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Cost-effectiveness of home-based stroke rehabilitation across Europe: A modelling study

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ABSTRACT

The aim of this study was to explore the cost-effectiveness of home-based versus centre-based rehabilitation in stroke patients across Europe. A state-transition cohort model was developed to simulate the impact of the intervention in 32 European countries. A cost-utility analysis was conducted from a societal perspective including healthcare, social care and informal care costs, and productivity losses. Health outcomes were expressed as QALYs. Sensitivity analyses were conducted concerning model input values and structural assumptions. Data were obtained from a population-based cohort and previously published studies. Across Europe, over 855,000 patients with stroke would be eligible for rehabilitation in 2017. Europe-wide implementation of home-based rehabilitation was estimated to produce 61,888 additional QALYs (95% CI: 3,609 to 118,679) and cost savings of €237 million (95% CI: -237 to 1,764) and of €352 million (95% CI: -340 to 2,237) in health- and social-care and societal costs, respectively. Under base case assumptions, home-based rehabilitation was found highly likely to be cost-effective (>90%), compared to centre-based rehabilitation, in most European countries (29 out of 32). Evidence from this study suggests that a shift from a centre-based to a home-based approach to stroke rehabilitation is likely to be good value for money in most European countries. Further research should be conducted to assess the generalisability of these findings to local settings.

1. Introduction

Stroke is one of the leading causes of global disability. [1] In Europe, 1.5 million people are diagnosed with stroke every year, costing European societies in excess of €60 billion annually [2]. Stroke affects patients' activities of daily living [3–4], with many having to rely on the health and social care system, as well as on informal carers, for their care [5].

While remarkable improvements have been achieved in terms of reduction of stroke incidence over the last two decades [6], demographic projections have shown that European populations are ageing [7]. This implies that the economic burden of stroke will likely increase in the future, with more pressure put on European healthcare budgets as a result. There are, therefore, strong incentives for policymakers to commission stroke interventions that provide good value for money.

Rehabilitation is an integral part of stroke patient care [8–10] and has received increasing research attention over the last two decades [11]. A Cochrane review found clear evidence that organised inpatient care (stroke unit) is more likely to result in better recovery and disability-related outcomes, compared to generic hospital wards [12]. Nonetheless, increased pressure on hospitals and inpatient centres has meant that new rehabilitation approaches outside the hospital setting ought to be considered as well [13–15].

Another systematic review evaluated the effectiveness of home-based compared to centre-based (outpatient clinic or day hospital settings) rehabilitation for stroke patients. It found a significant effect in favour of home-based rehabilitation (HB) [16]. The aim of this study is, therefore, to explore the cost-effectiveness of HB compared to centre-based rehabilitation (CB) for stroke survivors across European countries.

2. Materials and methods

We conducted a cost-utility analysis from a societal perspective over a 5-year time horizon for 32 European countries, namely,

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the current 27 State members of the European Union, Iceland, Israel, Norway, Switzerland and the United Kingdom. We compared HB and CB in terms of quality-adjusted life years (QALYs) and societal costs which included health and social care costs, informal care costs and productivity losses.

Home-based rehabilitation was defined as a package of care whereby a stroke patient would receive physiotherapy, occupational therapy, and speech therapy at their home. This strategy was compared to CB where the patient would only receive conventional hospital-based care (inpatient and outpatient). We used country-specific unit costs obtained from a study evaluating the costs of stroke in all the 32 countries [2]. The price year was 2017, and all costs were reported in Euros (€). For countries not in the Euro zone, 2017 average exchange rates were used (exchange rate: €1 = £0.88[17]).

The target population consisted of patients who survived the acute stroke phase (between 24 h and two weeks from symptoms onset [18], i.e., stroke survivors) and: had a confirmed diagnosis of intracerebral haemorrhages, ischaemic stroke or strokes of unknown type, were aged ≥20 years old and admitted to the hospital [4]. Country-specific, age- and gender-stratified adult stroke cases were identified from the Global Burden of Disease study. [19]

2.1. Decision-analytic model

A cohort-level Markov model with an embedded decision tree (**Appendix I**) was developed to simulate the natural history of stroke survivors and the impact of the intervention. Eligible stroke patients (i.e., stroke patients admitted to the hospital who survived the critical phase of two weeks) entered the model and were simulated to receive either one of the two interventions (HB or CB). In the decision-tree part of the model, stroke survivors were all assumed to remain alive between two weeks and 3 months from hospital admission. [20,21] The type of intervention – whether HB or CB– was assumed to impact functional independence (as defined by the modified Rankin Scale[22], mRS, at 3 months – with mRS varying from 0, no disability, to 5, confined to bed). Subsequently, to simulate what the patients experience after the 3 months as a consequence of a given level of functional independence, in the Markov section of the model, the risk of death, costs and utilities were estimated over the remaining years conditional on the 3-month mRS score, age and gender [23].

