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Saving lives.

One analogue alarm at a time

How to harness the hidden data in your existing alarm equipment to keep people safe right now.

Taking
Care

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Dark Data: What are the risks and rewards?



David J. Hand.

Bestselling author and Emeritus Professor of Mathematics and Senior Research Investigator at Imperial College London, formerly President of the Royal Statistical Society and Fellow of the British Academy. David's book *Dark Data: Why What You Don't Know Matters* examines the risks and benefits of dark data and how to use this 'hidden' data to your advantage.

What is dark data?

Dark data is data you don't know. It might be data you thought you had, hoped to have, or wished you have. You might know that you are missing something, but on the other hand you might be unaware that such data exists, and its absence might have led you to dramatically incorrect conclusions. Dark data might even be data you have in principle, perhaps data lying unnoticed, hidden, and unsuspected elsewhere in your records or files, and not included in your analysis.

Why should I be concerned?

The consequences of dark data can be catastrophic, in terms of both lost lives and lost fortunes. But the promise of dark data can be substantial - in all ways, including health and finance. If all this sounds like a message of despair, there is a flip side. Awareness of dark data allows one to look at things from a different perspective. This perspective reveals that dark data can be immensely powerful - in advancing science and medicine, in increasing profitability of companies, and in improving effectiveness of government.

Harnessing the hidden power of your dark data

This brings me back to one of the most basic and simplest, but often most effective and powerful applications of the dark data perspective: the use of data that has already been collected, lying gathering metaphorical dust in unnoticed and unused folders in your computer: data which exists but has hitherto been concealed. This data was probably put aside because it had no relevance to a certain question. But that does not mean that it doesn't contain valuable information about other questions. It simply takes someone to formulate the right question and recognise that this dark data can shed light on it.

"And this is exactly what the team at Taking Care is striving to do: to use the large data set of existing records of personal alarms to build models to identify those at risk, so that proactive action can be taken. A clear example of the beneficial power of dark data."

Prof. David J Hand, Imperial College London

Why your personal alarm data is important

Personal alarm users create lots of data

Technology Enabled Care (TEC) touches the lives of over 2 million people across the UK, in a variety of settings. Each interaction is therefore valuable to those individuals in keeping them safe and secure and allowing them to lead the life that they want to lead.

Additionally, as every customer interacts with providers of TEC they create data. This could be from an emergency call to fall detection, or even an accidental pendant activation. At Taking Care we have undertaken a programme to identify whether it is possible to use patterns within this data to predict declining health amongst our customers or service users.

By analysing the frequency, timing, and nature of interactions, Taking Care has explored whether it is possible to identify trends that are associated with a higher risk of declining health and emergency calls. We wanted to determine whether it is possible to establish a progression of need that may involve interaction with Adult Social Care in the near future (effectively providing a 'pipeline of need' indicator for Social Care).

Other factors that could be taken into consideration, as well as frequency of emergency calls, could include the individual's age, living situation and other information that they have volunteered that has been collected by TEC providers in a structured manner (where consent has been provided for its appropriate use). However this study has NOT sought to use this additional data, relying instead solely on alarm usage information available in the stored databases of Alarm Receiving Centres (ARC) across the country.

It is important to note that predicting changes to an individual's situation or declining health is a complex task and there are many factors that can contribute to an individual's health status. Hidden patterns in data are just one piece of the puzzle and should be considered in conjunction with other relevant information.

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Why Taking Care derives value from data

At Taking Care we constantly look for patterns in our data and analyse how our customers use our service. We do this proactively to improve both our service for our private pay customers and the service users of our corporate clients. We speak to our customers regularly and place them at the centre of everything we do. Our data-driven approach shapes our Technology Enabled Care (TEC) services to be more innovative, co-produced and person-centric.

Taking Care's trove of pendant customer data

As the largest private pay alarm service provider in the UK, we feel uniquely privileged to draw upon a valuable trove of anonymised personal alarm data we collect and use this in a proactive and preventative way. This report is designed to assist local authorities or housing associations which may not have the resources or time to take a detailed prevention focus with their data in a similar way, and to allow TEC providers to place themselves closer to the heart of health and social care

The prevention opportunity to seize today

Many of the industry discussions about prevention revolve around the application of new digital technologies and 'big data'.

However, at Taking Care we believe we should not have to wait for 'sometime' in the future to be able to support our Loved One customer with proactive, preventative care. The TEC industry should be able to reap the benefits of a long-term collection programme of data around the usage of analogue personal alarms – where the true definition of 'big data' spans back over 35 years. With the increasing pressures on the NHS and social care sectors it's even more imperative to act now where we can and to demonstrate that the TEC industry can play an important role in integrating the requirements of health and social care.

It is our view at Taking Care that there is a prevention challenge / opportunity for the TEC industry. The sector is currently trying to navigate the analogue to digital transition, and whilst fully established proactive and prevention solutions are acknowledged as important, they are possibly considered of marginal interest as part of the social care ecosystem.

For those interested in proactive and prevention solutions, their options currently revolve around new technology / wearables which require further investment, rather than utilising existing legacy equipment at zero additional cost. Another challenge stalling the uptake of proactive and prevention solutions is lack of clarity for providers on how to deliver them in a meaningful way or who should pay for them.

Taking Care's 'Predictive Pendants'™ Risk Analysis

To continue driving innovation and progress in the TEC industry, Taking Care has shared, through this insight report, how we use our data science driven research to deliver prevention – to give commissioners and telecare professionals practical help to:

- **Deliver prevention right now using their existing analogue equipment and with no extra investment**
- **Easily identify and more effectively build a pipeline of potential care users by harnessing their own service user hidden / dark data**

Why delivering prevention right now is important

Prevention as defined in The Care Act 2014 is one of the key responsibilities for local authorities, with an inseparable link to the fundamental principle of promoting wellbeing.

In social care, prevention involves care and support systems that actively promote independence and wellbeing. In a health and social care setting this means intervening early to support individuals, helping people to retain their confidence and skills, and wherever possible, preventing need or delaying deterioration.

In practice, that includes delivering services that prevent, reduce, or delay the need for care in higher-cost or more intensive settings and adopting strategies to improve the quality of life of older people and how they engage within their community. Commissioners and practitioners both need to understand the scope of prevention, what the different approaches are and what opportunities there are to prevent, reduce, or delay need.

In Taking Care's opinion the benefits of prevention are very clear. They include empowering individuals to become more proactive in their own health and wellbeing, increasing independence, and reducing falls, thereby helping people live longer, healthier lives. For health and social care systems a proactive and preventative approach it is argued can reduce or delay the need for care and support services, reduce the strain on health and social care budgets and ease the demands on services.

“Prevention is about helping people stay healthy, happy, and independent for as long as possible. This means reducing the chances of problems arising in the first place and, when they do, supporting people to manage them as effectively as possible. Prevention is as important at seventy years old as it is at age seven.”

