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The Watch Is Ticking: A Five-Year Plan to Harness Wearable Health Tech

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Our Future of Britain initiative seeks to reinvigorate progressive politics to meet the challenges the country faces in the decades ahead. Our experts and thought leaders will set out a bold, optimistic policy agenda across six pillars: Prosperity, Transformative Technology, Net Zero, Community, Public Services and Britain in the World.

Executive Summary

The latest strategy from the Department of Health & Social Care, Our Plan for Patients, is – perhaps unsurprisingly – focused almost entirely on managing demand: ambulance response times, availability of GP appointments, social-care capacity. Prevention is mentioned in only one paragraph. Yet prevention – reducing demand – must be at the core if the NHS is going to survive on a sustainable basis. When governments and decision-makers move health systems from reacting to predicting, people's health can be transformed. But predictive, preventative health systems require information, data and research. Wearables continue to be an untapped mine of such information and can help drive better decisions and resource allocation in health systems like the NHS.

From Pastime to Mainstream

In 2010, *Wired* editor Gary Wolf walked on stage at TED Cannes and described how tech enthusiasts were using new gadgets to track their physiological data, mood and even the rate at which their children went through nappies. The notes for the talk describe this as an "intriguing new pastime".

Twelve years later, 40 per cent of UK consumers and 58 per cent of US consumers have access to a smartwatch or a fitness tracker. Wearables are being adopted as quickly as smartphones were shortly after the iPhone was launched in 2007 – and in 15 years' time, they may be just as commonplace. Wearable devices have entered the mainstream.

Advances in wearable devices and their increasing uptake have come at the right time. Demographic and economic pressures are making our current health-care model in the UK increasingly unsustainable. It is widely acknowledged that we will need to embrace technology to improve health outcomes and make health-care delivery more efficient. Indeed, in the UK wearables are already used to promote healthier lifestyles and to monitor and treat people with chronic health conditions.

However, existing efforts are insufficient to meet the challenges we face, and we are not yet fully realising their benefits to help people to lead healthier lives. The most transformative advances in wearable-device technology lie in the near future: we will soon be able to use wearables to detect disease earlier, enabling large-scale prevention programmes, giving people more control over their health and contributing to the personalisation and democratisation of health care, especially in the NHS context. Widespread adoption will ensure that the tech becomes more sophisticated, allowing more people to benefit and giving researchers access to powerful datasets. Unfortunately, and as is often the case, the demographic groups that could benefit most from adopting new technology are usually the least likely to embrace it.

A Five-Point Plan for Accelerating Wearable Health Tech

We must go further and faster. For the UK government, we recommend five actions that will ensure the country is able to make the most of wearables now and take advantage of future technological developments:

1. Set a target of 30 per cent of adults to actively participate in a wearable device-enabled public-health intervention by 2027.
2. Pilot a scheme that offers wearables for no upfront cost, with payments spread over two years that are reduced if participants meet activity targets. The scheme should initially be limited to people aged over 50 and those identified as needing to take more physical activity by health-care providers.
3. Carry out the Fit Miles pilot that was initially announced in October 2021 but has been delayed.
4. Develop and pilot further wearable device-enabled public-health interventions, such as a scheme based on the Cycle-to-Work model with tax exemptions conditional on meeting physical-activity targets.
5. Prepare to rapidly roll out multiple nationwide schemes based on evidence obtained from the pilots and take steps to address the associated policy issues to ensure the NHS is well-placed to benefit from future developments (for example, by passing new data-privacy legislation and building supporting technological infrastructure).

What Can Wearable Devices Do?

Wearables already provide a wide range of functions that can be broadly categorised as 1) monitoring and diagnosis; 2) treatment and therapy; and 3) disease surveillance and clinical research.

1. Monitoring and Diagnosis

By continuously monitoring various biological measures – heart rate, steps taken, distance travelled, calories burned, sleep, temperature, respiratory rate, blood pressure, oxygen saturation and so on – and feeding these measures into algorithms, wearables can monitor health and detect disease ranging from Covid infection to cardiovascular health. Individuals can monitor their own health directly with a variety of apps while health-care professionals can use wearables for remote monitoring of patients, for example in the early postoperative period.

