

**Title:** Foot and ankle impairments affect balance and mobility in stroke

(FAiMiS): the views and experiences of people with stroke

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## Abstract

**Purpose:** To explore the nature and impact of foot and ankle impairments on mobility and balance in community-dwelling, chronic stroke survivors. **Methods:** A qualitative research design using face to face semi-structured, audio recorded interviews. Thirteen community-dwelling stroke survivors, all of whom had self-reported foot and ankle impairments, were interviewed (female n¼6, mean age¼67 years, SD¼12 years, mean time since stroke¼4 years, SD¼6 years, right stroke n¼7, left stroke n¼6). A framework analysis approach was used to analyse and interpret transcribed interviews. **Results:** Three themes emerged: (1) Impact. The influence of foot and ankle impairments on mobility and balance. (2) Standing out. How participants felt they “stood out” because of their impairments and wanted to be normal. (3) Help. The specific help and advice participants received in managing their problems. **Conclusions:** Foot and ankle impairments such as pain, altered somatosensory input and weakness significantly contribute to problems with community ambulation, balance and fear of falling in people with chronic stroke. Specific foot and ankle impairments may also negatively contribute to perceptions of physical appearance and self-esteem. Therapeutic management approaches within clinical practice appear to focus mostly on the gross performance of the lower limb with little emphasis on the specific assessment or treatment of the foot or ankle.

## Implications for Rehabilitation

- Foot pain, sensory impairments and muscle weakness in the foot and ankle can impact on community ambulation, balance and fear of falling following stroke.
- Foot and ankle function post-stroke should be routinely assessed and monitored.
- Clinicians should be aware of the potentially distressing negative perceptions associated with altered gait patterns, footwear and orthotic use.

## Keywords

Balance, fear of falls, foot and ankle, mobility, stroke

## **Introduction**

The desire to regain the ability to walk safely and independently both at home and in the community often underpins the focus of stroke rehabilitation [1,2]. Whilst it is reported that 60–80% of stroke survivors are able to walk independently [3], many have reduced balance [4], walk slower [5], cannot walk as far [6], are more likely to fall [7] and feel less integrated into their respective communities [8]. Unsurprisingly, many stroke survivors capable of independent walking indoors are either unable or lack the confidence to walk unsupervised in their respective communities [9].

In an attempt to address these issues, clinical and research efforts have focussed on gait and the performance of the lower limb. Indeed, lower limb impairment following stroke is considered a greater indicator of participation restriction than upper limb impairment by those experiencing it [10]. However, work has concentrated on the gross performance of the lower limb during gait with little attention given to how foot and ankle impairments contribute to functional decline after stroke.

The foot and ankle complex involves multiple segments and joint mechanisms which strongly influence the interaction between the lower limb and the ground during locomotion and balance [11]. In older people specific foot and ankle impairments have been identified as significant determinants of balance and functional ability [12,13]. Following stroke, foot deformity [14], altered plantar sensory inputs [15], reduced ankle proprioception [16], altered motor control [17], toe clawing [18] and hitch-hikers toe [19] have all been observed, yet identifying how these impairments impact on mobility and balance remains unclear. There is some evidence from quantitative studies demonstrating that reduced strength in the ankle plantarflexors and ankle joint position sense influences gait velocity [20,21], increased spasticity in the ankle plantarflexors and altered sensory inputs contribute to gait asymmetry [22,23], and ankle dorsiflexor activity and altered ankle proprioception are linked with walking endurance [15,24] and balance impairment [25].

Whilst these studies provide some objective evidence of the role the foot and ankle has to play in function and mobility poststroke, they do not enhance our understanding from the patient's perspective. There is growing consensus that the experiences of patients provide invaluable insight into the real issues and can help develop complex interventions to facilitate recovery and health [26,27]. Qualitative research studies have highlighted a wide range of issues related to the impact of stroke and the organisation and delivery of services [28] yet the stroke survivor's perspective regarding the nature or impact of foot and ankle impairments on mobility and balance has not been explored.