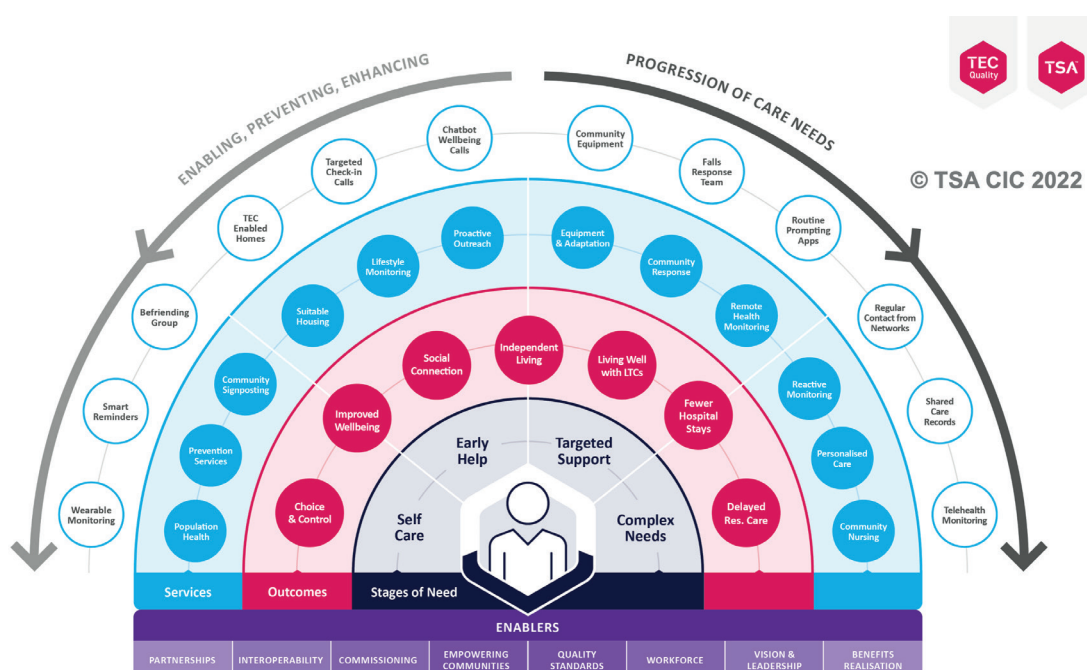
“Prevention is better than cure” - Department of Health and Social Care, November 2018

<https://www.gov.uk/government/publications/prevention-is-better-than-cure-our-vision-to-help-you-live-well-for-longer>

How the TSA is supporting prevention

Delivering prevention and using digital care technology and support services to 'slow down the progression of need' is a core remit of our industry body, the TEC Services Association (TSA).

Personalised Innovation Care Model



The TSA's Business Plan for 2023-2025 has given the TEC industry a strong challenge.

How we can best utilise a mix of enabling technologies, data insights and robust 24/7 monitoring services, and their mobile responder counterparts, to support the shift towards proactive and preventative services? The TSA's goal for the future of prevention is a blend of physical care, proactive care, and reactive care services, informed by data and predictive insights.

"... using data to intervene at the right time with the right individual moves us more to enabling a support model rather than having that 'just in case' model of care."

Nathan Downing, Director of Membership & Consultancy Services, The TEC Services Association

In 2023 there has therefore never been a more pressing need to do as much as we can to move towards more preventative models of care, and this is the driving reason why Taking Care commissioned this ground-breaking research into personal alarm call-data trends.

Who was involved?

The analysis described here was carried out by the team at Livesheets Ltd, led by Dr Daniel Maxwell, in collaboration with Prof. Mark Kelson of the University of Exeter's Institute for Data Science and Artificial Intelligence and the internal teams at Taking Care.

The analysis

THE BASIS

The purpose of the analysis carried out was to identify customer vulnerability based on call records dating back to 2010, together with records of customer de-registrations / lapses (defined as accounts being closed because the alarm service is no longer needed) and the reasons for de-registering (for example, due to death or moving to a care home).

Other customer details, such as age and limited medical details, are available but for the purpose of this analysis have been excluded.

We had one clear aim in mind – to answer the question: "Can we identify at-risk customers based on alarm usage patterns alone?"

Our starting hypothesis was that more frequent calls of certain types could indicate increasing frailty. Calls received and made by Taking Care are classified according to the reason for the call; five of those reasons have been designated as 'qualifying' calls for the purpose of this analysis, and are all standard codes within the major emergency call answering platform used within ARCs:

- "999 Called"
- "Assistance Required"
- "No Response"
- "Test"
- "Accidental"

Additionally, we have included a count of ALL qualifying calls, described as 'Total Qualifying Calls' (descriptions of all six counts are shown in Table 1). We have sought to determine the strongest indicators of frailty based on the patterns of those calls.

Table 1 Qualifying Call Reasons

Call Reason	Description
999 Called	A 999 call is made on behalf of a service user following a pendant activation.
Assistance Required	The customer experiences a non-emergency situation, for example they may have fallen, and although it is not life-threatening, they may feel unwell. Their nominated contacts are contacted instead of the emergency services at this stage.
No Response	The customer does not respond when the call is answered after a pendant activation was received by the ARC and the operator has sought to speak to the customer via the pendant / alarm unit.
Test	The customer initiates a test call.
Accidental	The customer responds and tells the call handler that the call was made accidentally.
Total Qualifying Calls	Calls made for any of the reasons above.