Measurement accuracy varies depending on the particular device and what it is measuring. A recent literature review found that Fitbits were good at measuring step counts and Apple Watches gave reliable heart-rate measurements, but none of the tested devices were accurate for calories burned. Nonetheless, continuous monitoring by wearables allows them to detect trends or divergence from normal ranges, which often compensates for inaccuracy and can provide information that non-longitudinal data cannot.

2. Treatment and Therapy

Treatments ranging from administering drugs to recommending lifestyle changes can be facilitated:

- **By patients:** For lifestyle interventions, wearables can send alerts, such as reminding users to meet a step-count target or to take medication, to improve patient adherence to doctor recommendations. For example, the Healthier You NHS Diabetes Prevention Programme offers wearables that monitor exercise and provides a suite of apps to access health coaches, participate in support groups and set goals.
- **By clinicians:** Accessing patient data can help clinicians monitor chronic conditions such as heart disease. A trial in Greater Manchester is using data from commercially available wearables, including Oura smart rings, to monitor cancer patients and help clinicians make more informed treatment decisions.
- **Automatically:** Some conditions with relatively simple metrics may even be treated automatically. For example, the NHS is piloting an "artificial pancreas" for up to 1,000 patients with type-1

diabetes. The device, which is worn under the skin, continually monitors blood glucose and automatically adjusts the amount of insulin given through a pump, eliminating the need for finger-prick tests and reducing the risk of hypoglycaemic attacks.

3. Disease Surveillance and Clinical Research

In addition to monitoring individual patients, wearables show potential for population-level disease surveillance. Multiple research groups, including the Stanford Healthcare Innovation Lab, have developed apps that diagnose Covid-19 before symptoms manifest themselves using data from consumer wearables. While wearables were not part of the government's response to Covid-19, they could be used in the future for early monitoring of infectious diseases, as noted in our previous report.

Wearables are also being incorporated into clinical trials of drugs and devices. The proportion of trials involving wearables doubled from 4 per cent in 2016 to 8 per cent in 2020. Incorporating wearables into clinical trials can reduce or eliminate the need for in-person examinations, reducing the burden on both patients and investigators while also widening the pool of trial participants.

Categories of Wearable

A wearable device can be classed as either a wellness device or a medical device depending on whether it is *intended by its manufacturer* to be used for a medical purpose. The market has split into two on this basis and how the device is regulated depends on which category it is aimed at.

Figure 1 – Comparing consumer wearables with medical wearables

CONSUMER WEARABLES (WELLNESS DEVICES)

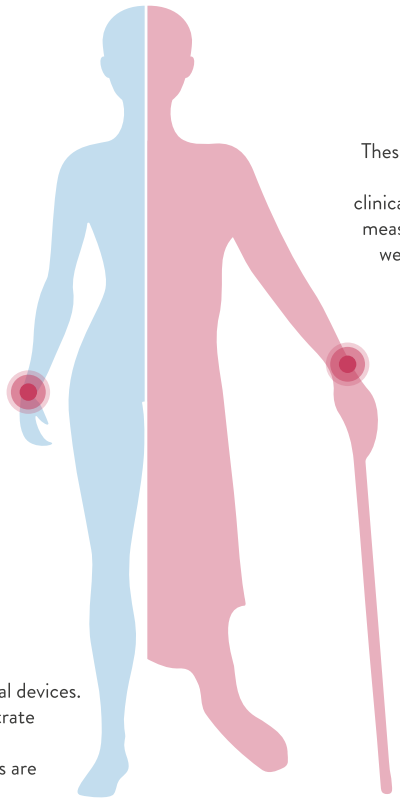
PURPOSE
Monitor fitness and health markers to promote a healthy lifestyle and spot any health issues early.

WHAT IS TRACKED
In the past, these devices tracked measures of activity (e.g., heart rate, steps taken, distance travelled). As sensor technology improves and becomes cheaper, new biological measures are starting to be tracked (e.g., blood oxygenation). All consumer wearables are non-invasive.

EXAMPLES
Includes smartwatches (e.g., Apple Watch), fitness trackers (e.g., Fitbit) and sleep trackers (e.g., Oura Ring).

TYPICAL USERS
All consumers, regardless of health status. Early adopters tend to be younger, wealthier and fitter.

REGULATORY STANDARDS
Most consumer wearables are classed as consumer-electronics devices rather than medical devices. These require some regulatory approval to demonstrate that they meet applicable health, safety and environmental standards, but the regulatory hurdles are much lower than for medical devices.



