REGULAR PAPER

WILEY

# Home as riskscape: Exploring technology enabled care

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The growth and spread of ubiquitous smart technology to deliver public health outcomes at home, and its relationship with risk, urgently requires greater scholarly attention, not least given COVID-19. Theoretically informed by both critical geographies of home and risk scholarship, this paper uses data from interviews with professionals in Scotland designing and implementing technology enabled care (TEC) for current and future homes. It explores the organisation of risk in the context of TEC, and the importance of this in relation to home. Drawing on geographical writing on home, and the riskscape, I argue that the smart home is a contemporary manifestation of the riskscape with implications for ideas of intrusion and inequality, and the experience of home.

**KEYWORDS**
home, risk, Scotland, smart, technology enabled care

## 1 | INTRODUCTION

"Smart" technologies are expected to radically transform healthcare, reducing trips to hospital and providing greater opportunity to live longer, healthier lives at home. Notions of risk are entwined with "smart" technologies, which are simultaneously a response to risk and a generator of new risks (Lupton, 2016). Exploring the "taking place" of risk, particularly how notions of home (Blunt & Dowling, 2006; Brickell, 2020; Reid et al., 2010), domestic routines and practices (Reid & Ellsworth-Krebs, 2017) are being reconfigured and experienced as a consequence of the digital health agenda is urgently required. The study of technology enabled care (TEC)[1] is one way to explore the relationality of risk and how we conceive of, design, and experience home. Traditionally, TEC is used to describe "commissioned" services such as telehealth/care, ehealth, door/bed/chair occupancy sensors, and heat alarms, installed and monitored by public sector organisations following well established protocols. Over recent years, the use of new, affordable, consumer devices have been advocated by high-profile organisations such as the Royal National Institute of the Blind and Alzheimers Scotland, for use to aid informal caring practices by familial/kinship carers. One review of a Google Nest Indoor Camera on Amazon exemplifies this:

> We decided to buy this to keep an eye on our mum who has dementia. We liked this because it is motion detection, has sound, has two-way communication, live feed as well as recorded history and all the family could log in to keep an eye – ticked all the boxes for us. (February 2018)

TEC no longer simply relates to "commissioned" devices for which there is some form of accountability by health and social care providers, but in its widest conceptualisation includes "consumer" devices such as Amazon Echo, Google Home, Hive, indoor CCTV, and Ring Doorbells. The acceleration of digital technologies, and TEC specifically, has been notable given COVID-19, with reporting from organisations such as the Nuffield Trust (2020) and British Medical Association (2020) proving some sense of this urgent uptake.

The delineation between "commissioned" and "consumer" devices is useful in highlighting the different actors, procurement, and proprietary arrangements and expectations involved in their use. But we should not lose sight of what these technologies "do" for what purpose, why, and for whom, rather than focusing on what they "are." They are all technologies implicated in care and caring practices, regardless of whether they were designed for such a purpose, enabling, for example, activities such as shopping or managing heating systems remotely, downloading talking books, monitoring inhabitant activities, or checking who is at the door. They are all technologies implicated with risk; whether in response to risk or in themselves being "risky." It is useful to therefore engage with risk scholarship, which has highlighted the relationality of risk, emphasising political and moral dimensions of risk and the necessity of moving towards more pluralistic understandings, shifting "the analytical lens of the risk researcher towards interactions, practices and objects (Moore, 2020)" (Brown, 2020, p. 8). An emphasis on performativity, and how relations are enacted in and through practices, has characterised recent writing on health risk (Alaszweski, 2020; Lupton, 2016) and the riskscape (Müller-Mahn et al., 2018), mirroring debates in studies of home (Brickell, 2020). In this paper, my aim is to bring scholarship on risk and home together to explore how risk comes to matter at home in the context of TEC, reflecting on empirical work with professionals involved in housing, social care, health, and public policy arenas.

Foremost amongst discussions with professionals were the: risk of falling; risk of lying undetected after a fall or worsening of health; data risk (who has access to data, how they are stored, who owns them; e.g., software developer, device creator); risk of abuse if new forms of access and control are acquired; risk of inaccurate readings given lack of clinical calibration of devices; and, obduracy of devices/systems. Such concerns are heightened by COVID-19 as more people shelter-in-place, and increasingly rely on TEC which magnifies these risks and others: installers may need to enter homes to install new devices or give technical installation advice from afar; a heightened risk of scams, both existing and new forms which can be especially risky for people not exposed to internet scams before; and a false sense of security which new devices may give, meaning that individuals are more likely to undertake risky activities. There is, therefore, an urgent need to investigate the ways in which ideas of home and of risk co-evolve in discussions of TEC. In this paper I sketch out the different ways in which risks of TEC at home were organised according to logics of likelihood, severity, and temporality, exploring why this is important in the context of home and what this means for the (re)production of these in relation to issues of intrusion and inequality. In concluding this paper, I set out a new research agenda suggesting areas for investigation, given that the home may increasingly be governed as a site of risk.