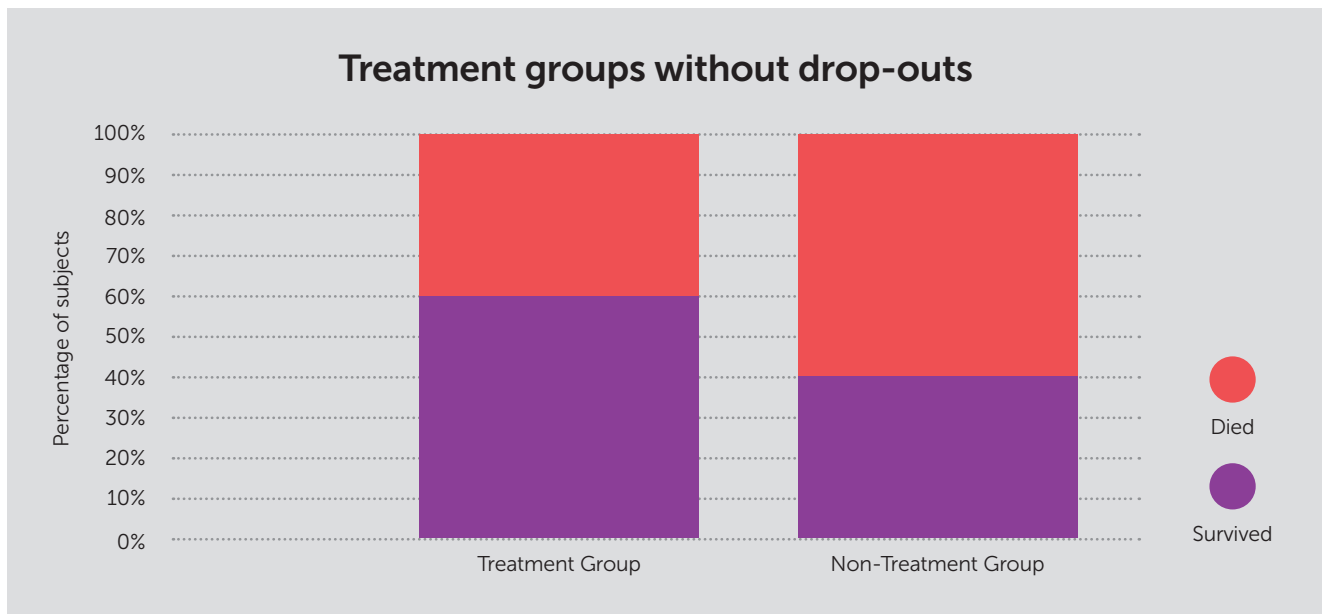
What is Survival Analysis?

The key analytical technique used is a technique referred to as 'Survival Analysis'. This is used in a wide range of scenarios to assess the likelihood of an event taking place within a given period of time.

Survival Analysis is frequently used in medical applications to assess the efficacy of treatment, with the 'event' referring to a patient death. The feature that makes it particularly appropriate for this analysis is its ability to accommodate the fact that people sporadically drop from the sample without the event in question having taken place.

To understand why this is important here, imagine undertaking a treatment in which all subjects continue in the trial until a set end date. At the end of the trial some will have survived, and others died. Figure 1 shows an example of how such an analysis might look. We can clearly see the split between the two possible outcomes.

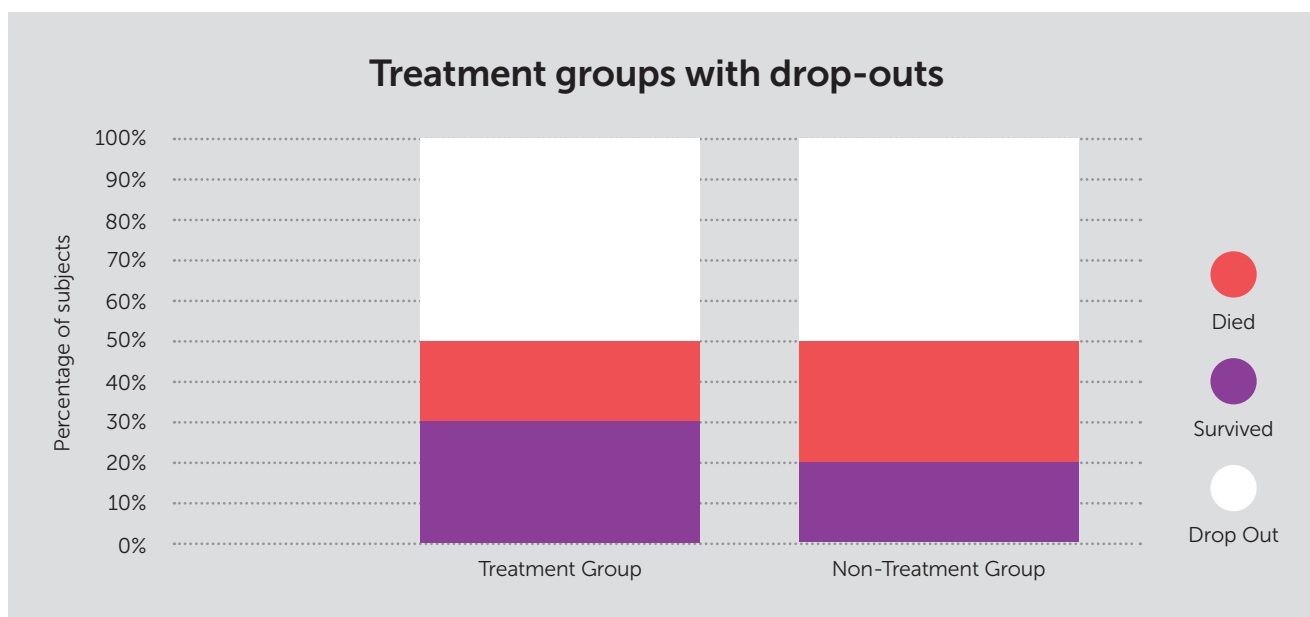
Figure 1 An analysis of treatment groups. We can clearly see the split between survival and death outcomes for the two groups.



More often, however, there will be subjects who leave a trial before the end date, some of whom will have survived to the end date and some not, but whose outcomes are invisible to us. These subjects are referred to as 'censored' and at this point become 'censored data'.

In this example shown in Figure 2, 50% of subjects have been censored. Although 30% of subjects in the 'Treatment' group are known to have survived and 20% died, some of the censored subjects will also have survived and some not, meaning true figures for both survival and death will be higher.

Figure 2 Survival Analysis with 'Censored' Subjects.



We do know something about censored subjects: for each, we know they survived until the point at which they dropped out. Survival Analysis accounts not only for the existence of censored subjects but also for the point at which the drop-out occurred.

Applied to our context, we can use this to look at how call pattern events (such as a call-count over a given threshold) are related to outcomes. The results enable us to estimate the likely survival times of customers who do and do not exhibit those call patterns, or to estimate survival probabilities over given periods of time.

There is a shortcoming: Survival Analysis assumes subjects who drop-out are no more or less likely to die than those who remain in the sample.

Moving into residential care – another indicator of increasing frailty

In our context we do know that when customers de-register for reasons other than death the most likely reason is a move to a care home. This is, in itself, an indication of increasing frailty, so it seems reasonable to believe that such frailty may be linked to higher-than-average mortality.

For this reason, we would expect mortality to be slightly under-estimated by the Survival Analysis, and to be a little higher, in all cases, than the estimates it provides. Since those customers remain invisible to us, we are at present unable to estimate the scale of the difference that would make.

Risk adjustment

Any risk depicted over a period of months (referred to as an 'absolute' risk) can be adjusted to show monthly risk, which tells us the risk of the event in question happening during each month in question. This adjustment makes risks over different numbers of months comparable. Both absolute risks and monthly risks are quoted at different points in the findings below.

The findings

Summary

Initial findings have shown significant differences in outcomes based on call frequencies, indicating in some cases a risk of death having increased by a factor of nearly five (or, put another way, a 400% increase in risk of death).