MEDICAL WEARABLES (MEDICAL DEVICES)

PURPOSE
Monitor and inform treatment of chronic health conditions.

WHAT IS TRACKED
These devices typically track one biological measure with sufficient accuracy for clinical usage. Some devices track biological measures that are unavailable to consumer wearables (e.g., blood glucose monitors).

EXAMPLES
Smartwatches that monitor tremors, distributed to patients with Parkinson's disease by the NHS.

TYPICAL USERS
Patients with specific health issues and hospital inpatients.

REGULATORY STANDARDS
Wearables must clear strict regulatory hurdles to be used for medical purposes.

Source: TBI

Wearable Tech Now and in the Future

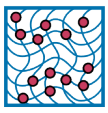
When forecasting future technological progress, it is helpful to categorise wearables as invasive (that is to say, not convenient to wear most or all of the time, such as implanted devices or headbands) or non-invasive. All consumer wearables are non-invasive, as are many medical wearables, such as cardiac activity-monitoring chest patches.

Figure 2: How wearable tech might develop over the next five years

Non-invasive

Now		Within five years	
	Can accurately measure heart rate and heart-rate variability. Can measure skin temperature, blood oxygen and stress levels based on galvanic skin response less accurately, but accurately enough to be useful.		Sensors become more accurate and more standardised. Future biological measures accessible to non-invasive wearables likely to include blood glucose, stress levels, behavioural phenotypes (e.g., gait disorder), neurodegeneration from movement or speech patterns, immune activation, metabolite-specific assays, blood circulation, joint inflammation, fatigue and attention levels.
	Currently can monitor and detect a number of conditions including arrhythmia, infectious disease, anaemia.		With sufficiently large data sets, behavioural data (e.g., movement, sleep) and easily accessible biological measures (heart rate, skin temperature, blood oxygen and glucose, galvanic skin response) will allow detection of almost all metabolic, cardiac, pulmonary, psychological, infectious and inflammatory conditions. Only osteological and dermatological conditions will remain difficult to detect using these biological measures.
	As non-invasive measurement continues to improve and larger data sets improve detection, non-invasive wearables are able to detect a greater number of conditions rather than just monitoring activity. For example, the ECG App on the Apple Watch was recently given a CE mark in the UK, meaning it is approved for use (but not fully medically approved).		Detection by non-invasive wearables may not reach standards of medical-grade diagnosis, but will be sufficiently accurate to act as a funnel for referrals either to primary-care providers or in some cases to specialists for further diagnostics (eg, MRI, blood test, examination etc.)

Invasive

Now	Within five years
 Invasive wearables are largely limited to laboratory settings, with the exception of implanted continuous blood-glucose monitors.	 Brain wearables are sufficiently inconvenient that most people probably will not wear them in their day-to-day lives. However, brain wearables are getting cheaper, and they may soon be used to personalise mental-health treatments.
	 Microneedle patches resemble plasters and are minimally invasive. Their short needles penetrate the outer layer of the skin, giving access to the many biological measures that can be taken from interstitial fluid. This can be used to deliver drugs in a controlled form, such as testosterone or metabolism drugs, as well as to monitor levels of metabolites or other molecules present in the interstitial fluid.
	 Smart pills use combinations of novel chemistry and micro-electronics to provide internal imaging and drug delivery to specific sites in the intestine.
	 Stents are used to reroute circulation in some patients. New stent designs with integrated sensors can warn of associated complications and are able to monitor patient health over time.
	 Emerging research in tissue- and organoid-based therapeutics offers the possibility of engineering living tissues to monitor disease attributes and release or manufacture treatments within the body, such as replacement pancreatic islet cells.

Source: TBI

How Are Wearables Currently Used by the NHS?

The NHS Long Term Plan anticipates that in ten years' time, ill people "will be increasingly cared for in their own home, with the option for their physiology to be effortlessly monitored by wearable devices. People will be helped to stay well, to recognise important symptoms early, and to manage their own health, guided by digital tools." There are already many instances across the NHS of wearables being used to improve patient care and reduce costs.

Wearable medical devices are used in several ways across the NHS. Parkinson's patients in England are offered smartwatches containing a Parkinson's Kinetigraph that allow doctors to remotely assess their condition. Patients wear the watch around the clock for six days, and the information gathered is relayed to doctors who can check how their patients are faring and spot any issues, such as excessive movement, immobility and even sleep disturbance. A number of regional NHS teams use wearables to scale digitally enabled health care at home for people with long-term conditions by replacing in-person visits with camera- and wearable-based examinations.