## 2 | HOME-ING IN ON RISK AND TEC: A LITERATURE REVIEW

Recognising that home is a concept and reality that is made, rather than something or somewhere that simply exists, helps to reveal the importance and interdependency of materiality, power and scale, opening up questions such as the following: What kinds of home/care/everyday life are desirable? Whose interests do they represent and how? How do these ideals and interests grow from and contribute to individuals, households, communities, institutions and societies? Increasing levels of automation, interconnection, and sophistication are synonymous with "smart" – ubiquitous devices, platforms and systems that are connected to and through the internet, that can even "think for themselves." Whilst there is little clarity about what "smart" means, often it is a list of attributes or functionalities, including for example, those related to detection, monitoring, and control (Sadowski, 2020). Beyond its use as an adjective, noun, and verb, and perhaps most critically, smart has been described as a "desired state," which "encapsulates ideas of efficiency, security and utilitarian control in a technologically mediated and enabled environment" (Strengers, 2013, p. 1). Thus, whilst it is possible to define a healthcare smart home on the basis of what it can do (i.e., functionality) or what type of life or lifestyle it makes possible (e.g., living with multiple sclerosis, "ageing-in-place"), a more critical perspective reveals that there is a broader political agenda (e.g., the necessity to intervene in homes for health) within which these types of homes are deemed desirable, even necessary, or made possible. In this section of the paper, I review ideas of home, particularly in relation to smart technologies and TEC, bringing these into conversation with contemporary scholarship on risk to identify areas of synergy and difference.

The desire for smart(er) homes stems, in part, from a romanticism of home as a place of safety, control, and autonomy. Ontological security, a concept which concerns one's ability to have autonomy and control in order to maintain continuity, has historically dominated in accounts of home, but has increasingly been challenged through explorations of stability, fixity, and temporality (Brickell, 2020; Lui, 2020). For instance, Gibas (2019), drawing on Gilles Deleuze, unpicked the contradictions between home as place to be rooted and ontological security enacted, whilst simultaneously being temporary and translatable. Scholarship on home now subscribes to ontologies which understand reality as conditional, multiple, dynamic, and entangled, and of home as stretching beyond the fabric of a single building (Ellsworth-Krebs et al., 2019). Similar observations might also be made of scholarship on risk, which has evolved to consider the political and moral

implications for how risk is understood, categorised, and acted upon, challenging arbitrary and abstract approaches (Alaszweski, 2020; Bonholm & Corvellec, 2010). For instance:

> Risk necessarily involves a form of thinking which – by its abstract quantification and dissolving of context – has a tendency to ignore the whole person and their humanity, through its focus on 'factors' and a wider epidemiological logic (Castel, 1991). The categories that do emerge have deeper institutional roots and, from a Douglasian perspective, we should be attentive to 'the way our classification system is set' and how this relates to organisational dynamics. (Reis, 2019, p. 2; drawing on Douglas, 1986) (Brown, 2020, p. 6)

Bringing discussions of risk and home together is productive in highlighting shared recent moves towards plurality and relationality. In part, such moves have been a response to somewhat reductionist, arbitrary, and abstract modes of categorisation: about types of risk or people at risk; or, about types of home, types of tenure, types of householders.

How risk intersects with TEC homes, and the digital health agenda more broadly, has been part of the move towards revealing the contingency and relationality of risk, most often discussed in the context of self-monitoring (Lupton, 2013), measurement and quantification (Ruckenstein & Schüll, 2017), studies of dataveillance (Ash et al., 2016), and datacapitalism (Sadowski, 2020). Yet there is more to do to understand the way in which risk shapes these phenomena, particularly how it relates to the conceptualisation and design of TEC systems, infrastructures, policies and implementation within homes. We know that healthcare interventions targeting individuals (using personal data) overlook the idea of homes as shared and mediated between different residents (cf. Goulden, 2018 et al., on interpersonal data) which may also be intervened in from afar (cf. Hines, 2019 and "living together, apart"), revealing the types of homes and dynamics therein which require more sophisticated understandings in the context of TEC at home. Indeed, the openness of home as a concept and experience, particularly the porosity of its boundaries (not simply the fabric of walls), reflects the public–private nature of everyday life (Brickell, 2020) and is relevant in the context of TEC given data flows and information sharing between different organisations. Thus, the nature of TEC at home, and what precisely it entails, remains obscure.