We might have expected that 999 calls would indicate the highest risk but, whilst they do indicate a higher risk, it is actually 'No Response' calls that, in high volumes, seem to suggest the highest increased risk. Key findings are:

- **Assistance Required calls** - Customers who make three or more 'Assistance Required' calls in a month are nearly five times more likely to die each month over the following three months than those who make two or fewer such calls (4.8% per month vs 0.64%).
- **No Response calls** - Customers who make five or more 'No Response' calls in a month are nearly five times more likely to die in the following month than those who make one call or no such calls (4.4% vs 0.95%).
- **One or more 999 calls** - Customers who trigger one 999 call, or more, are more than three times more likely to die in the following month than those who do not make any (3.1% vs 0.95%).
- **5 or more calls of any type** - Customers who make five or more calls of any type in any given month are three times more likely to die each month in the following three months than those who make one – two calls (1.5% vs 0.49%).
- **10 or more Accidental calls in any month** - Customers who make 10 or more Accidental calls in any given month are twice as likely to die each month over the following 12 months than those who make one or zero such calls (1.0% vs 0.52%).

Risk factors for de-registration due to death

Table 2 shows the key risk factors. In this table, we see the call reasons ranked according to 'risk ratio'. The 'frequency trigger' indicates the frequency corresponding to the highest risk; the 'monthly risk' indicates the monthly risk of death over the ensuing period shown in the 'prediction period'. The 'risk ratio' indicates how much greater the risk is for someone who triggers the frequency trigger than for someone with the lowest risk. To take the first row as an example, a customer who makes three or more 'Assistance Required' calls in any given month therefore has a 3.1% risk of death each month over the following three months, which is 4.8 times more than a customer with the lowest risk profile (the lowest risk profiles are not shown in this table, but in this case this applies to customers who made two or fewer such calls).

Table 2 Key Call-Frequency Risk Factors. The call reasons are ranked according to 'risk ratio'. The 'frequency trigger' indicates the number of calls in a given month corresponding to the highest risk; the 'monthly risk' indicates the monthly risk of death over the following period shown in the 'prediction period' for those whose call patterns trigger the 'frequency trigger' in any given month. The 'risk ratio' indicates how much greater the risk is for someone who triggers the frequency trigger than for someone with the lowest risk.

Call reasons as correlated to subsequent death	Frequency trigger (how many is too many)	Monthly risk	Prediction period	Risk ratio
1. Assistance Required	3 calls or more in a month	3.1%	3 months	4.8
2. No Response	5 calls or more in a month	4.4%	1 months	4.7
3. 999 Called	1 call or more in a month	1.5%	3 months	3.0
4. Total Calls	5 calls or more in a month	1.2%	1 months	3.0
5. Test	0 calls in a month (1 or more indicates lower risk)	1.0%	12 months	2.0
6. Accidental	10 calls or more in a month	3.1%	3 months	2.0

Risk factors for de-registration for other reasons (moving into a care home)

There are also risk factors linked to de-registration for other reasons. The most common reason for de-registration when not caused by the death of the customer is a move to a care home. Table 3 shows the call patterns related to higher risk of de-registration for reasons other than death.

Table 3 De-registration risk factors. The call reasons are ranked according to 'risk ratio' as applied to the risk of de-registration for reasons other than death. The most common reason other than death is a move to a care home.

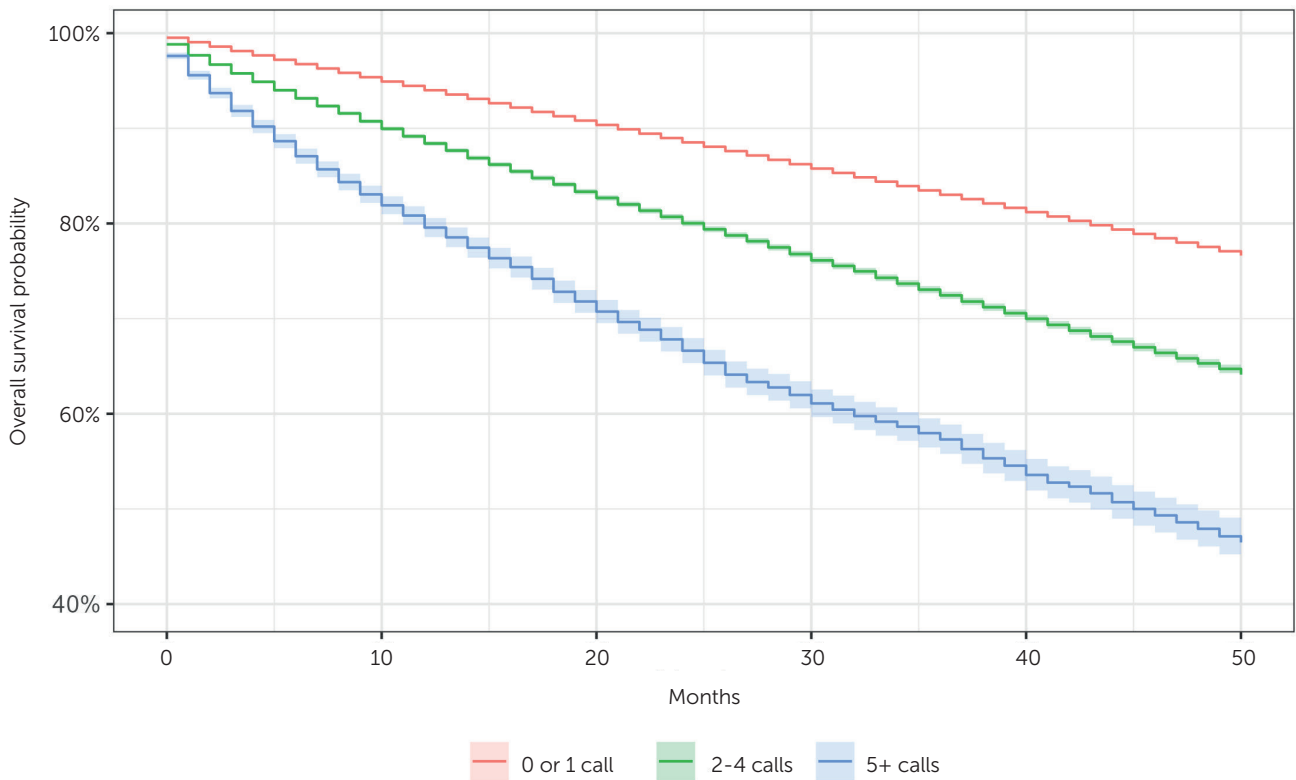
Call reasons as correlated to de-registration for reasons other than death	Frequency trigger (how many is too many)	Monthly risk	Prediction period	Risk ratio
1. No Response	10 calls or more in a month	2.7%	3 months	5.7
2. Assistance Required	3 calls or more in a month	2.5%	3 months	5.3
3. Total	10 calls or more in a month	1.5%	1 month	4.8
4. 999 Called	2 calls or more in a month	1.4%	6 months	3.1
5. Test	0 calls in a month (1 or more indicates lower risk)	0.6%	1 month	2.4
6. Accidental	5 calls or more in a month	0.9%	6 months	1.9