In line with a previous cost-effectiveness analysis, the time horizon was five years [24]. The effectiveness of HB was modelled as a change in the distribution of 0–5 mRS scores at 3 months, compared to CB. Costs and QALYs were discounted at an annual rate of 3.5%. [25] To account for the fact that transitions can occur not necessarily at the start or end of each cycle, half-cycle correction was applied. [26] The decision-analytic model was built using Microsoft Excel 2013 [27].

Appendix II reports the probabilities and data sources used to populate the model. Briefly, country, age, and gender-specific numbers of incident stroke cases were derived from the Global Burden of Disease. [19] Data from OXVASC were used to estimate all-cause mortality risks [28]. Model cycle length was one year following the first 12 months of simulation. This was judged to be sufficiently short to capture all relevant outcomes and costs in each cycle.

Intervention effectiveness was based on the results of a meta-analysis, [16] which found a statistically significant improvement in the 0–20 Barthel Index of 1.00 point (95% CI: 0.12 to 1.88) at 6–8 weeks post-intervention of HB over CB.

2.2. Modelling treatment effect

For stroke survivors (0–5 mRS), the distribution of mRS scores at 3-months following CB was assumed to be the same as that observed in a UK-based population-based cohort study assessing stroke incidence, namely the Oxford Vascular Study (OXVASC) [3]. This distribution was conditional on age and gender, hence allowing the related heterogeneity to be captured across countries. We thus linked the 0–20 Barthel Index score to the observed 0–5 mRS distribution in stroke survivors, so that any given Barthel Index value would represent a certain proportion of mRS scores. For example, a Barthel Index of 1 (3.2% of the sample of stroke survivors) corresponded to a combination of mRS4 (17.6%) and mRS5 (82.4%) scores, while a Barthel Index score of 13 (2.5% of the sample of stroke survivors) corresponded to combination mRS3 (45.8%) and mRS4 (54.2%) scores. To model the effect of HB, we shifted the Barthel Index score up by 1 point, as per the identified meta-analysis [16], and adjusted the 3-month 0–5 mRS distribution accordingly. This meant that, on average, stroke survivors undergoing HB would see a decrease in their mRS score, reducing their risk of disability at 3 months.

2.3. Survival and quality of life

Five-year survival and quality of life following stroke, given 3-month mRS score, were obtained from OXVASC. [3,4] In OXVASC, quality of life values were derived from the Euroqol-5 dimensions-3 levels [29], with responses being collected from stroke patients at: 1 to 3, 6, 12, and 60 months and converted into utilities using UK population tariffs. [30] We assumed that patients would experience the same mortality risk and quality of life, irrespective of the country of origin. However, country-level mortality risks and utility values varied due to different age/gender distributions in each country.

2.4. Treatment costs

The intensity and type of rehabilitation care was assumed to overlap that of a published study [31], with stroke patients undergoing either one of the two interventions within three months since hospital admission (**Appendix III**).

Intervention costs were calculated by multiplying the mean number of therapy sessions by their respective unit costs. The unit costs for each type of therapy session (physiotherapy, occupational and speech therapy) were based on national UK reference costs [2] and converted into euros. To capture country-heterogeneity in intervention costs, we applied weighting factors to these unit costs. These weights were obtained by dividing the unit cost for an outpatient care visit in a given country [2] by that of the same type of visit in the UK. Across Europe, home-based rehabilitation was estimated to cost €1423.49 per patient whereas centre-based rehab was €981.79 per patient (**Appendix IV**).

2.5. Health and social care costs

Evidence from OXVASC was used to derive health and social care resource use following stroke dependent on 3-month mRS score, age and gender up to 5 years [2]. Resource use items were hospital stay and day cases (inpatient costs), outpatient visits, accident and emergency (A&E) visits and nursing/residential care (for patients aged at least 65 years old).

