: OP: Other personnel, OT: Occupational Therapist

The results of sensitivity analyses (as described in section HE1.7.1 and summarised in Table HE026 and Table HE027) using probabilistic results remained unchanged and HAM undertaken by OTs remained the dominant option, that is, HAM undertaken by OTs is less costly and more effective than HAM undertaken by a mix of OTs and OPs.

HE2.3 Discussion

HE2.3.1 Principal findings

The principle finding of the model was that HAM undertaken by OTs a is cost-effective option when compared to a practice where HAM is undertaken by a mix of OTs and OPs. This is because of the low additional costs of HAM being undertaken by OTs when compared to standard care (the additional intervention cost of £18 in the base case analysis), the relatively large treatment effect in terms of falls reduction associated with HAM by OTs (RR=0.68) and related reduction in NHS and PSS costs and health-related quality of life improvements. The intervention was dominant for both males and females. However, the findings were more favourable for females. This is mainly because of the higher baseline falls risk in females than males and also a higher probability of more severe falls.

Overall, given the size of the clinical benefit and the small difference in costs of the staff undertaking HAM, it is unsurprising that using an OT is cost-effective and in line with what the GDG expected. However, the GDG discussed that there is a lack of funding and a shortage of OTs with often less qualified people undertaking HAMs. The committee was of a view that having an economic analysis showing that an approach that used OTs represent value for money for the NHS may facilitate and encourage more funding.

HE2.3.2 Strengths of the analysis

This is the first economic analysis in this decision area. Its development involved the clinical expertise of a multidisciplinary committee who had input on the model structure, parameters assumptions and validated the model outputs.

One of the main strengths of this analysis is that the results are very robust to changes in the model inputs. A large number of parameters were tested to extreme values that the multidisciplinary committee felt were feasible values. Most sensitivity analyses supported the main result that HAM undertaken by OTs was the optimal approach. Of the few sensitivity analyses that did not show dominance, only one had an ICER above NICE's lower cost-effectiveness threshold of £20,000 per QALY gained; this was the most pessimistic view analysis in males. In this scenario HAM undertaken by OTs resulted in an ICER of £23,541 per QALY gained when compared to HAM undertaken by a mix of OTs and OPs, which is just above the lower NICE threshold. The committee felt that the values in this scenario analysis were extremely unlikely, especially the cost of residential care of £27,335 (base case: £54,669) and the additional cost of £150 for prescribed OT modifications (base case: £0). Therefore, the committee were not concerned about this finding but were interested to see the potential drivers of the results.

Another strength of the analysis is that for a range of NICE thresholds from £0 to £20,000 per QALY gained HAM undertaken by OTs is always the preferred option. When looking at the cost effectiveness acceptability curves (CEAC) in both males and females (Figure HE004 and Figure HE005) the probability that using OTs as assessors is cost effective is over 60%. This means that we can be quite confident in the result that HAM undertaken by OTs is a cost-effective option. Also, the treatment effectiveness data was obtained from a meta-analysis undertaken for this guideline systematic review. Therefore, the effectiveness data is from all the available evidence that is directly applicable to the NICE decision-making context and is more likely to reflect the true effect value as any biases in the data will be reduced by pooling data form multiple studies. Also, the economic analysis used a lifetime time horizon which allowed to capture all the benefits and costs associated with the intervention.

This model has been designed to generate results for males and females separately. This was done because often females will have more severe injuries from a fall because of co-morbidities such as osteoporosis. This allowed us to investigate how the different parameters affect the results for males and females separately.

HE2.3.3 Weaknesses of the analysis

One weakness of the analysis is that in some areas there was no published evidence and therefore the committee had to use expert consensus instead. The parameters for which there was no published evidence included the proportion of OTs currently undertaking HAM and the additional cost of modification that OTs may prescribe.

The GDG explained that the proportion of OTs currently undertaking HAM within the standard care varies throughout the country. There are some areas where most people completing HAM will be OTs, but in more remote areas it is often more challenging to find OTs and therefore HAM is more likely to be done by OPs. The committee further explained that such data is not collected. Therefore, this model input was based on the committee's expert opinion and was tested over a wide range of values. However, given the relatively small difference in staff unit costs this model input did not make much difference to the results.

For the additional cost of modifications, the GDG agreed that, on average, an OT would not prescribe higher cost modifications. They noted that an OT will be better suited to find the most appropriate modification which may be cheaper than an OP would prescribe. However, the sensitivity analyses found that changing this assumption did not change the conclusion, although the ICER for males increased to £2,113 per QALY.

Another potential weakness is that due to the lack of better data the baseline risk of falls data was for all people over 65 years residing in the community, that is, not just those at increased risk of falling. This means we have likely underestimated the number of falls at baseline and, therefore, underestimated the number of falls that could have been prevented. This means that HAMs by OTs are likely to be even more cost-effective. Further sensitivity analyses on the baseline risk of falls included doubling all the baseline fall risks, and the other analysis, suggested by the GDG, which adjusted the baseline risks of falls using the ratio of falls in high risk versus low-risk people as reported in Wang 2023. In both these analyses conclusions remained unchanged.

HE2.3.4 Comparison with other CUAs

No other cost utilities studies could be found that assessed the cost-effectiveness of different professionals undertaking home hazard assessments and modifications.

HE2.4 Conclusions

Home assessments and modifications undertaken by OTs are very cost-effective compared to standard care, which involves a mix of OTs and OPs undertaking HAM. These findings are robust to changes in key model inputs as explored using extensive deterministic and probabilistic sensitivity analyses.

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