We see similar patterns here to those seen in Table 2 Key Call-Frequency Risk Factors. The call reasons are ranked according to 'risk ratio'. The 'frequency trigger' indicates the number of calls in a given month corresponding to the highest risk; the 'monthly risk' indicates the monthly risk of death over the following period shown in the 'prediction period' for those whose call patterns trigger the 'frequency trigger' in any given month. The 'risk ratio' indicates how much greater the risk is for someone who triggers the frequency trigger than for someone with the lowest risk, perhaps indicating that in many cases customers respond to their own awareness of increasing frailty by moving into care homes. However, there are, in some cases, longer prediction periods (meaning increased periods over which the numbers of customers de-registering are elevated – for example, after a 999 call the prediction period for death is one month whereas for de-registration for other reasons it is six months). It is easy to imagine the administrative burden of moving, or a delay in customers or family members realising or acknowledging their increased frailty, could be behind this longer prediction period.

Survival times and risk groupings

The result of a Survival Analysis can be presented in a number of ways. A good overview is given by the graph shown in Figure 3. overleaf, which depicts the survival curve for customers grouped according to three categories of 'No Response' call densities: those who made 0 or 1 such calls; those who made 2-4 such calls; and those who made 5 or more in any given month. This graph shows the estimated likelihood (shown on the vertical axis) of surviving a given number of months (shown on the horizontal axis) for customers, based on the call-volume group they fall into in any given month. The blue shaded area shows the 95% confidence interval (the range within which we can be 95% certain the true value lies).

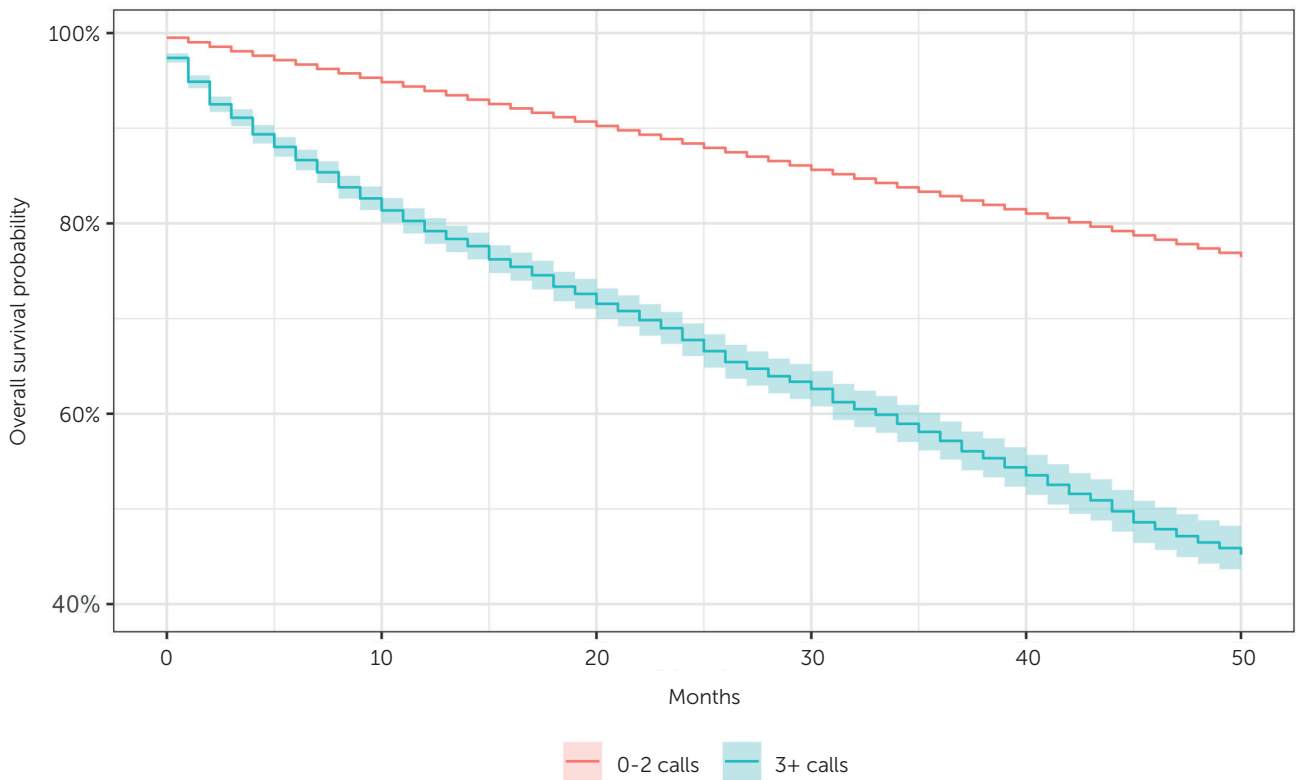
Figure 3 'No Response' Events Survival Curve showing customers grouped according to three categories of 'No Response' call densities: those who have made 0 or 1 calls; those who have made 2-4 calls; and those who have made 5 or more such calls in any given month.



The gap between the red and blue lines shows the difference in risk between customers who have made five or more 'No Response' calls in a month relative to those who made no calls or one call. We can see here that, after 50 months, whereas those in the low-risk group (who made no calls or one call) are 77% likely to have survived, those in the high-risk group (who made five calls or more) are 47% likely to have survived.

Large differences between groups are also apparent for 'Assistance Required' calls. Figure 4 'Assistance Required' Survival Curves showing customers grouped by whether they made 0-2 calls in a month (low risk) or 3+ calls (high risk) shows the Survival Curves for 'Assistance Required' calls with customers split between those making three calls or more and those making up to two calls.