Country-specific resource use weights[1] were applied to adjust UK estimates for the remaining 31 European countries (**Appendix V**). For inpatient days, weights were calculated as ratios of mean numbers of days in hospital following stroke in the UK over the respective mean numbers of days in hospital for the country under analysis. For A&E visits, weights were calculated using per-capita visits due to stroke, while for nursing / residential care per-capita rates of institutionalisation in those aged 65 years or more were used.

2.6. Informal care

Informal care was assumed to be required for 50% of stroke patients identified with a mRS score of 3, and for all stroke patients with either a mRS score of 4 or 5 at 3 months following the event. A literature search found no reliable evidence on the proportion of stroke patients that would require informal care by mRS score by country. Hence, aligning with a previous analysis [26], we informed this assumption based on the expected level of mRS-induced dependence. Informal care costs were estimated using age/gender specific numbers of days of care received, based on the Survey of Health, Ageing and Retirement in Europe (SHARE) study [32]. For countries not included in the SHARE study, the average of the macro-region to which the country belongs (i.e., Scandinavia, Central Europe, Eastern Europe and Southern Europe) was assigned.

2.7. Productivity losses

In line with a recent published study [2], loss of productivity was calculated in terms of mortality and morbidity in stroke patients under the age of 65 years. Mortality-related losses were estimated as the number of working years lost due to premature death multiplied by the country-specific employment rate [33,34]. In terms of morbidity, we assumed that absence from work in stroke survivors with a 3-month mRS score $\leq$ 2 would be temporary and thus applied country-specific average days off work due to stroke. For patients with a mRS score $>$ 2, we assumed that absence from work would be permanent, and applied a friction-adjusted method [35], whereby the first 90 days of work absence were considered. Working time lost was valued using country-specific, gender-stratified earnings [2,33].

2.8. Analysis

For each country, the model was run for 28 age /gender combinations (two gender and 14 age five-year groups). Results were subsequently combined based on subgroup size defined in terms of stroke incidence (i.e., weighted average). Under the base case scenario, a societal perspective was adopted, and HB was judged to be cost-effective if the incremental cost-effectiveness ratio (ICER) was below the country GDP per capita [36]. The ICER was obtained by dividing the between-intervention difference in mean costs by the between-intervention difference in mean QALYs. Weighted averages accounting for population size were applied to calculated estimates for the whole European Union and for all 32 countries combined. A narrower health and social care perspective and a €22,727 (£20,000) per QALY gained cost-effectiveness threshold [37] were both used to test the results for sensitivity.

The model was checked both for internal consistency, by applying extreme and zero values, and in terms of its mathematical logic, by checking whether results obtained by changes in parameters made sense (e.g., whether no difference in effectiveness between the two interventions resulted in no difference in QALYs). To characterize the uncertainty surrounding the decision, a series of deterministic and a probabilistic sensitivity analysis were also performed. [38] The robustness of the results was tested against variations to: 1) the effectiveness of the intervention (considering the lower and upper bound of the 95% CI); 2) the cost of the interventions, by assuming *a* +/- 50% difference in the total cost and their components separately; 3) risk of mortality, by assuming *a* +/- 50% difference and no difference in survival between the two interventions; 4) utility values, by assuming *a* +/- 50% difference and 5) the cost domains to consider, by excluding all health and social care, productivity losses and informal care costs, alternatively. In probabilistic terms, a thousand iterations were simulated to represent the full distribution of uncertain parameters and to assess the likelihood of the intervention being cost-effective.

3. Results

In 2017, just over 1.4 million people aged 20 years and over suffered a stroke across the 32 European countries under study, with Germany, Italy and Poland showing the highest number of cases (**Appendix II**). Of these, 855,083 (59%) were identified as eligible for rehabilitation in the 32 countries under study.

3.1. Life years and quality-adjusted life years

Home-based rehabilitation generated higher number of LYs and QALYs, on average, when compared to CB, in all the 32 European countries (Table 1). For the whole of Europe, home-based rehabilitation generated additional 59,211 LYs (95%C CI: −1558 to 109,975) and 61,888 QALYs (3609 to 118,679). However, only for six countries (Austria, Belgium, Croatia, Estonia, Ireland and Italy) incremental estimates of LYs and QALYs were significant.

