

<b>Institution:</b> University of Glasgow (UofG)		
<b>Unit of Assessment:</b> UoA 1 Clinical Medicine		
<b>Title of case study:</b> Practice-based interventions to improve rehabilitation after stroke		
<b>Period when the underpinning research was undertaken:</b> 2000–2017		
<b>Details of staff conducting the underpinning research from the submitting unit:</b>		
<b>Name(s):</b> (1) Prof Peter Langhorne (2) Dr Satu Baylan	<b>Role(s) (e.g. job title):</b> (1) Senior Lecturer; Professor of Stroke Care; Senior Research Fellow (2) Research Associate; Lecturer in Psychology; Lecturer in Mental Health and Wellbeing	<b>Period(s) employed by submitting HEI:</b> (1) 1994–2001; 2001–2020; 2020–present (2) 2014–2019; 2018–2019; 2019–2020
<b>Period when the claimed impact occurred:</b> August 2013–present		
<b>Is this case study continued from a case study submitted in 2014? No</b>		
<p><b>1. Summary of the impact</b> Each year, 5 million stroke survivors worldwide experience reduced quality of life owing to physical and/or cognitive disabilities. Recognising the need for improved rehabilitation programmes, UofG research findings have informed UK, European, US and Australian stroke guidelines (2016–2019). These guidelines recommend the timeframe when in-hospital mobilisation should (24–48 hours) and should not (&lt;24 hours) be undertaken. They also recommend early supported discharge (ESD) to aid patients' transition from hospital to home. Specialist ESD services are provided by 143 teams in the UK, with the proportion of eligible patients receiving this intervention rising from 24.7% (2014) to 39.0% (2019). ESD benefits survivors through improved independence and daily life activity, with annual per-patient savings over 5 years of GBP1,600 for health care and GBP8,400 for social care.</p>		
<p><b>2. Underpinning research</b> Stroke survivors can experience reduced quality of life owing to physical and cognitive disabilities. Nonetheless, despite ongoing improvements in stroke care, lack of clarity has existed about the components of rehabilitation that are key to ensuring good functional and quality-of-life outcomes. UofG stroke specialist <b>Prof Peter Langhorne</b> led investigations into two discrete practice-based interventions—very early mobilisation (VEM) and early supported discharge (ESD)—that are intended for use in hospital and community settings, respectively. This work shed light on the value of VEM and ESD in the post-stroke rehabilitation pathway.</p> <p><b><i>AVERT identifies the treatment window for in-hospital mobilisation after stroke</i></b> How soon, and at what intensity, patients should be mobilised after acute stroke (i.e. out of bed and sitting, standing or walking) to improve their outcomes is a critical question in stroke care, the rationale being that bed rest might slow neurological recovery. However, this intervention was poorly defined and supported by only a weak evidence base (159 patients).</p> <p>In 2015, publication of clinical findings from A Very Early Rehabilitation Trial (AVERT) provided healthcare practitioners with robust and generalisable evidence on mobilisation after stroke that had been gathered from a large cohort [3.1]. <b>Langhorne</b> was a grant holder for AVERT; a member of the Management Committee, the Trial Steering Committee and the Writing Committee; and Chief Investigator for the UK. In addition, UofG was one of three AVERT coordinating centres. Between 2006–2015, AVERT recruited 2,104 patients from five countries (610 [29%] in the UK) within 24 hours of stroke onset and tested the outcomes of VEM (mobilisation at &lt;24 hours) versus usual care (start time of mobilisation at the discretion of each participating site) [3.1]. Patients in the VEM group began mobilising at a median of 18.5 hours after stroke versus 22.4 hours for the usual care group (range, &lt;12 hours to ≤48 hours). The VEM group accrued a total of 201.5 minutes out of bed (31 minutes daily spread over 6.5 sessions) versus 70 minutes (10 minutes daily spread over 3.0 sessions) for usual care. Crucially, AVERT revealed that VEM had a negative effect on functional outcomes at 3 months after stroke. By contrast, usual care—which involved short bursts of regularly repeated mobilisation activity—improved recovery, particularly when initiated at 24–48 hours [3.1].</p>		

**The ESD Trialists establish the benefits of ESD services**

Many patients recover within 2–3 weeks of experiencing stroke but approximately half of all cases require a prolonged period of rehabilitation (>2 months). Previously, survivors underwent rehabilitation in hospital; however, from the early 2000s, ESD services offered hospitalised patients with medically stable, mild-to-moderate disability a route to early discharge and home-based rehabilitation. ESD aims to replicate stroke unit care and is delivered at the same intensity by a team of physiotherapists, therapists, nurses and physicians.