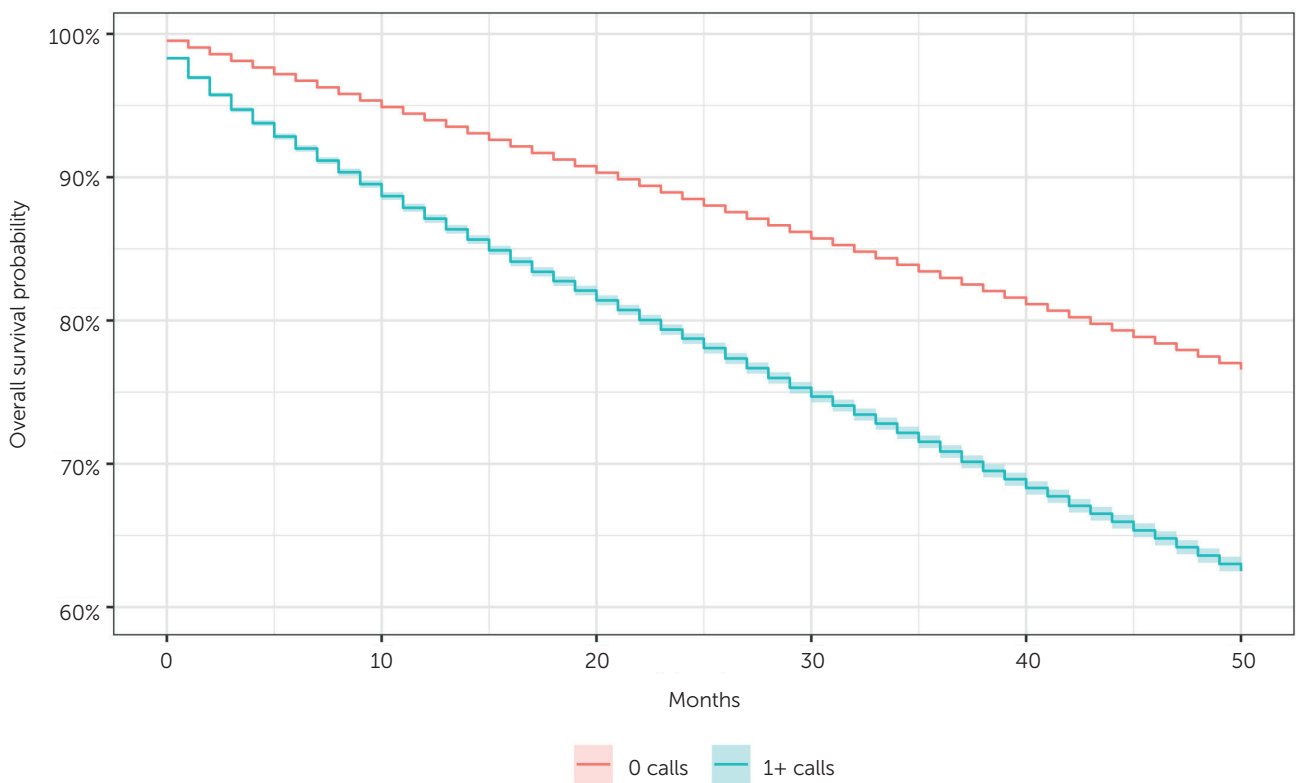
Figure 4 'Assistance Required' Survival Curves showing customers grouped by whether they made 0-2 calls in a month (low risk) or 3+ calls (high risk).



Again, we see here a sharp difference between the two groups, with those in the low-risk group 77% likely to have survived at 50 months, compared with 45% for the high-risk group.

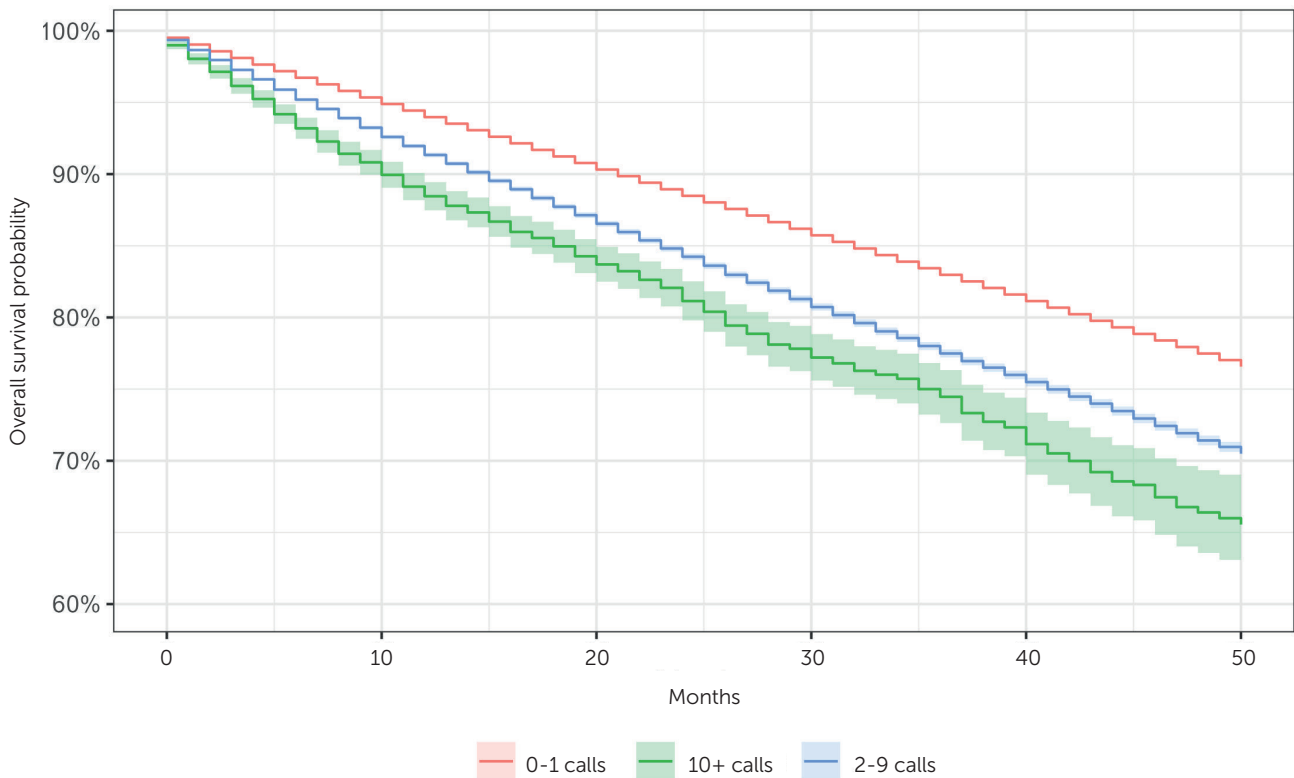
Figure 5 (overleaf) Survival Curves for 999 Calls, grouped by whether or not the customer had at least one call in the month, and Figure 6 Accidental call Survival Curves, grouped by whether customers made 0-1, 2-9 or 10+ calls in a month, show the Survival Curves for '999 Called' calls and 'Accidental' calls respectively. For '999 Called' calls we again see a sharp (albeit smaller) difference between the two groups, with survival at 50 months reduced from 77% to 63% for the high-risk group.

Figure 5 Survival Curves for 999 Calls, grouped by whether or not the customer had at least one call in the month.