There are also instances of NHS teams using medically approved apps with consumer wearables, typically for preventative interventions. The Fit Miles pilot, which was set to launch in January 2022 but has been delayed, "will see users wear wrist-worn devices that can generate personalised health recommendations, such as increasing their step count, eating more fruit and vegetables and decreasing portion size. Users will collect points for these healthy behaviours which will unlock rewards, which could include gym passes, clothes or food vouchers and discounts for shops, cinema or theme park tickets." The pilot will be offered to all adults within the pilot area and will be delivered in partnership with HeadUp.

Policy Considerations

There are several policy issues that must be considered to maximise the societal benefits of wearables and to minimise their potential downsides.

Evidence

The Department of Health and Social Care (DHSC), the NHS, the National Institute for Health and Care Excellence (NICE), the Medicines and Healthcare products Regulatory Agency (MHRA) and Public Health England (now disbanded) have made good progress in addressing questions over what evidence is required for wearables and other digital-health technologies. MHRA should adopt a constructive approach when dealing with device manufacturers. For example, MHRA could explore ways to only require regulatory re-approval for device features (such as heart-rate monitoring) each time that feature is updated, rather than each time any component or feature of the device is updated.

NICE's Office for Digital Health is currently updating the evidence standards framework for digital-health technologies. The review will include "adaptive algorithms" which continuously improve as new data are collected, rather than each model having to remain exactly as it was when it was approved for use. The MHRA recently reaffirmed the government's commitment to allow software medical devices to adapt their models over time without re-approval via "predetermined change-control plans".

Interoperability

The work of the DHSC, NHS, NICE and Public Health England also covers interoperability. The NHS service standard states that services and systems must be interoperable and provides tools to help with this, while the Faculty of Clinical Informatics, a charity, has been commissioned by the NHS England Transformation Directorate to help them with consultation on their Standards and Interoperability Strategy. Interoperability will be particularly crucial for wearable devices to maintain and promote competition between device manufacturers and app developers as the market grows.

Equity

As is often the case with emerging technologies, wearables will not benefit everyone equally by default. Inequities can creep in when devices, or the algorithms that run on them, are designed and tested. For example, the green lights that many wearables use to monitor heart rate and blood-oxygen levels can be

partially blocked by high melanin levels, reducing accuracy for people of colour. Devices are often tested on a relatively homogenous local population with limited objective measurement of skin pigmentation, resulting in a lack of accurate information about how wearables work with diverse skin tones.

Inequities can also arise from different rates of adoption. People who are young, highly educated and white are more likely to use wearables. Data from wearables are increasingly being used for large-scale clinical investigations, such as Johnson & Johnson and Apple's Heartline Study. This can mean that algorithms for predicting disease propensity may significantly underestimate risks when applied to individuals drawn from populations different from those on which the algorithms were built or trained.

Finally, as consumer wearables become increasingly sophisticated, they are likely to be able to materially improve health outcomes for their users. If differing rates of adoption persist, health inequalities may widen.

The general path to addressing inequities in device testing and the use of wearables in clinical investigations is clear, even if the specifics are not. Regulators must ensure that devices are tested on representative populations, and they must ensure that algorithms used for medical purposes are tested for bias. In the longer term, governments may need to ensure that anyone who wants a wearable device can get one in order to prevent health inequalities from widening.

Privacy

Medical devices are governed by the Medical Devices Regulations 2002. Devices are classed as either smart wearable devices or medical devices. A device is classed as a medical device if it is *intended by its manufacturer* to be used in humans for a medical purpose and as such is subject to stricter regulation. However, the dividing line between "smart" and "medical" is unclear and most consumer wearable devices are currently classed as smart devices. This allows them to continuously send the data generated back to their parent company.

Insufficiently protective privacy regulation means that users may find their data being used in ways they have not approved. Wearables can detect when users are anxious, information that could be used to improve targeting of online advertising. Data from wearables could be used to increase insurance premiums or discriminate against employees.

As we have argued previously, policymakers must develop modern privacy regulations, with standards for informed consent and data transfer, analysis and application. These should ensure that health data collected from wearables are not sold to third parties for discriminatory purposes.

Supporting Technological Infrastructure

Major investment is required to unlock the full potential of wearables. As we have set out previously, rapid technological advancements offer opportunities to improve patient outcomes and reduce costs, but significant investment will be required to unlock these opportunities.