How networks of/for care are impacted by new practices of technological control has been a key concern in the literature (Ball et al., 2016; Lupton, 2013; Power & Hall, 2018). Even well intentioned interventions by familial and kinship carers which rely on consumer devices, may give rise to new forms of control, raising issues around whose knowledge is accepted; for instance, what an individual says happened versus evidence collected by devices. Such practices may expose people and their caring networks in ways which are beyond their control (Ball, 2009), causing them to reconfigure their relationships with each other and with the home environment (Ball et al., 2016; Domenico & Ball, 2011). That is, TEC and other forms of monitoring, mean that people adapt their own practices and activities within the home because they know they are being "watched." As Maalslen and Sadowski (2019, p. 119) suggest:

> Smart systems, many have argued, have shifted society from one of discipline to one of control (Gabrys, 2014; Sadowski & Pasquale, 2015). Yet, at the same time, it is important to recognise that these different power relations are not exclusive but rather overlapping, coproduced, and context dependent. (Iveson & Maalsen, 2019; Evans & Kitchin, 2018)

These are important and valuable concerns to be addressed, to understand who and what has power or control over whom, and why. Moreover, we should ask the fundamental question about why TEC at home has become desirable at all (see, e.g., Power & Hall, 2018 on "shifting landscapes of care"). Whilst this may partially be answered due to changing demographic pressures (longer lives, higher incidence of complex and chronic illness) and challenges for the public sector (finance, time, resources), the detection, reduction, and management of risk has had a significant role, hence the importance of exploring the variety of ways risk is implicated in TEC at home.

One conceptual device which may be useful in exploring the ways in which risk co-evolves with TEC at home is the riskscape, which helps to emphasise the relationality of risk. The idea of the riskscape emerged from Appadurai's five "scapes" (1990) and "conceives of space in terms of relations, instead of more traditional spatial concepts that focus on topography, borders, regions and divisions" (Müller-Mahn et al., 2018, p. 198). It, with Appadurai's other "scapes" and geographical thinking around "flat ontologies" (Marston et al., 2005), is an attempt to move away from ideas of fixity to reflect the multiple and dynamic, thereby articulating the complexity of risk and its manifestations. For instance, Appradaurai (1990, p. 296) uses the following suffix:

> Scape to indicate first of all that these are not objectively given relations which look the same from every angle of vision, but rather that they are deeply perspectival constructs, inflected very much by the historical, linguistic and political situatedness of different sorts of actors.

Scape, in this sense, is a reminder that these relations are a matter of perspective, both in the sense of personal history and positionality, but also in how we attempt to understand relations and their comparative importance. My use of the term organising logics (of/to risk) within this paper is therefore an attempt to signal the comparative importance of risk relations within the context of TEC at home. Indeed, studies of the riskscape have developed their own logics to demonstrate how risk is relational as mediated by sociomaterialistic arrangements. For instance, riskscape scholarship has concentrated on the interface between social and environmental concerns, exploring, for example, environmental justice (Cain & Hendryx, 2010; Lee et al., 2018) or health disparities, and their intersection with environmental hazards (Jenerette et al., 2011; Morello-Frosch et al., 2001). Although urban spaces and phenomena such as gentrification (Abel & White, 2015) have featured within riskscape scholarship, discussions of home and TEC specifically have not yet been explored. The value of awarding greater attention to more relational, perspectival approaches of/to risk, as riskscape does, helps to reveal how risk is imagined, experienced, understood and acted upon in the context of home and with what effect, as I seek to demonstrate in my empirics. What this offers to wider discussions of risk, is attention to the digital within sociomaterialistic relations and some suggestions about which organising logics are involved and why. It also extends the application of the riskscape into new domestic terrains.

## 3 | METHODS

I draw on interview and focus group data with 31 participants to explore the way in which TEC at home in Scotland is imagined and realised by different professionals. Participants represented institutions who govern, design, implement, and evaluate healthcare technologies for homes within the TEC umbrella. Launched in late 2014, the TEC Programme is an initiative overseen by the Scottish Government, "designed to significantly increase citizen choice and control in health, well-being and care services" with the ambition "to place Scotland at the forefront of innovative approaches to technology enabled care" (Scottish Government, 2020a, 2020b). It recognises that expectations around services are changing with advances in digital technologies, and that people are living longer, healthier lives but often have complex care requirements.

Participants spanned several sectors, with differing levels of seniority, from directors with responsibilities for delivering national policies (e.g., NHS innovation, housing association boards, charities), to those managing and delivering care everyday – allied health professionals (AHP's) and carers. Participants who agreed to interview did so because they were already invested in TEC and felt they had important reflections to share, so there was a high degree of commitment to TEC. Whilst this mostly translated into enthusiasm for TEC, three of the participants were particularly vocal in their scepticism of technological solutionism. That the participants were drawn from different sectors mattered little (e.g., there was no clear difference in enthusiasm according to sector) but did provide insights into how specific issues (e.g., data sharing or information governance) were problematised and responded to as is highlighted in my discussion.