The Survival Curves relating to 'Accidental' calls show a similar gap at 50 months, with survival for the high-risk group reduced from 77% to 66%. Apparent on this graph is a phenomenon that applies to all curves, though is usually less apparent, that confidence intervals become progressively wider as time progresses. This reflects the fact that, as the months pass, the numbers of customers in each group shrinks, reducing confidence about expectations for the wider population

Figure 6 Accidental call Survival Curves, grouped by whether customers made 0-1, 2-9 or 10+ calls in a month.



Combination risks

A further step that can be taken, initiated but not progressed far in this analysis, is to look at combined risks. Taking the two highest risk events discussed above, we can establish the risk to a customer under any combination of densities of the two types of calls. Table 4 No Response and Assistance Required call combination risk shows the risks for all the previously tested combinations of 'No Response' and 'Assistance Required' call volumes.

Table 4 No Response and Assistance Required call combination risk.

No Response Calls	Assistance Required Calls	1 Month Risk (95% CI)	2 Month Risk (95% CI)	6 Month Risk (95% CI)
0 or 1	0-2	0.9% (0.9%, 1.0%)	1.4% (1.4%, 1.4%)	3.2% (3.2%, 3.3%)
0 or 1	3+	4.9% (4.1%, 5.6%)	7.1% (6.2%, 8.1%)	12% (11%, 14%)
2-4	0-2	2.3% (2.2%, 2.4%)	3.3% (3.1%, 3.4%)	6.8% (6.6%, 7.0%)
2-4	3+	5.5% (3.8%, 7.1%)	7.6% (5.7%, 9.5%)	14% (12%, 17%)
5+	0-2	4.3% (3.8%, 4.8%)	6.1% (5.5%, 6.7%)	13% (12%, 13%)
5+	3+	6.1% (3.9%, 8.3%)	9.6% (6.7%, 12%)	19% (15%, 22%)

The risk to a customer when high volumes of both types of call have taken place is strikingly higher than the risk corresponding to those with the same *total* call counts. Table 5 shows the final row of Table 4 (relating to months in which customers made five or more 'No Response' calls and three or more 'Assistance Required' calls) together with the risk relating to customers who made eight or more qualifying calls *in total* in any given month. At each of the three time-horizons shown, the combination risk is more than double the risk that prevails for customers who made the same total number of qualifying calls but without necessarily exceeding the thresholds for both 'No Response' and 'Assistance Required' calls.

Table 5 Combination Risk compared with Total Calls risk

Risk Factor	1 Month Risk (95% CI)	2 Month Risk (95% CI)	6 Month Risk (95% CI)
5+ 'No Response' AND 3+ 'Assistance Required' calls	6.1% (3.9%, 8.3%)	9.6% (6.7%, 12%)	19% (15%, 22%)
8+ Total Calls	2.8% (2.5%, 3.0%)	4.0% (3.7%, 4.3%)	8.7% (8.3%, 9.1%)

For a customer who exceeds both thresholds in a given month, the risk of death in the following month is 6.1%, and 19% over the six months (equating to an average monthly risk of 3.5% over that period).

Further work

This initial analysis has established a clear capability to estimate the vulnerability of customers from their call patterns but has also raised questions about where the limits might lie. How far could we go in delineating risks through more detailed analysis of historical records, incorporation of more details of call histories and customer details, and through an improved understanding of how risks combine?

Perhaps of even greater interest, though, is the question of how that information can be used, and whether there is potential for timely intervention to improve customer outcomes. This intriguing question remains a work in progress.

How can personal alarm providers use this research?

What are the PRACTICAL implications of this data analysis?

While the behaviour and patterns of pendant or wearable usage will be different for the service users of every provider, this analysis of Taking Care data appears to strongly indicate that the patterns of personal alarm usage CAN provide strong indicators of health decline and potential changes to need.

This is vitally important in recognising that the TEC industry can effectively intervene to support service users in a more proactive / preventive manner than has traditionally been the case within the industry.

By applying the identified data-patterns that precede a negative health outcome for a service user, it is possible to apply the pattern-analysis to existing service users to identify those who are at highest risk of following the health path of those that have gone before them.

This provides a foundation for a form of co-production that allows the application of 'big analogue data' to enhance the lives and health outcomes for individuals with lived experience of a range of conditions, and particularly older and more vulnerable individuals.

We sincerely hope the insights in this report have been both inspiring and reassuring. At Taking Care we strongly advocate thinking differently about delivering proactive, preventative solutions for the benefit of our Loved One customer, service users, commissioners, and practitioners.

By harnessing the power of your own hidden personal alarm data, it is possible to genuinely deliver a better, more joined-up prevention solution right now. With informed insight you will be able to create and manage a health and social care needs 'pipeline' more effectively and, among other benefits:

- Deliver more holistic support services for your service users
- Schedule more informed interventions and re-assessments
- Review care and support packages earlier and more effectively
- Use data insights to reduce the likelihood of hospital or residential care admissions / costs
- Ultimately prevent, reduce, or delay support needs right now and going forward

Each local authority or housing association will have their own hidden data to discover and be able to spot the patterns of potential early intervention.

Taking Care has been delighted with the initial feedback from our own corporate clients about the potential for their own prevention planning. Many have stressed that simply being able to identify service users at early risk through trends in existing data is extremely powerful. There is the potential to deliver a more supportive service that's not intrusive, but that offers a more co-designed, person-centred approach, individual to that person. Being able to recognise something that is or may be wrong and address a trend that is happening but clearly isn't being recognised, is fundamental to creating a truly proactive and preventative approach to health and social care.

Data Privacy

Using personal information may be necessary in the research and deployment stages of this service. Wherever possible, Taking Care anonymises personal data to mitigate any privacy risk. Where this is not feasible, Taking Care carries out a Data Protection Impact Assessment (DPIA) so that any privacy risks to individuals can be identified and managed. We recommend that third parties providing the service to individuals perform a DPIA so that the processing of personal information can be assessed within their own context.

