# Wearable Airbags: Investigating Attitudes Towards Inflatable Hip Protectors

This paper explores new technologies applied to hip protector (HP) garments worn by people at risk of falls to reduce the risk of hip fractures. The research relates to a practice-based PhD investigating ways to develop more effective HP products, especially for women who are most at risk of fracturing a hip (Stevens 2005). Hip fractures can have a devastating impact on people’s lives and lead to a rapid decline in health and increased dependency, especially for older people (Royal College of Physicians 2018). Over 3.5 million people living with osteoporosis in the UK, a disease that causes low bone mass and deterioration of bone tissue, are at higher risk of fragility fractures, including hip fractures (NICE 2017). Indeed, one in two women over 50 will break a bone because of the condition (Royal Osteoporosis Society 2022).

HP garments, consisting of underwear with protective pads positioned over the hip joints, are designed to reduce the risk of hip fracture. However, trials of HPs show only a small reduction in hip fracture risk in care home settings, and little or no effect on hip fracture risk in the community (Santesso, Carrasco‐Labra, and Brignardello‐Petersen 2014). However, study participants find HPs uncomfortable or dislike the way they look (Sims-Gould et al. 2014), which can negatively impact on the clinical effectiveness of intervention studies using HPs due to lack of compliance and limited ‘wearing time’ (Kurrle et al. 2004). The Cochrane Review concluded that poor acceptance of HPs by older people is a barrier to their use, noting that, ‘better understanding is needed of the personal and design factors that may influence acceptance and adherence.’ (Santesso, Carrasco‐Labra, and Brignardello‐Petersen 2014).

Inflatable HPs – a new technology – consist of a belt containing inertial sensors that can detect when someone is falling and deploy airbags automatically around the hips. Examples of these products, such as the Tango Belt and Wolk hip airbag, have been studied in clinical trials that indicate improved efficacy compared with underwear HPs when used in long-term care facilities (Tarbert and Singhatat 2021; Nemeth et al. 2022). Although these early results are promising in terms of user compliance and reduction of hip fractures, there are yet to be any studies that report on user expectations or attitudes towards these new types of HPs.

Table 1: Online survey responses.

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| --- | --- | --- | --- |
|  | Yes% (n) | No% (n) | Maybe% (n) |
| Would be prepared to pay significantly more for an airbag hip protector compared to an underwear or padded belt hip protector (n=146). | 16 (23) | 37 (54) | 47 (69) |
| Would be put off using an airbag hip protector due to always having to ensure the battery is charged (n=141). | 24 (33) | 48 (68) | 28 (40) |
| Would be put off using an airbag hip protector due to having to replace the compressed gas cartridges every time the airbag is activated (n=140).  | 31 (43) | 37 (52) | 32 (45) |

An online survey was conducted to explore attitudes towards HPs and preferences in their design. To engage with community dwelling populations at risk of hip fracture, the online survey was directed towards members of the Royal Osteoporosis Society (ROS) and 146 women responded. The survey findings (see Table 1) show that the cost of airbag HPs and necessary on-going maintenance, such as battery charging and gas cartridge replacement, are barriers to their acceptance for some potential users.

The qualitative data also provides insight into a range of attitudes – positive and negative – towards these products. For some women, the perceived barriers to using airbag HPs are worth accepting for the increased protection they provide. As one respondent put it, ‘I want to do all I can to avoid having a hip fracture’. However, several barriers related to this high-tech solution also emerged, such as running costs, inconvenience, and safety concerns. Difficulty of use and maintenance for older users, who may experience hand strength and dexterity issues, are also reported. Many of these factors suggest that airbag HPs would be better suited to care home environments, where ongoing product maintenance can be carefully managed, alongside protecting the most vulnerable adults from injuries from falls.

Within the community-based population, the barriers to acceptance could be overcome by capitalising on lightweight inflatable surfaces for impact absorption but perhaps where they are integrated and permanently inflated in garments. In this respect, another respondent noted, ‘I feel it should be a passive system such as padding. Having an active system is more complicated and could fail to operate’. Some of the concerns relating to traditional HP garments, such as their bulkiness, are also directed towards the airbag products. One woman observed that, ‘the idea that the pads are not visible unless a fall occurs is appealing but the tyre effect round the waist is not’. Another respondent felt the same way, noting, ‘I'm not very vain but this looks like a roll around the waist; not an attractive look’. This issue is addressed by the Wolk hip airbag that is worn hidden under clothing. Alternative HP designs with ‘inflatable padding’ would need to have a low profile to avoid a bulky aesthetic.

Inflatable HPs seek to provide more comfortable and effective hip protection compared to traditional underwear products. However, this high-tech and expensive solution overlooks other critical user needs, potentially alienating some of the most vulnerable people at risk from falls. Acceptance of wearable airbags is an under-researched area so further investigation is needed to understand the ‘personal and design factors’ related to these products.

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