Interview discussions surrounded "commissioned" devices/services, "consumer" devices and the interoperability of these arrangements. Themes for the interviews included the multiple visions and versions of "health smart homes"; the diversity of technological devices and preferences towards these; and the extent to which professionals consider the impact of these technologies on attachment to and meanings of home. Questions about risk were not on the interview schedule, but ideas, definitions, categorisations, and management of risk dominated in all discussions, to an extent not anticipated prior to the fieldwork. Risk was explicit in every interview, whether that was about the use of TEC in response to risk, or the risks that TEC, or lack of TEC, posed. It was also clear that risk was an emotive and subjective topic. Participants not only discussed notions of risk in abstract or hypothetical ways, but also according to how they had experienced risk themselves, whether in their professional or personal lives. The importance attached to risk, according to frequency with which it was mentioned, and the affective quality of responses, was what motivated the focus of this paper, representing an inductive research approach (Robson & McCartan, 2016).

Interviews and focus groups were undertaken in the place of work of the participant, and ethical approval was awarded by the university. Pseudonyms are used.

# 4 | ORGANISING AND (RE)PRODUCING RISK

In the following sections I present my empirics to explore the organisation of risk (section 4.1) and impacts of these logics (section 4.2) on how TEC at home is considered, considering the implications that may arise.

## 4.1 | Organising Risk

Risks related to falls, loneliness/isolation, information governance, and organisational reputation were key risks raised by participants. The type of risk, or specific practices implicated, rather than the person at risk, was the focus. Notions of likelihood, severity (gravity of impact for the individual, service, technology adopted, or the organisation) and temporality (short/long term, differences in duration etc.) were used as key organising logics. The dynamics of these logics and their interplay shaped the way in which participants felt TEC could or should be used within homes. I explore these logics in the proceeding paragraphs.

Several participants referred to a tragic event which happened in 2008, when a tenant of a housing association in Scotland was found dead at home, having lain undiscovered for 18 months. The shared desire to prevent this from happening again mobilised enthusiasm for TEC at home, with almost all participants realistically optimistic about digitalisation:

> I think there is a real impetus for technology enabled care to become more widespread, but I think that we have to be cautious and make sure that we are clearly aware of what we're using and what we're using it for and I think we'll get real benefits from that if we do. (Care manager 1)

One of the common attractions of digitalisation was the move from reactive (e.g., telecare where a service is enacted after an individual has pressed an alarm for help) to proactive services (e.g., detecting changes in patterns of activity before an event to predict it):

> I think too often we're dealing with issues once a problem has emerged how do you do that more predictive and preventative type of approach where you're beginning to anticipate, be able to put in appropriate supports if people's health or safety is being compromised in any way. (Policy maker 1)

These sentiments highlight the importance of likelihood in shaping risk prevention, rather than the risk/event itself:

> It wasn't about predicting an event, it was about predicting the likelihood of an event. (Housing association professional 1)

In this sense, likelihood is a judgement of probability, which Brown (2020, p. 5) suggests is a "profoundly political and moral" dimension of risk. Indeed, the likelihood of risk was entwined with assessments for social care support based on classifications of need, as the following focus group conversation demonstrates:

| | |
|---|---|
| SocialWorker: | I think my perception is that when you go out and do an assessment you see a risk, but for the majority of people that we have doing the assessing, the only way to negate that risk is to put a physical person in there. |
| Care manager 2: | There's just I think some things or tasks or reasons behind supporting someone [with a person, rather than a technology]. |
| Social worker: | There is, and I think we've probably reached that point because we've had to be very careful. Nearly all *the referrals we receive are either critical or substantial and we have to be really careful.* |
| Researcher: | What's the difference between critical and substantial? |
| Social worker: | So, critical is if we don't get care then they're going to end up in hospital, they're going to either deteriorate, their health will deteriorate or they'll injure themselves, so that's critical. And then, you've got substantial, whereas they're struggling along but actually if you don't get to them soon … |

The categories of critical and substantial referred to are part of the National Eligibility Framework (NEF) used to determine whether a person requires a social care service: "The risks do not refer only to an individual's current independence, health and wellbeing, but also to the risk that she or he may not be able to gain these outcomes without support" (Scottish

Government, 2002a [accessed 6 July 2020]). Whilst there is a nationally defined framework, there was recognition that assessments of risk likelihood contrasted by profession:

> A colleague gets really cross about her clinician colleagues who talk about the risk of people being discharged home because they're not necessarily thinking it would be better and she just says you just need to start understanding and counting the risk of the person staying in the hospital. So, we have a very partial understanding of risk. (Data professional)

Thus, although a policy framework such as NEF suggests a clarity between categories of risk likelihood, the reality demonstrates greater ambiguity in terms of interpretation and obfuscation of the fundamental reasons for risk (e.g., desire to stay at home longer). This reminds us that anticipation of likelihood is contingent on wider normative and political ontologies and is a relational phenomenon (Bonholm & Corvellec, 2010), which has implications for the development of TEC at home if it is designed in anticipation of particular likelihoods. For instance, there are more fundamental questions about the types of life that are desirable – lives lived at home for longer – and how that plays into notions of risk likelihood:

> you can put some technology in which means you catch a fall earlier but you can't do anything about the fact that people will fall if they stay at home longer when they are super old. But we don't then look beyond that and say okay, they fell but what are the wider benefits of staying at home and what do they feel about this. (Policy maker 2)

Participants reflected that the assessment of a risk, and reason or speed of intervention (i.e., tailoring of TEC) was determined by notions of severity as well as likelihood. The ultimate interpretation of severity was the risk of harm to vulnerable people, which all participants were motivated to reduce. Interestingly, however, all were sensitive to reputational risk for their organisation, and the extent that these varied by severity. This was manifest in many interviews, specifically the meeting of legal obligations:

> The mere fact that they're actually there [paid carers in an individual's home] and leaving a track and that makes sure that we're meeting our commitment to deliver that service to that individual. Because if we don't there's a big … in terms of our registration with the Inspectorate there's … we have a commitment to … if we advise that we're going to deliver the service and then tell that service user that this is when they're going to get their visits and we then fail to meet that, fail to turn up or are late then there's a consequence in relation to our registration with the care inspector. (Care manager 1)

Likewise, the risk of being unable to act (or react to risk) because of capacity issues and consequences of this, was also remarked upon as having potentially severe consequences for that organisation:

> There's a sense of responsibility that if they are receiving the data they'd better be doing something with it and they're not quite sure where to put it, who is going to monitor it and then you start getting into conversations about at what point do we take some action to then go and check that 'Mrs Smith' is okay. (TEC evaluator)

Relatedly, there were specific concerns around an organisation's reputation in relation to GDPR:

> There's lots of value in the GDPR regulations and my own view on GDPR is that the regulations are sensible and coherent but I think the public sector has translated them as being quite bureaucratic so I think … it's [had] quite an impact on the delivery of services I think because the public sector is understandably nervous about how it uses data. (Policy maker 3)

If reputational risks were believed to be severe (e.g., accreditation rescinded, inability to respond appropriately) this shaped the nature of engagement with TEC (e.g., which types of systems/services were used, or the continued reliance on personal carers instead of a TEC service). The perceived severity of risk was therefore a significant organising logic for practices of TEC adoption and use.

Accompanying assessments of likelihood and severity were notions of temporality, particularly in relation to progressive impairment (e.g., cognitive decline, increasing physical frailty) and the recognition that greater intervention may be required over time. For example, it:

> Would be useful for us to know when their behaviour's changing for example so … you know roughly what time they get up during the day, you know roughly when they have their lunch, roughly when they're moving about in the afternoon and when they go to bed. If they start to go out of their normal parameters, they might be organic or mental health illness developing. Again, that's reliant on continuous data streaming and also establishing patterns for that person … so what's normal for that person and then when you set the trigger for an abnormality of some sort, so knowing what's normal for them, their general day to day behaviour, changes you'd like to know and the last part to that is, you would definitely want to know if they've fallen over, if they've fallen over that means there's something wrong with their locomotor motor system, their nervous system by become unsteady because they're developing a chest infection, a urine infection that sort of thing. (Clinician GP)

This sentiment, that individuals and their practices may change over time, as a justification for a different type of TEC, one capitalising on the "best" features of digital data, was common in many interviews. Relatedly, temporal dimensions of risk were observable in discussions about data, with the recognition that data created by/for TEC can exist in perpetuity generating future risks, reflecting the idea of self-perpetuating logics (Brown, 2020). One interviewee recalled how, when attending a conference, other speakers were praising proprietary systems:

> And what they're saying is 'Well we're getting this really cheap.' And it's like yes, that's because you're selling tenant's data for nothing and I stood on stage going you know we are the gatekeepers of the data of the poorest and most vulnerable in society and we have to take that seriously and protect them. It's shameful if we're doing it any other way because you're selling somebody else valuables basically, their identity. (Housing association professional)

Thus, there are potentially severe consequences from not fully appreciating the range of risks from using personal data by organisations. In this sense, the temporal concerns the short/medium/long term (chronometric ideas of time) and the incremental accrual of risk as, as has been explored in riskscape scholarship (cf. Müller-Mahn et al., 2018). However, it also concerns the duration and patterning of risk over the lifetime of an individual or practice, with these changing over time (see Lui, 2020, for further discussion on home timescapes).