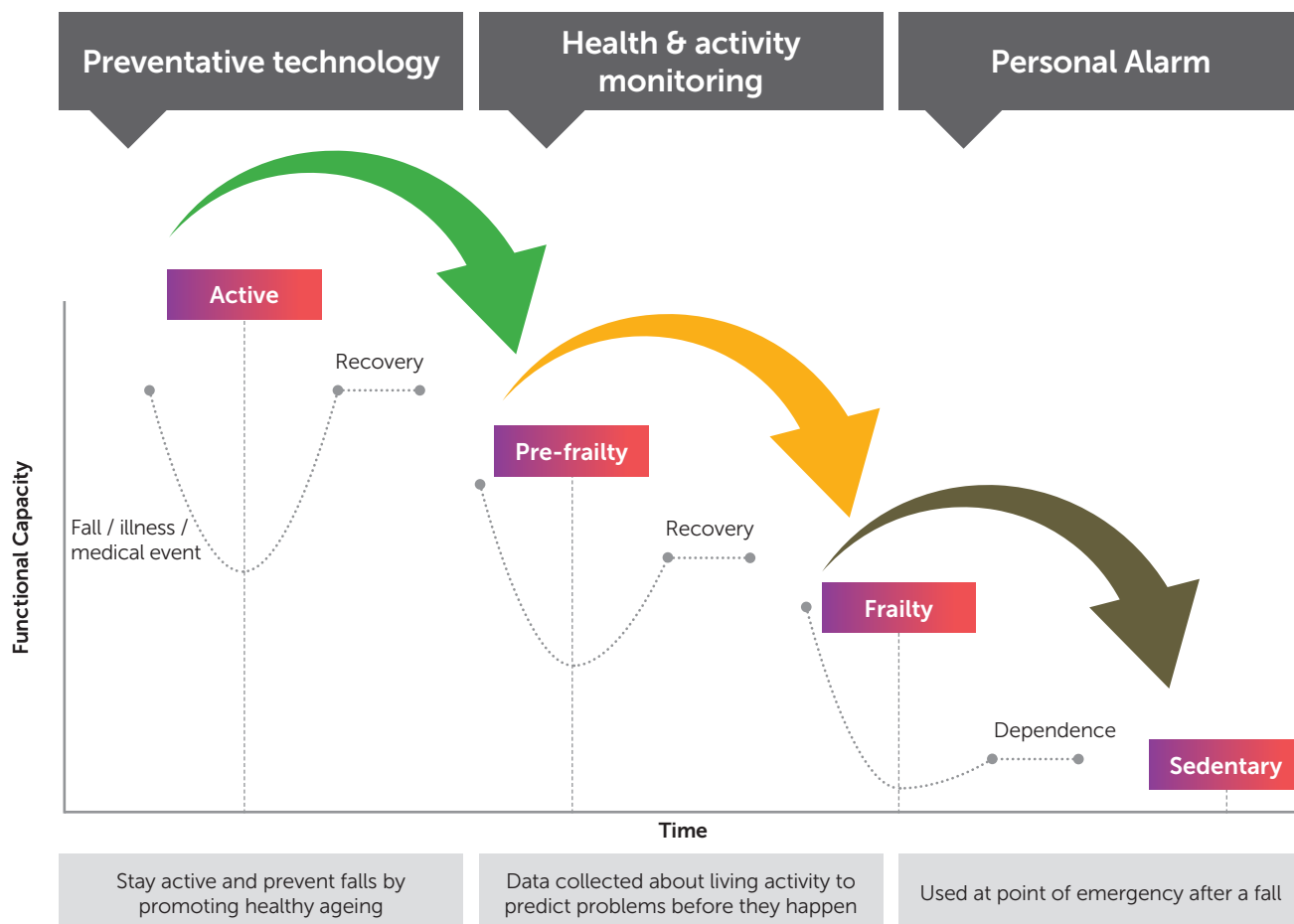
What is Taking Care doing with this research?

From Reactive to Proactive, Prediction and Prevention

For years personal alarm services have been a reactive service, responding to and resolving emergencies at point of crisis. The Taking Care Prevention Team works alongside our existing Emergency Resolution Service and is responsible for proactive, non-emergency interventions, working as part of our:

- **Innovate UK Healthy Ageing Challenge** – Designed for Ageing Competition research pilot with Age NI and participating NHS Health Trusts, we look at health data and recommend OT led and other interventions to improve health outcomes for the falls prevention and wellbeing support programme “Move More Live More” in Northern Ireland
- **B2C smart home monitoring services**, Taking Care Safe Home Alert and Taking Care Sense that make interventions with family members and keyholders to keep people independent and safe in their own homes
- **Taking Care Prevent service** which combines a state-of-the-art, wrist-worn fitness watch together with activity tracking (powered by the ARMED AI platform) and one-to-one guidance and advice to reduce frailty and the risk of falls.

How Technology Enabled Care can help predict, delay or reduce frailty.



Based on 'The cascade of functional decline in older adults from independence, through to frailty and disability' Dapp et al. (34) Hoogendijk et al. (35), Clegg et al. (36) and Fried et al. (37) Physical Frailty: ICFSR International Clinical Practice Guidelines for Identification and Management.

'Predictive Pendants'TM support package



We aim to launch into the private pay consumer space under the Taking Care Predictive Pendants brand. This service will be a world-first addition to our analogue and digital alarms services adding an extra layer of protection to our customers. This service is only made possible with the support of our highly trained in-house Prevention Team and expert data analysis into the needs of our market.



We analysed many years of alarm call data

As the largest provider of personal alarms, we drew upon our 30 years of customer call data from personal alarms and fall detectors, together with additional data around our users and how they use our alarm services. Our own in-house data team worked closely with external data science consultants including academics from the University of Exeter.



We looked for patterns in the data

The starting point of our analysis was whether we could identify at-risk customers based on call patterns alone. Working with an expert team of data scientists, we looked at types and frequency of calls and how that could potentially indicate an increasing risk of frailty.



We built a predictive model for prevention

Taking Care's Predictive PendantsTM Risk Analysis is a world-first data research driven model based on our years of customer call data. To continue driving innovation and progress in the TEC industry we harnessed the power of 'big data' and AI to identify these at-risk patterns and profile when potential future needs may occur for both existing and new customers using our alarm services.



Allowing early interventions

Our new Predictive PendantsTM support service will allow Taking Care's Prevention Team to proactively look at these patterns of need and suggest interventions earlier in the care cycle. We will initially be contacting the alarm user or family member to establish any additional support they may need. Our aim is to keep our Loved One customer safe and independent at home for longer and give an extra level of reassurance for their family members or friends.

About Taking Care

Taking Care is one of the UK's largest providers of personal alarms and monitoring services. We provide around-the-clock Technology Enabled Care services to over 100,000 people throughout the UK.

We are the only Which? Trusted Trader approved personal alarm service and are the exclusive alarm provider of Age Co Personal Alarms.

Taking Care is committed to innovation and finding new ways to use Technology Enabled Care to support our customers.

We are proud to hold the ISA 9001:2015 Quality Management Accreditation, demonstrating the robust nature of our processes and underpinning our high-quality, TSA Quality Standards Framework accredited service.

Our organisation is built on strong foundations of over 35 years' experience of providing personal alarms and 24/7 monitoring services, and we are a subsidiary of AXA Health.

AXA Health has been helping people to access healthcare services, including wellbeing, counselling, occupational health, and rehabilitation, for 75 years.

Through our combined in-house healthcare expertise, we ensure our services are always evolving – providing personalised solutions for our customers.



If you would like to know more about the services and products we offer, please call or email and a member of our Corporate Team will be delighted to get in touch.

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