3.2. Costs

Home-based rehabilitation was found to generate 5-year cost savings when compared to CB-rehabilitation (€43.8 billion to society vs. €44.1 billion, respectively). Health and social care costs accounted for the majority of total costs, though in varying proportions across countries and interventions (**Appendix VI**). These costs ranged from 41% of the total costs (€66/€162 million) in Israel under CB, to 80% Switzerland (€1/€1.4 billion) and Finland (€703/€877 million) under HB.

In 26 of the 32 countries, the implementation of HB vs CB was associated with positive cost-savings. This number declined to 21, with Cyprus, Israel and the United Kingdom bearing additional costs, when a health and social care perspective was considered. On a per-treated patient basis, home-based generated the highest cost savings in Switzerland (€1691), followed by Germany (€1396) and Luxembourg (€1278). However, none of the cost-savings were statistically significant for all the 32 countries (**Appendix VII**).

3.3. Cost-effectiveness of home-based versus centre-based rehabilitation

In the base case, that is adopting a societal perspective (i.e., including informal care costs and productivity losses) and using the country's per-capita GDP as the cost-effectiveness threshold, HB was found to be provide good value for money. Specifically, HB was found to be dominant (i.e., it generated cost savings and was more effective) over the comparator, for the European Union, Europe as a whole and the majority of individual countries (24/32) and cost-effective in the remaining eight countries (Table 2). The probability of HB being cost-effective, when compared to CB, was found to be 0.95 for Europe as a whole (Fig. 1) and range from between 0.85 and 0.98 across the 32 European countries. When a UK-based threshold of cost-effectiveness was considered, comparable probabilities were estimated except for Sweden (0.62) and Finland (0.77).

3.4. Sensitivity analysis

Sensitivity analyses showed that HB remained the most cost-effective option across most scenarios and parameter variations tested (**Appendix VIII**). For example, assuming that the type of rehabilitation had no effect on mortality post stroke still showed HB to be cost-effective, compared to CB. Only when we used the lower

Table 1
Life years and quality-adjusted life years of stroke patients undergoing HB and CB in Europe.

	HB		CB			
	LYs	QALYs	LYs	QALYs	Inc. LYs (95% CI)	Inc. QALYs (95% CI)
Austria	45,748	25,804	44,817	24,792	930 (9 to 1741)	1012 (1 to 2017)
Belgium	53,648	29,845	52,486	28,660	1162 (2 to 2115)	1186 (28 to 2302)
Bulgaria	74,526	41,724	73,062	40,071	1464 (−29 to 2756)	1653 (101 to 3240)
Croatia	39,585	22,088	38,796	21,209	789 (46 to 1475)	879 (47 to 1768)
Cyprus	3016	1699	2953	1633	63 (−4 to 120)	67 (−1 to 135)
Czech Republic	75,890	42,783	74,410	41,102	1480 (−79 to 2835)	1681 (48 to 3331)
Denmark	24,089	13,499	23,593	12,966	496 (−7 to 963)	533 (11 to 1073)
Estonia	8988	5033	8817	4834	170 (2 to 325)	199 (3 to 416)
Finland	33,366	18,518	32,656	17,779	710 (−28 to 1353)	738 (20 to 1454)
France	249,146	137,375	243,582	131,878	5564 (−151 to 10,521)	5497 (−24 to 10,622)
Germany	465,324	259,598	455,748	249,287	9576 (−509 to 17,702)	10,311 (−207 to 19,651)
Greece	64,589	35,316	63,121	33,889	1468 (58 to 2638)	1427 (−90 to 2737)
Hungary	77,955	43,805	76,456	42,077	1499 (14 to 2831)	1728 (−4 to 3527)
Ireland	14,393	8211	14,108	7893	285 (12 to 569)	318 (14 to 651)
Italy	312,919	170,442	305,747	163,523	7172 (43 to 13,363)	6919 (284 to 13,502)
Latvia	23,654	13,095	23,199	12,570	456 (−10 to 862)	525 (−13 to 1021)
Lithuania	29,297	16,378	28,735	15,729	562 (−4 to 1059)	649 (−7 to 1285)
Luxembourg	2055	1152	2011	1107	44 (−1 to 83)	45 (3 to 93)
Malta	1722	973	1689	935	33 (−0.2 to 65)	38 (2 to 74)
Netherlands	68,021	38,122	66,597	36,617	1424 (−51 to 2736)	1505 (26 to 3009)
Poland	242,045	135,976	237,224	130,613	4821 (−50 to 9101)	5362 (−131 to 10,639)
Portugal	52,037	28,518	50,869	27,367	1169 (−26 to 2199)	1151 (46 to 2231)
Romania	200,573	112,556	196,677	108,108	3896 (133 to 7486)	4449 (−378 to 8520)
Slovakia	40,510	23,113	39,784	22,216	725 (19 to 1409)	898 (−9 to 1799)
Slovenia	11,970	6708	11,724	6443	245 (−2 to 461)	265 (11 to 555)
Spain	194,047	107,774	189,741	103,491	4306 (−203 to 8394)	4282 (−79 to 8537)
Sweden	47,365	26,358	46,345	25,311	1020 (55 to 1931)	1047 (−29 to 2041)
Total EU-27	2455,839	1366,223	2404,014	1311,871	51,825 (383 to 98,686)	54,352 (540 to 104,929)
Iceland	1161	657	1137	631	24 (−1 to 46)	26 (0.2 to 51)
Israel	21,766	12,371	21,323	11,890	443 (−2 to 878)	481 (−10 to 952)
Norway	23,555	13,261	23,065	12,740	490 (21 to 966)	521 (−18 to 1036)
Switzerland	37,954	21,269	37,152	20,430	802 (−10 to 1462)	839 (32 to 1636)
United Kingdom	256,736	142,432	251,121	136,762	5615 (−13 to 10,350)	5670 (−441 to 11,139)
Total 32 countries	2796,985	1556,205	2737,774	1494,317	59,211 (−1558 to 109,975)	61,888 (3609 to 118,679)