Critical risk scholarship has highlighted how risks are not equal, and that how we conceive and categorise risk is instrumental in shaping responses to them. That some individuals are more at risk than others has been well documented (Amoore, 2011), but discussion of the types of practice which are riskier than others (Müller-Mahn et al., 2018), and why that is so, has been less central in riskscape debates. This may be important in understanding how responses to risk are shaped. Exploring how risks are organised and mitigated helps to identify and understand which practices are more/less risky (e.g., falls, data sharing, responding to risk) and how ideas of these are shaping relevant agendas, in this case the desire for TEC at home. Moreover, it helps to highlight that participants were juggling the relative importance within and across these organising logics. For instance, in the context of severity, there was somewhat of a tension between the severity for the individual versus the severity for the organisation. Likewise, the necessity for intervention reflected the interaction between the organising logics; a judgement based on the likelihood of an event, its severity (whether through action or inaction), and temporal dimensions (when in the future it would occur, how long it would exist). These reflections reveal the importance of understanding the intersection of logics as relations within and between the organising logics varied not only according to the practices from which risk arose but also in how they generated new risks (e.g., digitisation and data sharing). Beyond the relational, these discussions add a dimension of futurity to riskscape scholarship, highlighting for example, how with digitalisation, personal data, data on patterns of activity and data related to risk may exist in perpetuity and beyond the contemporary riskscape.

## 4.2 │ (Re)producing risk at home

What discussions of likelihood, severity, and temporality reveal are judgements of the relativity of risk, demonstrating the complexity in designing, implementing, and evaluating TEC at home. Within the domestic context, the necessity of considering such complexity is paramount, not least due to these spaces (often) being shared with other family members and carers, but also because of the routines and activities that take place therein, which are significant for structuring everyday life. With the possibilities of continuous monitoring via digital data, debates on the public–private nature of home have become increasingly relevant with new digital TEC interventions, shaping notions of control and how this varies. Examples of this were offered by participants:

> As we move towards much more adapted, sheltered and housing accommodation, we will have people in communal areas, living independently in their own rooms or spaces but in communal areas being picked up by an awful lot of smart devices, where's my control in that, if I enter a shopping centre there'll be a notice to say that you're be recorded and by entering you're giving permission [to be recorded] but that's not the case in many communal environments in care homes or sheltered accommodation. (Charity CEO)

With the opportunity for continuous monitoring via TEC, and the availability of data following digitisation, almost every aspect of daily life within homes can be collected: from showering patterns (via humidity and water flow sensors) to food preparation (monitoring of cupboard door openings, fridge sensors, and energy meters), and having visitors (doorbell sensor, movement sensors). For participants, the volume and type of data, and importantly, knowing when and how to respond to changes in domestic data patterns were key concerns:

> If you're generating vast amounts of data, how and when do you respond? If someone's watching Strictly Come Dancing and they get very excited and their pulse rate will go up and we wouldn't want to respond to that, but if they've got a high temperature and high pulse then we would respond to that. (Clinician GP)

The risks of data sharing, consent for this, and potential for abuse of data were also key issues raised by participants:

| | |
|---|---|
| Clinician consultant: | So I think the central tenet is that it is the individual person's data. I think it's a nonsense that we don't all hold our own medical records. I think we should all be … all have a little subcutaneous chip, an implant that contains our health records and what drugs we take and what allergies we have. |
| Researcher: | Do you mean that flippantly? |
| Clinician consultant: | No. I think we should and I can't see any reason why. We put implants into people all the time. After all my Labrador is chipped, and it's got his health record on it and I know where he is if he gets lost. So why are we so reliant on bits of paper? And it's your data, it's my data, it's not the state's data. Having said that, I would personally be happy to share all my health data with anyone, within the context of care delivery. And so as long as the person consents for their data to be shared and be explicit about who they're sharing their data with then that's a good place to start. |

In this example, the assessment is being made between relative risk of sharing data versus not, and what level of sharing is acceptable under which conditions. It was reflected in numerous interview conversations where participants reflected on the challenge of balancing concerns of the public who may have TEC in their homes, with the necessity of data to make appropriate clinical or healthcare decisions. For example, when one housing professional was exploring the design of new homes which embedded TEC sensors, the reaction from potential tenants:

> Was all the Big Brother questions you know, 'you're collecting stuff on me and what are you going to do with that data?' so as I said this was about 2014/15 and what we found was that in people's head they didn't want the Government to have it because that was the kind of Big Brother-y, Putin, Trump stuff but they didn't want private sectors to have it either because it was Facebook and Cambridge Analytica. (Housing association professional)

The tension between sharing data and with whom, reflects longstanding debates within studies of home, and the public–private boundaries home crosses (Reid et al., 2010).

The idea of intrusion dominated conversations around the experience of TEC at home, and was one manifestation of this relationship between the public–private binary, for instance:

> It is a fine line, it's really intrusive to have people come in, strangers effectively, coming in and out your home, four or five times a day, delivering intimate personal care, probably asking you to do this, asking you to do that when actually a bit of technology might be able to do that for you, but in the same respect it's quite intrusive to have alarms and sensors and bit of kit for this, bit of kit for that, that's quite intrusive as well. (Housing association professional 1)

Similarly:

> We provide a night support service, it's people that traditionally would have had a sleep over. We provide them with a device, and we have a team that'll respond to it no more than 10 minutes away from the individuals. So, if they press their alarm or if they trigger a full detector or whatever automatically the two-way video will open. It's been really interesting, at first some of the families were 'what about privacy?.' But then as they explored it more they were like actually 'you have a stranger sleeping in your house at night' because that was a service that the Local Authority provided it was quite often agency staff that were doing it, so we had customers that had had a different sleepover person every night … whereas now we have a team of six staff, so three on shift at any one time. So they've built up a relationship with the individual, so you get a lot of calls at 10 p.m. from the customers just saying just seeing who's on shift and then that's them happy, they're relaxed and they know who's on, they've been reassured that someone's there to help them if they need it. (Housing association professional 2)

These two accounts show how TEC may be perceived as being less intrusive than having paid carers come into the home, but that it is not a panacea. Arguments about the changing nature of state provided care (Power & Hall, 2018) and replacement of paid carers with technologies aside, it reveals the importance of intrusion, ideas about which can differ according to the organising logics explored in Section 4.1. For instance, whether intrusion is more likely to reduce risk (e.g., of falling or of undertaking riskier activities as TEC provides an enhanced sense of security), whether the severity of risk may outweigh the nature of that intrusion, and how the frequency, duration, or time of day TEC is used (temporal dimensions) shapes feelings of intrusion.

It is important to qualify that these concerns were raised in the context of discussions around "commissioned" services/devices, where there are greater regulations in the monitoring of continuous data compared with consumer devices where proprietary systems are used on a DIY basis with different implications for intrusion (e.g., within familial networks or of private companies). Whilst participants recognised that commissioned devices and services were the "gold standard," the demand for these services resulted in more DIY approaches. The perceived slowness of commissioned services to act largely fed into this DIY-TEC phenomenon:

> I think there is a risk for public sector that it sits off on the side and continues to do what it's always done which is scramble a bit and try and meet the increase in demand by producing funding and actually users, if they have the ability to, will just go elsewhere and find their own solution. (Policy maker 3)

The mass media reporting of abuse via commissioned services has also contributed to the appetite for DIY-TEC as one participant suggested:

> A number of media outlets showing cases down south where people going into mainly residential care were being abused by carers. Which is unfortunate, so it's a knee jerk reaction [to, in this example, install CCTV] from some families to say, I want to make sure this is not happening to my mother/father. (NHS 1)

Amongst participants there was an acknowledgement that consumer devices were being used to largely supplement commissioned devices, as advocated by some charities (e.g., RNIB and Alzheimers Scotland). Anecdotal evidence following

COVID-19 is that this has increased since the time of the fieldwork. The use of consumer/mainstream devices to supplement or substitute commissioned TEC is a fairly new phenomenon and not well researched, but important in the context of risks at home (particularly in light of COVID-19, see Reid & Creaney, 2020); and in how the use of commissioned/consumer devices differs by household/social group.

A call to "acknowledge how varying experiences and perceptions of government and healthcare organisations, shaped at the intersections of class, gender, race and ethnicity, will shape very different relations and approaches to risk (Finucane et al., 2000)" (Brown, 2020, p. 3) is pertinent given these more recent developments. The promise of TEC at home should not blind us to the heterogeneity of need and experience, nor how these phenomena act to (re)produce risks they are designed to minimise, as reflected by one participant:

> I think a lot of these pilot schemes, they tend to self-select a nice little group of patients to work with so you know, they are not working with somebody living in a council flat with no carpet, no furniture, no cooker or you know as I said somebody living in a squalid bedsit when they don't have their wheelchair because it broke six months ago and nobody has replaced it for them yet. Or a disorganised person who is constantly being sanctioned by the benefit system and is literally penniless week after week after week. How do we, why do we bring that story in and get that out. Are we really modelling these things against a population that they would actually most fundamentally allegedly transform the lives of or are we modelling them against a bunch of people who look a bit like us and are likely to be interested in tech and that's what we are doing. (Policy maker 2)

The idea that some in society are better able to respond to risk than others is not a new idea (Wimmer & Quandt, 2006) but applies in these new contexts of TEC at home. One participant reflected:

> The product that we kind of trialled we could absolutely see the benefit of that and peace of mind for families in families able to see using technology see a wee bit more of what's going on in a household but people would have to pay more maybe to get that service and some people wouldn't have the people at the other end to be monitoring and looking at that and noticing changes in patterns and so on. My issue with that is nearly 60% of our tenants are on housing benefit and they seek assistance for their housing costs so there's quite a significant cohort of our tenants may not be able to afford that, even though it may be beneficial. (Housing association professional 3)

What was striking about this example was that it is not just about the cost of any devices or services, but the wider familial/kinships networks which are also required. This was seldom reflected upon by participants, and only a few openly discussed it.