Nonetheless, a problem for wider clinical commissioning of this service was the lack of data as to whether ESD truly accelerates return home and provides equivalent care. In addition, the most important ESD components and their implications for healthcare resources were uncertain. To address these important questions, **Langhorne** initiated the ESD Trialists group with the aim of exploring the role for ESD services in post-stroke care. Langhorne also designed and coordinated its programme of work. This international collaboration comprised a forward-thinking group of experts who were the co-ordinators of all ESD trials conducted worldwide. The ESD Trialists undertook several pooled data analyses, including a landmark 2005 meta-analysis of 11 studies that comprised a total of 1,597 patients from six countries [3.2]. This meta-analysis demonstrated that treatment by an ESD team reduced hospital stay by 8 days when compared with conventional care; furthermore, patients in the ESD group showed improved independence at 6 months, particularly when supported by multidisciplinary teams. In all, 65% of patients using ESD services were discharged within 4 weeks after stroke versus 50% of patients using conventional services.

**Langhorne** is Co-ordinating Editor of the Cochrane Stroke Group (2010–present), which has published more than 200 systematic reviews to inform evidence-based recommendations for clinical guidelines in stroke care. In 2012, the ESD Trialists developed a Cochrane systematic review (14 studies, 1,957 patients) [3.3], which was subsequently updated in 2017 (17 studies, 2,422 patients) [3.4]. These two analyses consolidated strong evidence on the outcomes of ESD for patients with mild-to-moderate disability. Benefits included reduced risk of death and disability; increased likelihood of living at home; improved quality of life; and decreased costs.

**3. References to the research**

1. The AVERT Trial Collaboration group (2015) Efficacy and safety of very early mobilisation within 24 h of stroke onset (AVERT): a randomised controlled trial. *Lancet*;386(9988):46–55 (doi:[10.1016/S0140-6736\(15\)60690-0](https://doi.org/10.1016/S0140-6736(15)60690-0)) (230 citations). **Langhorne** is listed as the second author, with his roles in AVERT outlined in the [supplementary appendix](#) (see p.1).
2. **Langhorne P et al.** (2005) Early supported discharge services for stroke patients: an individual patient data meta-analysis. *Lancet*;365:501–506 (doi:[10.1016/S0140-6736\(05\)17868-4](https://doi.org/10.1016/S0140-6736(05)17868-4)).
3. Fearon P, **Langhorne P**, Early Supported Discharge Trialists (2012) Services for reducing duration of hospital care for acute stroke patients. *Cochrane Database Syst Rev*;9:CD000443 (doi:[10.1002/14651858.CD000443.pub3](https://doi.org/10.1002/14651858.CD000443.pub3)).
4. **Langhorne P, Baylan S**, Early Supported Discharge Trialists (2017). Early supported discharge services for people with acute stroke. *Cochrane Database Syst Rev*;7:CD000443 (doi:[10.1002/14651858.CD000443.pub4](https://doi.org/10.1002/14651858.CD000443.pub4)).

**Grants**

**Langhorne P** (PI): National Institute for Health Research Health Technology Assessment Programme (AVERT), GBP420,756 (2013–2016).

**4. Details of the impact**

Stroke affects 15 million people worldwide each year, with one-third of survivors going on to experience physical and/or cognitive disability, and subsequent impairments to their quality of life. Post-stroke rehabilitation is a multifaceted and potentially lengthy process that aims to increase levels of mobility (or movement), activity of daily living and general well-being.

**Langhorne** is internationally regarded in the field of stroke care, with one key opinion leader stating “*He has been the most influential stroke researcher in the UK over the last 25 years and his work has saved many thousands of lives and improved the quality of lives for thousands more*” [5.A]. Langhorne’s research has enhanced rehabilitation among stroke survivors by

refining two practice-based interventions: in-hospital mobilisation (**impact 1**) and ESD (**impact 2**). Benefits include recommendations for the rehabilitation pathway in UK and international clinical guidelines; implementation of guideline recommendations in UK clinical practice; improved outcomes and quality of life for patients; and cost savings for health and social care.