This qualitative study aimed to explore the views of people with stroke and identify (1) the nature of the foot and ankle impairments they experience, (2) whether and how these may contribute to problems with mobility, balance and falls, (3) whether and how these impairments impact on their life and (4) what healthcare advice and interventions they have received in managing these problems.

## **Methods**

An outline interview schedule was developed by the research team based on a review of the literature and discussion with experienced clinicians. In accordance with Paterson and Scott-Findlay's [29] guidelines, three pilot interviews were carried out with stroke survivors which confirmed the interview schedule and procedure were appropriate. These pilot interviews did not

highlight any issues with the schedule that required revision and so a further ten face-to-face, semi-structured, audio recorded interviews were then conducted by the same single interviewer (T.G.) using the same schedule. All 13 interviews were included in data analysis. This study was approved by the National Research Ethics Service, North East Committee (2/NE/0416).

### *Sampling and recruitment*

Purposive sampling was used to recruit a maximum-variation sample in terms of age, gender, time since stroke, side affected by stroke and general level of function. Participants were recruited from stroke groups in the South West of England and through the South West Stroke Research Network database. To be eligible for inclusion, participants needed to be: \_\_\_\_\_18 years old; \_\_\_\_\_3 months post-stroke (not necessarily their first); report perceived foot and ankle problems as a result of their stroke; able to converse in English at a level considered appropriate to conduct an interview; willing and able to give informed consent and report no pre-stroke foot and ankle impairments as a result of other neurological/ musculoskeletal conditions. Interested potential participants were contacted by telephone or email by the researcher (T.G.) to allow for further explanation and questioning regarding the study and establish whether they met the study inclusion criteria.

### *Data collection*

Interviews were arranged at a time and place considered preferable to the participant. Twelve participants were interviewed at home and one at their local community hospital. Informal conversation occurred prior to starting the interview to place the participant at ease and offer the participant an opportunity to ask further questions prior to gaining written consent. In line with the framework approach an interview schedule was used to guide the conversation (Table 1) and encourage disclosure and elaboration of thoughts and feelings relevant to the study objectives. Interviews lasted on average 50 min (range 40– 65 min) and on one occasion a third party was present during the interview although they did not contribute verbally. A total of 13 interviews were carried out, by which time data saturation had been reached.

### *Data analysis*

All but one of the interviews was transcribed verbatim. In one case, expressive dysphasia made transcription difficult and hence, in line with recommendations set out by Lloyd et al. [30] the audio recording and field notes were used for analysis. All data were coded, grouped into sub-themes, summarised into main themes, charted and interpreted using a framework approach as outlined by Ritchie and Spencer [31] utilising software package QSR NVivo 9.2 [32]. Participant names were replaced with pseudonyms to ensure confidentiality but also to maintain an element of personality to each participant. A framework analysis approach enables both description and interpretation of what is happening in a particular setting with the aim of creating actionable outcomes [31]. It is considered an excellent tool to assess procedures from the perspective of the very people that they affect [33] and has been gaining in popularity as a means of analysing qualitative data derived from healthcare research, because it can be used to manage data and undertake analysis systematically [34]. This enables the researcher to explore data in depth whilst simultaneously maintaining an effective and transparent audit trail, which enhances the rigour of the analytical processes and the credibility of the findings [35].

### *Ensuring rigour*

Trustworthiness and credibility of the interpretation of the data were optimized through several strategies. Each of the pilot interviews were transcribed in turn, after which analysis and discussion was held by two of the research team (T.G. and J.F.) [36]. A coding reliability check was also completed on the three pilot interviews (T.G. and J.F.) and was deemed acceptable [37]. As further interviews were undertaken, regular meetings between these two researchers allowed de-briefing and ensured decisions could be evaluated and defended [38].

## Results

Thirteen participants were interviewed. Of these, six were females with a mean age of 66 years 6 months (SD=12 years, 2 months; range 38–78 years). The mean time since stroke was 4 years 4 months (SD=6 years 2 months, range 4 months to 20 years). Seven participants had experienced a right stroke, and six a left stroke (Table 2). Levels of mobility ranged from being independently mobile without walking aid through to requiring maximum assistance of one person with all transfers.