Most importantly, basic digital infrastructure must be upgraded and maintained, as described in the NHS Long Term Plan. Sufficient capital and resources must be allocated to complete and continuously improve the NHS's digital transformation as soon as possible. Beyond this, investment in smart hospitals and in preventative, personalised-medicine technologies would be complementary to developments in wearable technologies.

Should the Government Promote Wearables?

There is evidence that consumer wearables can improve health outcomes by promoting healthier lifestyles. As sensors and disease-detection algorithms improve, consumer wearables will significantly improve health outcomes by detecting disease early. Data from wearables may increasingly be used by clinicians to inform patient care: Salford Royal NHS Foundation Trust already uploads patient-generated wearable data to its electronic patient record. With sufficient levels of adoption, data from wearables could revolutionise medical research and disease surveillance by learning how various diseases emerge or treatments work in real-world settings. However, as noted previously, people who are young, highly educated and white are much more likely to use wearables than others.

It therefore follows that the government should promote the adoption of wearable devices in order to encourage healthy lifestyles now, detect disease earlier in future and prevent health inequalities from widening. This raises the question: what is the best policy to promote the adoption of wearable devices? This could take several forms: advertising, ensuring that doctors raise awareness of the benefits of wearables to their patients, or offering incentives. A carefully designed subsidy scheme is probably the most direct route to reaching some of the higher priority groups who would otherwise remain excluded. There are two key considerations for the potential subsidy. First, the subsidy must reach currently under-represented groups. Second, the subsidy should minimise deadweight and deliver value-for-money for taxpayers.

Designing Subsidies for Wearables

When designing a subsidy for wearable devices, it is useful to examine existing subsidies for wearables and other wellness-related purchases and consider whether they are a suitable model. Existing models include the Cycle-to-Work scheme, Singapore's National Steps Challenge and the Vitality Active Rewards with Apple Watch scheme. Potential subsidies can be classified by how their rewards are framed and by whether they are centrally managed or decentralised.

Reward Framing

Recent studies suggest that health interventions are more likely to affect physical activity if they offer incentives that are conditional on rates of physical activity. Incentives can either be positively framed (rewards given if participants meet activity targets) or loss-framed (rewards are taken away if activity targets are not met). Research suggests that loss-framed rewards are more effective on average at increasing activity than positively framed incentives. For example, participants in Vitality's scheme, in which participants must pay their full monthly repayments if they do not meet their exercise targets, saw an average 34 per cent increase in tracked activity days per month compared to participants in a similar scheme without the provision of an Apple Watch that carried loss-framed incentives.

However, there is the potential for loss-framed rewards to create financial burdens for participants if those who fail to meet their activity targets are then required to make larger monthly payments. This risk can be mitigated by spreading the cost over a longer period, and by giving participants who qualify for means-tested benefits, such as Universal Credit, a larger subsidy – either entirely conditional or with an unconditional component.

Centralised or Workplace-Based

Subsidies can also be classified in terms of how they are administered and managed. Most subsidies, including the Fit Miles pilot and the Vitality Active Rewards with Apple Watch scheme, are centrally administered.

In contrast, the Cycle-to-Work scheme works through a decentralised model – employers are responsible for signing up for and administering the scheme. The Cycle-to-Work scheme exempts income tax and national insurance on the costs of a bicycle or associated equipment provided by an employer to their employee for commuting to and from their place of work. Savings can reach up to 40 per cent of the value of the purchase. Around 180,000 people a year participate in the Cycle-to-Work

scheme. Only a modest increase in cycling achieved by a small proportion of participants is required to generate social benefits whose value would exceed the estimated cost of the scheme, particularly when combined with investments in cycling infrastructure. However, a review of the scheme in Ireland raised concerns over the equitability of the scheme, given the restrictions on eligibility and the fact that those with higher incomes enjoy greater savings. It also concluded there was likely to be significant deadweight loss from people purchasing equipment they would have still purchased in the absence of the scheme and from equipment obtained through the scheme being used for leisure rather than commuting.