**Impact 1: A defined window for initiating in-hospital mobilisation after onset of stroke**

Publication of **AVERT** [3.1] in 2015 has informed UK and international clinical guideline recommendations for the timing and intensity of in-hospital mobilisation:

- The Royal College of Physicians (RCP) publishes the preeminent clinical guidelines for stroke in the UK. They are developed by the Intercollegiate Stroke Working Party, which comprises experts drawn from all areas of stroke care. Langhorne was a member of the Intercollegiate Stroke Working Party (representing the Cochrane Stroke Group) from 2004 to 2016 [5.A]. The fifth edition of the RCP national clinical guideline for stroke (2016) cites AVERT [3.1] to support modified recommendations for the intensity (2.11.1B) and timing (3.12.1B) of mobilisation [5.B]. Mobility therapies should comprise short but frequent interventions each day, beginning from 24–48 hours after stroke. By contrast, mobilisation within 24 hours should be used only among patients who do not need assistance to move.
- Guidelines developed by the National Institute for Health Care and Excellence (NICE) inform routine healthcare practices within the UK. The 2019 NICE guideline on stroke and transient ischaemic attack in over 16s (NG128) cites AVERT [3.1; as 'AVERT III'] in the evidence review for VEM [5.B]. NG128 includes a new recommendation (1.7.3) that is supported by the AVERT findings: “*If people need help to sit out of bed, stand or walk, do not offer high-intensity mobilisation in the first 24 hours after symptom onset.*” The guideline highlights that this recommendation “*may change current practice in stroke units where there is an 'as soon as possible' focus on mobilisation [and] encourage healthcare professionals to consider the intensity of very early mobilisation*” [5.A].
- The 2016 joint American Heart Association and American Stroke Association (AHA/ASA) guidelines for adult stroke rehabilitation and recovery cite AVERT [3.1] to support the following recommendation for in-hospital interventions: “*High-dose, very early mobilization within 24 hours of stroke onset can reduce the odds of a favorable outcome at 3 months and is not recommended*” (class IIIA; treatment is not useful/effective and in some cases may be harmful) [5.C]. The 2019 AHA guidelines for early management of patients with acute ischaemic stroke [5.C] echo this recommendation on the basis of AVERT [3.1].
- The Australian Stroke Foundation guidelines for stroke management were first released in 2017 but have since been superseded by online ‘living guidelines’ that are updated on an *ad hoc* basis [5.D]. AVERT [3.1] is cited to support a new ‘strong recommendation against’ mobilisation within 24 hours, as well as an updated ‘strong recommendation’ for all eligible patients to commence out-of-bed activity within 48 hours of stroke onset. Data collected biennially to evaluate national delivery of stroke care recommendations show that uptake of the audit indicator for early mobilisation (physiotherapy assessment within 48 hours) rose from 60% in 2009 to 72% in 2019 [5.D].
- The 2019 European Stroke Organisation consensus statements and recommendations cited AVERT [3.1] to support the following recommendation: “*Early mobilization is safe in stroke patients but should not be too intense*” [5.E].

**Impact 2: ESD services facilitate transit of stroke rehabilitation from hospital to home**  
*Clinical guidelines*

Work by **Langhorne and the ESD Trialists** [3.2–3.4] has provided key evidence for UK and international clinical guideline recommendations on ESD services for post-stroke rehabilitation:

- The RCP first incorporated recommendations on ESD in the fourth edition of its clinical guideline for stroke (2012), citing the 2005 meta-analysis [3.2]. The 2016 update to these guidelines [5.B] cites the 2012 Cochrane systematic review [3.3] in section 2.7 (transfers of care from hospital to home). Recommendation 2.7.1A states: “*hospital in-patients with stroke who have mild to moderate disability should be offered early supported discharge, with treatment at home beginning within 24 hours of discharge*”. Recommendations 2.7.1B–D set out the required elements of an ESD team.