CI= confidence interval.

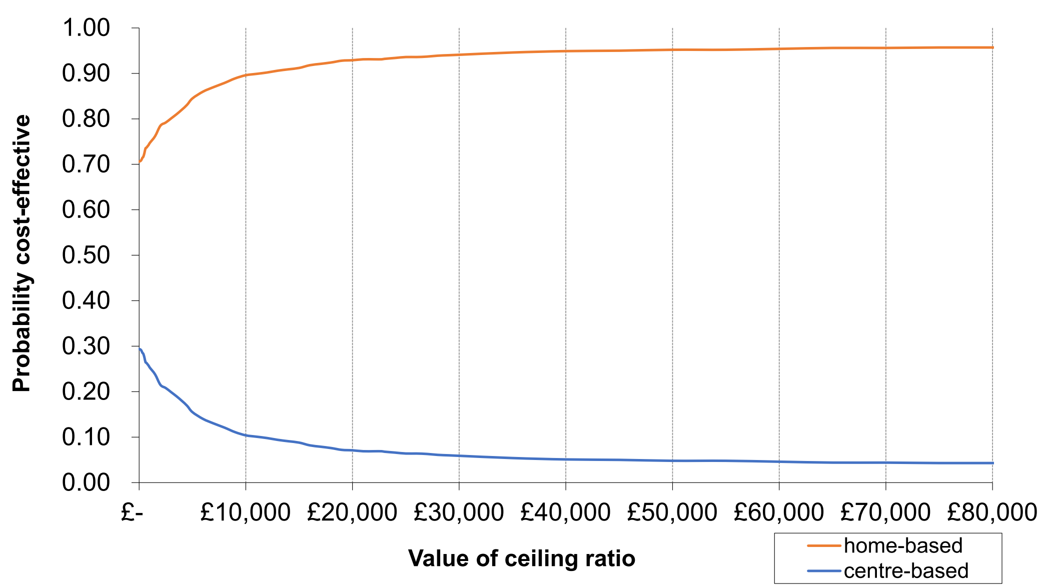

Fig. 1. Cost-effectiveness acceptability curve for Europe.

bound of the confidence interval concerning the effectiveness of HB (0.12), we found CB to be cost-effective at a 94% probability.

3.5. Health and social care perspective

Adopting a narrower health and social care perspective, cost-effectiveness results were overall comparable to those estimated under a societal perspective, providing good value for money (**Appendix IX**). For 21 countries, the European Union and Europe, HB was found to be dominant compared to CB while in the remaining 11 countries, it was still found to be cost-effective. Except for Sweden (0.60) and Finland (0.76), the likelihood of HB being cost-effective was at least 0.89.