Three main themes were derived from the data, reflecting the underlying objectives of the study. These themes were termed (1) Impact which described the nature of impairments and how they contributed to mobility and balance; (2) Standing out which described feelings of standing out, perceptions of disability and a desire to be “normal” and (3) Help which described the nature and extent of help and advice received.

### *Theme 1: Impact; the nature of impairments and contribution to alterations in mobility and balance*

All participants provided descriptions of the nature of the foot and ankle impairments they experienced as a direct result of their stroke. Impairments affected the toes, foot and ankle and included weakness, lack of control, altered sensation, altered tone/spasticity, pain, stiffness and swelling.

All participants believed foot and ankle impairments contributed substantially to difficulties with mobility, balance and falls. Pain (n=4), tone/spasticity (n=4), weakness (n=11), lack of control (n=10) and impaired sensory inputs (n=11) were the impairments most commonly associated with mobility difficulties. Participants highlighted the marked impact these had on community mobility:

Cos I've got this lack of feeling there, I'm a bit wary. Especially, if it's rough ground because I have to look down continually to see where I'm walking. Crossing the road is a lottery. I can't look at the traffic and look down at the road at the same time. That is a bit of a problem. I've got to be very, very careful. Barry

Difficulties with lack of volitional motor control and the unpredictable nature of this control at the ankle and foot meant foot placement could also be a lottery, which was reported to increase likelihood of falling:

. . . I struggle because I don't know which way my foot is going to drop. If it drops flat then I can walk Ok but if it drops sideways, then my ankle rolls over on itself and I'm liable to fall over. . . Mark

The vital role of the toes in maintaining equilibrium was also reported:

. . . normally you press down with your toes don't you? I don't think my toes will go down. Cos like your toes grip to stop yourself from falling forward . . . Margaret

Some, however, perceived the lack of control in the toes was not due to weakness, but more to do with the toes “having a mind of their own”:

. . . I didn't even know they [the toes] could do that. So they bunch up, they cramp, so they have moments of calm but they've got a mind of their own. I don't know what causes that. That glamorous spasticity word isn't it? Rebecca

Tone and spasticity was reported by a third of participants (n=4), its presence being predominantly in the toes and foot, impacting on the role the foot and toes play in maintaining balance:

. . . All the time I've got tension in the foot, it never feels relaxed. There's so much more tension in whatever that foot has to do. It can't do anything naturally. If that foot is in its clamped up position then it's this balance thing again because I think I'm not using my foot as a base that sort of balances . . . Paul

Altered sensory inputs were described by all but two participants, with wide variations in both the type and extent of sensory impairments. For example, people described altered feelings of temperature (n=2), reduced feeling/feedback from the foot/ankle (n=8), the foot and ankle “just not feeling right” (n=4), through to “the foot doesn't feel it belongs to me” (n=3). Most (n=10) highlighted the difficulty associated with being unable to accurately discriminate or confidently detect the floor surface and foot position with an increased risk of falls especially on rough or uneven ground:

. . . it is lack of feeling in the foot and that it doesn't tell me if I am on a flat surface or an inclined surface or tipping my ankle over, I haven't got so much feeling coming back to my brain . . . Larry

Some people clearly attributed altered sensation with impairments in balance highlighting the inextricable link between sensory and motor function:

. . . I've got no feeling in the foot so I can't feel, I can't get my balance properly, if that makes sense. You know, when your foot is working properly, you can feel the ball of your foot and your toes, and by using your toes and that, you go push yourself to keep your balance . . . Mark

Whereas for others sensory impairment had a clear impact on gait pattern, community ambulation and the increased need for concentration:

. . . When I put my foot down and I don't get any response, that no feeling comes back that I've got it down and therefore I hesitate to move the other foot forward. When I think about it, it's ok, I can walk in a fairly straight line, but when I get distracted by something else, that's when I stagger . . . so much so that a policeman stopped me once and smelt my breath . . . Larry

All participants felt some restriction on where they could go or were cautious and thoughtful about where they could go, directly as a result of their foot and ankle problems. The biggest restriction on mobility, which was mentioned by all but one participant (who was not mobile outdoors), was being able to manage rough/ uneven and unfamiliar terrain:

. . . I have to be careful where I'm walking . . . because if it's uneven or you know rough or anything like that. I'm conscious that I'm likely to sort of trip on things because this wretched foot doesn't lift up, very often it doesn't lift. It flops and it drags . . . Jim

Conversely, the same participant had a very different perspective when it came to walking in a different environment:

I do know that I'm very happy where I know that the surface is flat, say walking through the hospital on Wednesday going to the gym, it's alright. Jim

The presence of pain in the foot and ankle was also highlighted as a problem in a third of respondents (n=4) with descriptors strongly suggestive of neuropathic pain. For all respondents with pain, it was sometimes sufficient to stop them from walking at all:

. . .I get pain in my foot more than anywhere. It feels like walking on glass or it's burning. It's the oddest thing. I avoid walking. Rebecca

Increased stiffness through the foot and ankle was associated with increased effort with one participant describing his ankle joint as if it was "rusted up":

. . .it's very stiff and very slow. It's hard work basically to do it [move the foot]. I suppose the joints have rusted up with the stroke. . . Barry

Whilst swelling was reported in four participants, they did not relate it to any functional impact, and did not appear to be concerned by its presence:

. . .My ankle actually swells up quite easily after I've done any exercise. It doesn't seem to affect me. But that's something none of the doctors have ever said that's going to be a problem, they've always sort of said that's to be expected so I've never taken any notice of it and I don't think that impairs my movement. . . Barry

### Theme 2: Standing Out; "I felt like I had three heads"

Most participants described how they felt their foot and ankle impairments made them "stand out" from others. They reported feeling very conscious of "being disabled", expressing a desire to "be normal". A number of participants described how acutely aware they had become of their physical appearance to others. This was often manifested by their embarrassment about the type of footwear they had to wear, or the abnormal way they walked as a result of their foot and ankle impairments:

. . . when I was walking towards someone and my foot would be turning inwards and it looks, well it doesn't look very nice. . . It's having the confidence in people looking at me and not seeing that I am disabled . . . Mark

For one participant, it was about wanting to make any orthotic as inconspicuous as possible so she did not appear disabled:

. . . so hence the orthotic. But I didn't want anything more obvious than this. I've been offered something that will keep it so rigid which is fine if you don't mind looking disabled. Which I do. Rebecca

Whereas for others, wearing footwear out of context created feelings of social unacceptability:

Having to wear trainers with everything makes me feel as if, like a duck out of water you know. I don't feel naturally acceptable in different situations. I went into the hairdressers the

other day and they knew that I had had a stroke but I went in with these [trainers] on and he said 'cor crikey, you're alright now you're going out for a run aren't you?' Paul

Concerns around feeling conspicuous and a loss of normality were often related to the type of footwear they had to wear as a consequence of their stroke:

. . .I don't want shoes that look like they've been made for a purpose. You know I want to wear what everybody else is wearing. I want to fit in. I've never ever wanted to fit in but I suppose with this you do want to fit in. You want to be in the realms of normal because you know that there is an element of abnormality. Rebecca

However, there was a tension between the disadvantages felt about the appearance of orthotics and the functional gains that could be made by wearing them, which often promoted reassurance and confidence:

. . .with the orthotic I've got now, it stops the foot from turning in and stops it from dropping. So every time I lift my foot, I know it's going to go down flat. So it makes my walking a lot stronger and makes me a lot more confident in my walking. I hardly fall over at all these days. .  
. Mark

### Theme 3: Help; specific advice and interventions received

The overriding sentiment by the majority of participants was that advice and/or interventions had been made available to address their gait and mobility problems although there appears to have been little focus on the foot and ankle. Separating "generic" advice/intervention that addressed stroke impairments per se from specific foot and ankle focussed advice/intervention was difficult for most participants whose stroke caused widespread impairments. Input from physiotherapy was received by all but three participants with the predominant focus reported to be on gait re-education and gross performance of the lower limb although there was occasionally some specific foot/ankle advice:

. . .the thing that I remember most about everything was the heel and toe thing that the physio talked about. . .and the keeping of a regular stride. . .rather than dragging this foot along after me. . . Jim

Some recalled that specific concerns about their foot and ankle function were not addressed:

. . . Nobody's particularly picked up on the toes scuffing I don't think. They were more concerned about stopping my knee flicking back. . . Marion

Whereas others chose not to report their concerns to their attending clinician:

. . .I've never really pointed it out. I haven't really said to anyone "oh look, my toes are curling up, why?" Paul

Five of the 13 had either trialed or were regular users of ankle-foot orthoses (AFO) with the physiotherapist being the main referrer into a specialist orthotic service:

She took me to [the orthotist] and showed him what was happening with the foot and he made me the boot. (AFO)Margaret

Only one participant reported being seen by a Podiatrist who:

. . . showed me my options basically. Do you want this or this?. This will do x-y-z. What do you want it to do?. . . he said you can have something that keeps your foot very static. . . a rod up the back of your leg basically which I just couldn't bear . . . but I wanted something that's subtle . . . Rebecca

Those that had been issued with off the shelf AFO's by the physiotherapist were reported less successful:

It's supposed to keep my leg square to the shoe. But it doesn't seem to make any difference.  
Neil

Provision of an AFO made a significant difference to some participants with one participant purchasing the AFO via the internet as the "off the shelf" versions were uncomfortable:

. . .with the orthotic I've got now, which I bought off the internet, erm it stops the foot from turning in and stops it from dropping. So every time I lift my foot, I know it's going to go down flat. So it makes my walking a lot stronger and makes me a lot more confident in my walking. I hardly fall over at all these days. . . Mark

Although there were some perceived repercussions of frequent use of the AFO:

The only thing I've found is that my foot is weaker than it was. I think that because I wear the orthotic now, it means my muscles don't move so much so they are a lot weaker than they were. . . Mark

Interestingly, despite all participants reporting altered sensory input, some very significantly so, none specifically reported any sensory re-education based intervention. FES was only used with one participant specifically at the foot and ankle although it was reported that this was with limited success:

I was given a FES to wear for my foot. Which when I went to lift my foot it fired a pulse which made my foot straighten out instead of inverting. So it was going down more flat which was good for me, but I just didn't like the FES. I didn't like the feeling of the pulse going through my leg . . . Mark.

## **Discussion**

The results of this study provide a unique insight into the type of foot and ankle impairments experienced and how they impact on mobility and balance from the perspective of the stroke survivor. They highlight the wide ranging and significant impact of these impairments on stroke survivor's everyday lives and highlight areas for service development and future research. The type of impairment participants reported as impacting most on their mobility and balance were, in order of impact, those associated with pain, somatosensory impairment, weakness and lack of volitional control in the foot and toes. Pain in the foot appeared to have the most profound effect on mobility for some, who chose to entirely avoid walking when pain was present or drastically shorten the time spent on their feet. Descriptors of pain suggest symptoms of central or neuropathic origin rather than mechanical. The average time since stroke (of those four people who reported pain) was 2 years 3 months, suggestive of chronic rather than acute pain. Neuropathic pain syndrome, which is a