- The 2016 AHA/ASA guidelines [5.C] cite the 2005 meta-analysis [3.2], as well as other publications by the ESD Trialists, to support the recommendation that ESD services may be considered as “*reasonable for people with mild to moderate disability.*”
- The 2017 Australian Stroke Foundation guidelines [5.D] cite the 2012 Cochrane systematic review [3.3] to support an updated strong recommendation that “*where appropriate stroke services are available, early supported discharge services should be offered to stroke patients with mild to moderate disability.*” The 2018 national rehabilitation services audit recorded an increase of 47% in the availability of ESD services across Australia versus 17% in 2016 [5.D].
- The European Action Plan for Stroke 2018–2030 covers seven domains of stroke, including rehabilitation, and sets consensus targets for long-term development of stroke care across the region [5.E]. The 2012 and 2017 Cochrane systematic reviews [3.3, 3.4] are cited as best evidence of ESD as an innovative approach to rehabilitation. The action plan identified a shortage of ESD services across Europe, with this intervention not offered as part of the stroke rehabilitation pathway in some countries. The research and development priorities of the Action Plan include addressing how rehabilitation strategies can be efficiently implemented in Europe. A key target for 2030 is to provide ESD “*to at least 20% of stroke survivors in all countries.*”

#### *Uptake of clinical guideline recommendations for ESD in the UK*

Implementation of ESD was included as an ambition in the 2007 UK Department of Health [National Stroke Strategy](#), citing the 2005 meta-analysis [3.2] as the rationale. Furthermore, the 2017 National Institute for Health Research [Roads to Recovery](#) overview of the organisation and quality of UK stroke services stated that the 2012 Cochrane systematic review [3.3] had informed policy and practice, leading to increased availability of ESD. The RCP Sentinel Stroke National Audit Programme (SSNAP) tracks quality standards in the UK (excluding Scotland) and is overseen by the Intercollegiate Stroke Working Party [5.A, 5.F]. SSNAP enables clinical commissioners, service providers, healthcare practitioners and regulators to set priorities for improvement, especially where variations in care are identified. For example, in 2016, a statement on ESD was added to NICE quality standard 2 (QS2) for adult stroke, with compliance reported using SSNAP data [5.F]. From March 2014 to March 2019, the proportion of eligible patients treated by a skilled ESD team rose from 24.7% to 39.0%. Of note, only 34%–40% of all stroke survivors are expected to meet the patient and environment eligibility requirements for ESD. These requirements include disability; safety and medical stability (basic self-management in the home, able to manage medication with or without a carer); and practicality (home is a suitable environment, patients or carers live in the locality of the service). During 2014–2019, the proportion of stroke units resourced with at least one specialist ESD team rose from 74% to 85% (143 of 169 sites) [5.F].

For patients in Scotland, interventions to facilitate transition to the community were outlined in the 2014 Stroke Improvement Plan, with ESD listed as ‘priority 7.1.’ [5.G]. **Langhorne** and Dr Rebecca Fisher (University of Nottingham) subsequently led a collaboration with the Scottish Stroke Care Audit team to investigate ESD provision. They identified a range of approaches to providing community rehabilitation and highlighted the need for clear service definitions to aid implementation. These findings were presented to the National Advisory Committee on Stroke, which co-ordinates implementation of the Scottish Stroke Improvement Programme (SIP), and incorporated in the 2019 SIP report as revised performance targets for rehabilitation [5.G]. ESD services were available in 5 of the 14 Scottish health boards during 2018–2019, with the remainder working to implement this approach [5.G]. Specialist ESD teams were available in 13 of 29 Scottish hospitals.

#### *Patient and carer benefits of ESD*

Transition from hospital to home is a stressful time for survivors and their family, as they come to terms with the debilitating effects of stroke. ESD offers much needed support during this period and provides specialist stroke rehabilitation to aid recovery in the home. **Langhorne** and Dr Fisher have collaborated to determine the core components of effective, evidence-based ESD services when implemented at scale in frontline UK healthcare [5.H]. A study published in

2016 demonstrated that patients who received ESD services did not experience increased rates of mortality or readmission when compared with the control group [5.H]. ESD was associated with improved performance of daily living activity; increased quality of life; and satisfaction with the rehabilitation process/services offered after hospital discharge. The benefits also extended to carers, who reported improved mental health scores. Similar findings were reported in a Swedish study of stroke rehabilitation via ESD services (2019) [5.H]. Positive effects included reduced levels of depression; increased independence in mobility, toileting and dressing at 3 months; and high levels of satisfaction with the intervention.