Table 2
Cost-effectiveness of home-based relative to centre-based rehabilitation under a societal perspective.

		Probability of home-based being cost-effective		
		NICE threshold*	GDP threshold	
	ICER under a societal perspective	Probability	Probability	Country-specific GDP
Austria	home-based dominates	97%	97%	€42,100
Belgium	home-based dominates	97%	97%	€38,700
Bulgaria	home-based dominates	96%	94%	€7300
Croatia	home-based dominates	98%	98%	€11,900
Cyprus	home-based dominates	97%	97%	€22,900
Czech Republic	home-based dominates	97%	97%	€18,100
Denmark	home-based dominates	97%	97%	€50,800
Estonia	home-based dominates	97%	97%	€18,000
Finland	€ 7635	77%	86%	€40,600
France	€ 2132	91%	94%	€34,300
Germany	home-based dominates	96%	97%	€39,600
Greece	home-based dominates	96%	95%	€16,800
Hungary	home-based dominates	98%	98%	€12,700
Ireland	home-based dominates	93%	96%	€61,200
Italy	home-based dominates	95%	96%	€28,500
Latvia	€ 199	96%	95%	€13,900
Lithuania	home-based dominates	96%	95%	€14,900
Luxembourg	home-based dominates	96%	97%	€92,600
Malta	home-based dominates	96%	96%	€24,100
The Netherlands	home-based dominates	94%	97%	€43,000
Poland	home-based dominates	96%	94%	€12,200
Portugal	€ 825	95%	94%	€18,900
Romania	home-based dominates	97%	97%	€9600
Slovakia	home-based dominates	96%	96%	€15,600
Slovenia	home-based dominates	96%	96%	€20,800
Spain	€ 1189	92%	92%	€25,100
Sweden	€ 17,684	62%	85%	€47,200
Total EU-27	home-based dominates	95%	96%	€29,244
Iceland	home-based dominates	95%	97%	€63,200
Israel	home-based dominates	96%	97%	€35,962
Norway	home-based dominates	93%	95%	€67,100
Switzerland	home-based dominates	97%	98%	€71,200
United Kingdom	home-based dominates	92%	94%	€35,400
Total 32 countries	home-based dominates	94%	95%	€31,592

* at a €22,727 cost per QALY gained threshold. GDP-Gross Domestic Product; ICER=incremental cost-effectiveness ratio; NICE-National Institute of Health and Care Excellence. Dominates= more effective and less costly.

4. Discussion

We assessed the cost-effectiveness of HB compared to CB in 32 European countries. To the best of our knowledge, this is the first economic model providing a comprehensive cross-country comparison of societal costs and health outcomes associated with adoption of stroke rehabilitation interventions within the European context. Overall, this study found that providing home-based rehabilitation would be likely to be the optimal strategy in all the 32 European countries under study, irrespective of their wealth, compared to centre-based rehabilitation.

The findings from this study add to the currently limited evidence base on the value for money of rehabilitative interventions in stroke [39]. On stroke rehabilitation, a number of relevant studies have been conducted in European countries investigating, for example, the factors influencing the implementation of home-base stroke rehabilitation (the Netherlands) [40] or the drivers of management costs in early stroke rehabilitation (Czech Republic) [41]. In terms of published economic evidence however, we found only two economic evaluations which were conducted alongside a trial in the Netherlands [42] and another multinational trial including stroke centres in the UK [43]. As for the former, the authors assessed the cost-effectiveness of a self-management intervention based on proactive coping action planning compared to an education-based strategy and found that the intervention was unlike to provide good value for money from a societal perspective. The latter analysis focused instead on assessing the cost-effectiveness of adding a very early mobilisation strategy to usual care in stroke patients and found again that the proposed intervention was not cost-effective. More specifically in terms of home-based stroke rehabilitation however, a modelling study conducted for the Canadian context found, in line with the findings from this study, that a home-based strategy was high likely to be cost-effective compared to usual care [44].