direct consequence of ischaemic damage, is especially challenging to study because it usually observes an unpredictable latent period, which may be up to 18 months between stroke onset and development of pain or discomfort [39]. Our study suggests that pain can still have a significant impact on mobility many months or even years after formal discharge from stroke services, and because of its central nature, the pain may not follow predictable patterns or time frames. Whilst central and neuropathic pain syndromes may be poorly understood, this study further adds to existing qualitative work which highlights the significant effect of pain on quality of life after stroke [40] and functional independence [41]. The need for clinicians, especially those involved with community-dwelling stroke survivors to be aware of the potential latency and impact of foot pain following stroke, is therefore crucial. Apparent tactile sensory impairment of the foot and proprioceptive deficits at the ankle were reported equally by participants with some experiencing a combination of these two sensory impairments. Loss of sensory feedback from the foot was reported frequently. Particular concerns included not knowing the position of the foot in space, having a lack of awareness of what it was doing or difficulty discriminating the texture and orientation of the supporting surface. These impairments appeared to lead to difficulties with walking patterns, maintaining balance, adapting to different walking surfaces and gradients, misjudging step heights and co-managing the attentional demands of the environment. This study suggests that mobility and balance are affected by foot and ankle sensory impairments in stroke as has been established in MS [42] and peripheral neuropathies [43]. It further adds to recent qualitative work which highlighted that somatosensory impairments are of concern to stroke survivors, particularly when they return home [44]. The need to investigate the extent and nature of somatosensory impairments of the foot and ankle is clear, as evidence after stroke is largely limited to acute patients [45] and the effect of these impairments is not well understood [46]. . . .with the orthotic I've got now, it stops the foot from turning in and stops it from dropping. So every time I lift my foot, I know it's going to go down flat. So it makes my walking a lot stronger and makes me a lot more confident in my walking. I hardly fall over at all these days. . . . Mark Theme 3: Help; specific advice and interventions received The overriding sentiment by the majority of participants was that advice and/or interventions had been made available to address their gait and mobility problems although there appears to have been little focus on the foot and ankle. Separating "generic" advice/intervention that addressed stroke impairments per se from specific foot and ankle focussed advice/intervention was difficult for most participants whose stroke caused widespread impairments. Input from physiotherapy was received by all but three participants with the predominant focus reported to be on gait re-education and gross performance of the lower Whilst sensory impairment is suggested as a co-factor in disability and recovery, it is not considered an independent factor when strength or motor performance is included [47]. Lack of automatic and volitional motor control of both toes and ankle due to weakness and spasticity highlighted issues with catching toes during swing phase, lateral ankle instability during stance phase of gait, static standing balance, and multi-directional responses to perturbation and distraction. Worries about tripping, negotiating uneven or rough terrain, crossing the road, walking slowly and an increased fear of falling were common. Such worries have been reported to impact community ambulation and integration, affect quality of life and return to independence. Foot and ankle impairments appear to further contribute to these factors which are commonly reported by patients after stroke [48,49]. Participants conveyed the feeling that their deficits in motor control and sensory awareness could be relatively well managed in predictable, flat and quiet environments with most difficulties arising when the environment became unfamiliar, uneven or busy. Rough ground, busy streets and traffic caused challenges that did not necessarily occur indoors or during clinic-based therapy. These findings support previous research highlighting the role and impact of environmental factors on mobility and disability [50,51] and add credence to a shift in therapeutic focus from clinic-based gait

retraining to goal-directed and task specific training within variable environments [52]. They may also part explain why large proportions of independently mobile stroke survivors either cannot or are reluctant to mobilise without supervision in the community [9]. Foot and ankle impairments following stroke were associated with perceptions of standing out, feeling disabled and a loss of “normality”. The impact of stroke on survivors is repeatedly described as “loss” in the qualitative literature, with the significance of reduced functional ability being explained in terms of loss of activities, abilities, personal characteristics and independence and a desire to be normal again [28,53]. Within the context of this study, these feelings were predominantly driven by footwear choices (or lack of), the nature of participants’ walking pattern as a result of their foot/ankle impairment and the need to wear an AFO. Feelings regarding footwear and the use of an AFO tended to be stronger in the female participants who reported feeling self-conscious because of both the appearance of the AFO and the resultant loss of footwear choice because of the need to accommodate an AFO. The impact of footwear or lack of footwear choice has been established in other non-stroke populations [54] yet despite its importance, footwear advice following stroke is minimal [55]. All of these factors contributed to people feeling self-conscious about their physical appearance which has shown to be a strong predictor of general self-esteem [56]. Low self-esteem following stroke is not uncommon and can influence participation restriction [57,58]. Conversely, whilst some participants reported that the presence of an AFO may reinforce “abnormality” or evoke feelings of disability, the effect of wearing one was to “normalise” gait patterns and thereby improve perceived physical appearance. This suggests that the aesthetics of orthotics and adaptive footwear, as well as their therapeutic objective, need to be taken into account when prescribed by health professionals. It emphasises the need for healthcare professionals to be aware of how distressing negative perceptions of others can be for people with stroke. Our study asked participants to highlight what advice and interventions they had received with respect to their foot and ankle problems. Whilst most had received input from a physiotherapist, the participants reported the focus of that input tended to be generic gait re-education, motor retraining and strengthening, in the context of the gross performance of the lower limb. All but two participants reported somatosensory impairments, yet none specifically recalled receiving sensory retraining despite prompting. It appears that, contrary to current recommendations [59] and other qualitative work identifying somatosensory impairments as a concern for patients [44], most stroke rehabilitation remains focussed on motor recovery [44,60]. Furthermore, clinical convention suggests that sensory retraining is more fastidiously administered to sensory impairment of the hand and there is a dearth of evidence applying the learnings from the hand to the foot [23]. Only one participant reported being seen by a podiatrist, regarding the prescription and provision of orthotics. Podiatry services or podiatrists are not considered part of the core multidisciplinary team in the current stroke guidelines [59]. This may offer some explanation as to why, despite its potential importance to people with stroke, few receive advice about foot care or footwear [55]. Only one participant had trialled functional electrical stimulation (FES) for foot drop suggesting its use may be underutilised, despite recommendations [59] and stroke survivors reporting an overall preference for FES over AFO’s [61]. This study has several limitations. First, the participants’ willingness to provide information that would satisfy the researcher, who was a physiotherapist, may have led to potential exaggerated and/or inaccurate descriptions. Whilst most participants were informed of the clinical background of the interviewer, it was emphasised at the beginning of the interview that responses would be anonymous and would not affect any current or future clinical care. Second, the majority of interviews were conducted with stroke survivors who were, on average just under 4 years post-stroke and were no longer receiving rehabilitation, so recall of treatments received may have been inaccurate. Third, this study purposively recruited community-dwelling adults with selfreported and stroke-related foot and ankle impairments and therefore reflects the experiences