#### *Health economic benefits of ESD*

Stroke costs the wider UK economy GBP7 billion per year, with a quarter of this expenditure representing social care. The 2016 SSNAP health economics programme estimated the benefits and cost savings of increasing the proportion of UK patients using ESD services [5.I]. The mean annual baseline costs of stroke (over 5 years) per patient were GBP17,931 for health care and GBP27,301 for social care, with 1.63 QALYs recovered. For each additional patient undergoing ESD, the estimated cost savings over 5 years were GBP1,600 for health care and GBP8,400 for social care, with a QALY gain of 0.14.

#### **5. Sources to corroborate the impact** [PDFs uploaded for all listed items]

- A. Testimony from the Chair of the RCP Intercollegiate Stroke Working Party.
- B. UK guidelines: (1) RCP [National Clinical Guideline for Stroke 5th Edition](#) (2016). AVERT [3.1] cited in section 2.11 ('Rehabilitation approach – intensity of therapy') for recommendation B and section 3.12 ('Early mobilisation') for recommendation B. The 2012 Cochrane review [3.3] cited in section 2.7 ('Transfers of care from hospital to home') for recommendations A–D; (2) NICE guideline NG128 [Stroke and Transient Ischaemic Attack in Over 16s: Diagnosis and Initial Management](#) (2019). See recommendation 1.7.3 (p.16) and p.30–31. AVERT [3.1; as 'AVERT III'] cited as ref. 15 in the [evidence review](#) for VEM.
- C. US guidelines: (1) AHA/ASA [Guidelines for Adult Stroke Rehabilitation and Recovery](#) (2016). AVERT [3.1] cited as ref. 58 (p.e104 and p.e133). The 2005 meta-analysis [3.2] cited as ref. 17 (p.e102–e103). Additional studies by the ESD Trialists cited as refs. 16 and 18; (2) AHA [Guidelines for the Early Management of Patients with Acute Ischemic Stroke](#) (2019). AVERT [3.1] cited as ref. 279. See p.e386 and Table LXVIII ([data supplement 1](#)).
- D. Australian guidelines: (1) Australian Stroke Foundation [Clinical Guidelines for Stroke Management](#) (2017). See chapter 5 ('Rehabilitation'). AVERT [3.1; as 'Bernhardt et al.'] cited for early mobilisation (p.47–54; ref. 36). The 2012 Cochrane review [3.3] cited for ESD (p.24–37; ref. 11); (2) Testimony from the National Manager Clinical Services; (3) National Stroke Audit [Acute Services Report](#) (2019). See p.47 (Table 25) for mobilisation; (4) National Stroke Audit [Rehabilitation Services Report](#) (2018). See p.32 for ESD.
- E. European guidelines: (1) European Stroke Organisation [Consensus Statements and Recommendations](#) (2019). AVERT [3.1] cited in session 8 (p. 314) and the [supplemental material](#) (p.61–62); (2) [Action Plan for Stroke in Europe 2018–2030](#). The 2012 and 2017 Cochrane reviews [3.3, 3.4] cited in the section on rehabilitation (p.319–321; refs. 34, 35).
- F. Uptake of ESD in the UK: (1) NICE quality standard QS2, [Quality Statement 4: ESD](#) (2016); (2) Compliance with QS2 statement 4 (2014–2019); (3) Sources for trend analysis: RCP SSNAP acute organisation audits (2014, 2019), RCP SSNAP annual reports (2014, 2019).
- G. Uptake of ESD in Scotland: (1) [Stroke Improvement Plan](#) (2014). See priority 7.1 (p.20); (2) [SIP](#) report (2019). See section 8 ('Rehabilitation'; p.35) and priority area 7.1.2 (access to stroke rehabilitation services; p.4, p.60).
- H. Patient and carer benefits of ESD: (1) Testimony from the University of Nottingham; (2) Clin Rehabil 2016;30(3):268–276 (doi:[10.1177/0269215515578697](#)); (3) BMC Neurology 2019;19:40 (doi:[10.1186/s12883-019-1268-8](#)).
- I. Health economic benefits of ESD: (1) SSNAP [health economics programme](#) report (2016). The 2005 meta-analysis [3.2] and the 2012 Cochrane review [3.3] cited as refs. 29 and 5. See section 3.2 (baseline data; p.39); section 3.3.3 (ESD data; p.58, p.64, Table 30, Figures 12–17); (2) SSNAP health economics presentation (slides 12 and 14); (3) SSNAP health economics tool for ESD.