This study builds on previous meta-analytic work [16] by modelling the economic implications of a guideline-recommended shift in mode of care. [8–10] In so doing, it provides relevant evidence for national and international decision-making. This study also presents a novel modelling approach, based on the mapping between two widespread measures of disability (i.e., the Barthel Index and the modified Rankin Scale). Health and social care resource use, quality of life and mortality parameters were obtained from analysis of a large UK-population-based cohort of stroke patients (OXVASC). We accounted for individual-level heterogeneity by allowing parameters to vary by age, gender and 3-month mRS score. By doing so, we accounted indirectly for country-level heterogeneity given the different age-gender distributions. We also captured country-level heterogeneity directly in terms of health and social care resource use, informal care and productivity, as well as unit costs.

Unlike previous economic studies using hypothetical cohorts of patients, our simulations were based on country-specific demographic data at stroke onset [18], therefore making the findings from this study a better representation of the potential population-level impact of the intervention. We evaluated the uncertainty surrounding the average results using probabilistic sensitivity analyses, two cost-effectiveness thresholds (i.e., per-capita GDP and NICE) and two perspectives on costs. This represents a more robust approach than simply relying on average results and one single decision rule. [45] Further, unlike previous cost-effectiveness studies [31], we included wider societal effects relevant to different areas of European society, including informal carers and employers.

A number of limitations need to be considered when interpreting the findings from this study. A currently scarce evidence on clinical effectiveness of stroke rehabilitation [46] meant that model inputs were derived from studies published more than 20 years ago, hence limiting the generalisability of the findings accordingly. In addition, while length of stay has been overall on the decline over the last decades [47], a recent study has shown that patients with early supported discharge stay longer in hospital (approximately one day) than those who do not [48]. Reductions in the average cost of health care for stroke patients and in the difference in lengths of stay between CB and HB strategies would reduce the ability of HB stroke rehabilitation interventions to generate cost-savings.

In addition, we assumed that patients with the same age and gender would experience the same mortality risk and quality of life irrespective of the country of origin, hence implying that no environmental-level differences affecting those outcomes existed across the 32 countries under studies. However, this is an exploratory study which provides a quantitative assessment of what a one-point upward shift in the 0–20 Barthel index amongst a representative cohort of stroke patients would generate in terms of costs and quality-adjusted life years over a five-year time horizon.

Another major assumption of this analysis is that stroke patients were all presumed to benefit from the intervention and receive the same level and type of care. This implied that the resources needed to perform HB were already available in each country and meant that no heterogeneity in treatment protocols. In fact, these are likely to vary across the different country settings we investigated and could not be taken directly into account. However, country weights were applied to unit costs, which at least in part adjusted for this level of heterogeneity. Moreover, by considering only care delivery-related costs, we assumed that no other additional costs, such as overheads (e.g., organisation of the team) and other capital costs (e.g., cars to go to patient's home) would be generated from implementation of a home-based approach. This was dictated by the data available. However, our findings that HB was cost-effective were robust to variations to the costs of providing the intervention.

A 5-year time horizon might not have allowed all the relevant intervention effects to be captured, as these can occur over a longer time period. We aligned this study to a previous cost-effectiveness analysis of stroke interventions [24], reflecting the shorter cycles of financial planning and decision-making [49]. However, this was a pragmatic choice as the source available for modelling costs and outcomes up to 5 years, based on the 3-month mRS score, was OXVASC. In addition, while country-level heterogeneity was taken into account by using weighting factors, these represent only proxy measures for the real between-country differences. Moreover, the proportion of eligible patients was calculated based on evidence from the UK (OXVASC) and this might not be generalizable to other European countries. Although these assumptions may have an impact in terms of absolute figures, given that they applied equally to both treatment groups, they should not affect the cost-effectiveness conclusions.

5. Conclusions

A shift from a centre-based to a home-based approach to stroke rehabilitation can provide good value for money in most European countries, irrespective of their wealth. Further research should assess the generalisability of these findings to local settings. In a context of increasing pressure on health and social care budgets, it is recommended that European policymakers consider the implementation of home-based rehabilitation in eligible stroke patients.

Declaration

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This manuscript has not been published elsewhere. Declarations of interest: none. As corresponding author, I confirm that the manuscript has been read and approved for submission by all the named authors. RL-F and JL were responsible for securing funding and the overall concept of the study. PC, RL-F and JL were responsible for designing the study and development of the economic model. MV produced some of the evidence underlying the economic model. All authors contributed to the writing, read and approved the final version of the manuscript.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.healthpol.2022.01.007.

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