of those with these specific impairments rather than the wider stroke population. In summary, foot and ankle impairments such as pain, altered somatosensory input and weakness may substantially contribute to problems with community ambulation, balance and fear of falling in people with chronic stroke. Specific foot and ankle impairments may also negatively contribute to perceptions of physical appearance and self-esteem. Therapeutic management approaches within clinical practice appear to focus mostly on the gross performance of the lower limb with little emphasis on the specific assessment or treatment of the foot or ankle. This first phase of a three-phased research programme has given some insight into the impact and nature of foot and ankle impairments post-stroke, thereby helping to inform assessment and management within the clinical setting. This study will further guide future phases of research which aim to investigate the prevalence of foot and ankle impairments in the wider, community-dwelling stroke population and the relationship between these impairments, mobility and balance.

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### **Declaration of interest**

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**Table 1. Interview Guide**

1. Could you tell me about how you have been affected by your stroke?
2. Could you tell me how your stroke has affected your foot and ankle?
3. Do you feel any of these foot and ankle problems affect how steady you feel on your feet?
4. Do you feel these problems affect your walking?
5. Could you tell me whether you feel your foot and ankle problems have impacted on any other aspects of your life?
6. Could you tell me about any advice or interventions you have been given to help manage the problems with your foot and ankle?

**Table 2. Participant demographics (names pseudonymised).**

<b>Participant</b>	<b>Gender</b>	<b>Age</b>	<b>Time Since Stroke</b> (Years and months)	<b>Hemi Side</b>	<b>Level of walking ability/use of walking aids</b>
Larry	Male	78	10 years 8 months	R	Independent with walking stick
Margaret	Female	70	1 year 1 month	L	Transfers only; quad stick
Neil	Male	72	1 year 6 months	L	Independently mobile indoors; supervision outdoors; walking stick
Barry	Male	70	20 years 1 month	R	Independent with walking stick
Mark	Male	56	5 years	L	Independent no aid
Paul	Male	62	1 year 4 months	R	Independent no aid
Jane	Female	76	1 year 5 months	L	Transfers only; quad stick
Marion	Female	69	6 months	L	Independent with walking stick
Jim	Male	78	4 months	R	Independent no aid
Rebecca	Female	38	6 years	L	Independent no aid
Nigel	Male	42	11 months	R	Independent no aid
Rose	Female	78	1 year 7 months	R	Independent with walking stick
Sandra	Female	76	9 months	R	Independently mobile indoors; supervision outdoors; walking stick