That understandings and experiences of risk are not equal should not be a surprise and is a reminder, if needed, of the political and moral dimensions of risk. How risks are (re)produced through changing socio-material conditions, vary by social group (policy makers, carers, patients), by practice (falls, data curation, caring), by space (private dwelling, sheltered or very sheltered housing, residential care home) and is critical to understand, a task begun in this discussion. Moreover, that homes are public–private spaces, often shared with other family members and carers – a relational space – means there is increased complexity when it comes to (TEC) intervention. The possibilities of continuous monitoring via digital data from ambient technologies within the home are arguably part of a broader move to govern the home through risk. The necessity of understanding the home as riskscape, of being and becoming a site of/for risk, and how this varies by place and time is more urgent than ever.

## 5 | CONCLUSION

Increasing demand on health and social care services and the rapid pace of digital transformation (national infrastructure, proliferation of devices and services), along with a cultural desire to live longer, independent lives in homely settings, means it is timely to explore the multitude of ways in which TEC at home is being understood. Exploring how risk is anticipated and acted upon with what effects contributes new insights to the digital health agenda, specifically to how TEC may be shaped by these phenomena. Bringing together academic scholarship on risk and home, to reflect on experiences of professionals on the front-line of TEC in Scotland, I have drawn attention to the organising logics of likelihood, severity

and temporality used by those professionals to rationalise intervention, and explored this in relation to two themes of intrusion and inequality. Indeed, calls to explore different riskscapes (of which home may be one) and why they matter (Müller-Mahn et al., 2018) stem from a desire to understand how organising logics and practices co-evolve to (re)produce risk. Moreover, what this paper has shown is that there is scope for studies of TEC at home to contribute to riskscape scholarship by revealing how futures, particularly given digitalisation, the ubiquity and in perpetuity of data, could be considered. The complexity of home and what this means for intervention also provides a "new" scape through which risk might be understood. In the following paragraphs, I therefore set out an agenda for future research in this area, recognising that the appetite for TEC at home is growing, and that the implications of this are yet to be fully acknowledged.

Firstly, this paper has explored professionals' perception of risk, and the ways in which this may shape the types of TEC deemed appropriate. Of course, this work should be extended to include the broader array of professionals involved, in different places (under different governance arrangements); for example, those involved in implementation. Importantly, however, it is urgent and critical that we investigate the heterogeneous experience of TEC at home, both those who are the target of intervention, and those who are affected by the "spill-over" of those interventions. This includes those who are part of the informal caring network – not necessarily in same physical dwelling as the individual in receipt of TEC, but who are "living together apart" or different configurations of this. This inherent relationality, which means that any interventions are particularly complex, is often overlooked and methodologies of/for future research should be sensitive to this. For instance, future enquiry should not simply centre on the autonomous individual "targeted" by TEC at home but consider the wider web of relations involved.

Secondly, participant reflections predominantly concerned "commissioned" TEC devices and services. The use of "consumer" devices and DIY services that are readily available, affordable and intuitive, but which are largely unregulated for caring purposes may have different implications when used at home, in comparison with commissioned TEC. New regimes of observability are just one potential effect. Globally, efforts to combat COVID-19 required people to "stay at home," increasing demand for remote monitoring of health and care. Yet the extent to which these consumer approaches supplement or provide a substitute for commissioned TEC or in-person visits, how they interact with existing domestic or caring routines, and shape experiences of home, for a vast range of different people, are key questions to be answered. Moreover, the spatial and temporal dynamics of these relations, how they evolve over time as the pandemic unfolds, are interesting to consider and explore (e.g., what will the legacy effects be: a new reliance on TEC via extension of the frequency and range of devices, or a "stepping back" and reduced reliance?). Indeed, it may be productive to learn from the multiple, other ways in which home is increasingly governed as a site of risk, for example, via new immigration policies and the "right to rent" (McKee et al., 2020), perhaps risks related to insecure tenure (Harris et al., 2020), and even by thinking about risky practices at home (e.g., youth nightlife and drinking Pelzelmyer et al., 2020).

Thirdly, the empirical work was designed to capture how ideas of home were changing considering TEC. Risk was not explicit in any question posed to participants, nor was it a theme for the research project. That it dominated participant conversations reveals how important a topic it was in the context of TEC provision and use within home, specifically the different types of risk, their organisation and relativity. Existing risk and health scholarship is less explicitly focused on home and there is therefore potential to extend the empirical basis of such scholarship as well as consider the theoretical ramifications for this "taking place" of risk. Relatedly, given the increasing appetite for TEC and digitalisation of health to take place at home, more critical research on notions and meanings of home is required. Lastly, there is a danger, as highlighted by Deborah Lupton (2016), that digital devices pose new (and perpetuate existing) risks to users. Those in receipt of commissioned TEC already require additional social care or health services, meaning the potential to extend inequalities of risk for already vulnerable people and households requires very close attention.

## ACKNOWLEDGEMENTS

## DATA AVAILABILITY STATEMENT

The data are not publicly available due to privacy or ethical restrictions.

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## ENDNOTE

[1] An umbrella term which includes both commissioned (e.g., telecare, telehealth) and consumer devices (e.g., Google Home, Alexa, Hive, Zoom).

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