A workplace-based scheme would put a lower administrative burden on the state and could mitigate concerns over participants taking on unsustainable debt, as payments can be taken directly from participants' wages. A workplace scheme would allow employers to create workplace initiatives (such as Apple's "close your rings" employee challenge) that could drive take up and engagement. However, the equitability issues this model creates would be more problematic for a wearables subsidy than they are for the Cycle-to-Work scheme. Much of the social benefit from the Cycle-to-Work scheme is from reduced traffic congestion, whereas targeting currently under-represented groups is a key criterion for a wearables-promoting intervention.

Conversely, a centrally managed scheme would create administrative costs for the government (including marketing and support services for less technologically literate participants). However, the government would be able to choose who is eligible for the subsidy, rather than the administration being handled by employers.

Figure 3 – Subsidy-design framework

	Centrally managed administration	Workplace-based administration
Positively framed reward	Singapore National Steps Challenge, Fit Miles pilot	Employer-run steps challenge
Loss-framed reward	Vitality Active Rewards with Apple Watch	Cycle-to-Work model with tax exemption conditional on meeting physical-activity targets

Source: TBI

An Alternative Scheme to Fit Miles

A workplace-based model would limit eligibility to those who work for larger, more professional companies, excluding many of those most in need of greater physical activity. This makes this model unsuitable for a wearables subsidy by itself, although it could be used to complement a scheme that more effectively targets those in greatest need of support.

A wearables scheme with loss-framed rewards, loosely based on the "Vitality Active Rewards with Apple Watch" model, would have a number of advantages over the Fit Miles pilot. Most importantly, when the incentives to exercise are loss-framed, participants are likely to exercise more. Secondly, this type of scheme would give participants more choice over the model of wearables they would prefer – those just looking for a basic activity tracker could choose a cheaper device that would be fully subsidised, whereas those looking for something more advanced could pay the additional costs themselves. While there are potential issues with schemes using loss-framed rewards, most of these can be mitigated by careful programme design. We outline such a scheme below.

Who Would Be Eligible?

People over 50 would be automatically eligible for the scheme as levels of physical activity generally decrease with age. Additionally, health-care providers (including GPs, nurses, occupational therapists,

pharmacists and physiotherapists) would be able to prescribe the subsidy for patients who need to increase their level of physical activity (for example, patients at a high risk of developing type-2 diabetes or those with mild depression).

Scheme Outline

Participants could purchase a wearable device, which they would pay for in monthly instalments over two years, reducing concerns around affordability. To improve rates of physical activity among participants, these monthly payments would be reduced if participants meet assigned fitness goals. Reductions would scale with how well participants meet their goals.

Subsidy Amount

Devices costing £100 or less would be fully subsidised. For devices costing more, the £100 subsidy would be spread out over the 24 monthly repayments and deducted from each repayment if monthly activity targets are met.

Participants eligible for means-tested benefits like Universal Credit would be eligible for a £200 subsidy. The subsidy would still be fully conditional, with devices costing up to £200 fully covered, and the subsidy would be spread out over 24 months for devices costing more than £200.

Increasing the subsidy amount would increase scheme participation and reduce risks from individuals taking on debt they cannot afford, but would cost the government more money and result in more deadweight.

It might be the case that the subsidy needs to be much larger than £100 per person in order to produce the same levels of engagement as are seen with the Vitality Active Rewards with Apple Watch scheme. The government may need to explore piloting full subsidies for a range of desirable consumer wearables.

Device Eligibility

Devices must be accredited to be eligible for the subsidy. Accredited devices must meet minimum standards for activity tracking (accurate heart rate and step count) and customer support.

In future, the required measures may be expanded to include other data that are required for early disease detection, such as skin temperature, gait, galvanic response, blood oxygen and blood glucose.

Mobile App

The NHS will provide the app which sets activity targets and monitors progress. This could be like the app used for the Fit Miles pilot. However, it should be noted that this will exclude some people from using the scheme.

Exemption From Repayment

A full subsidy will be applied for participants who are unable to exercise because of unforeseen incapacitation. Primary-care providers will be responsible for determining whether participants are exempt, in the same way that they now issue fit-for-work notes (formerly known as "sick notes") to patients who are too ill to work.

Administration

A central NHS team will be required to manage eligibility and exemption requests, set up marketing and support campaigns and monitor overall success against objectives. As discussed previously, primary-care providers will be able to prescribe subsidies for those under 50 and will be responsible for granting full subsidy due to incapacitation.

Future Directions

With this scheme in place, further steps should also be taken to improve the effectiveness of wearable devices:

- **Innovation prize:** To accelerate the development of disease-detection algorithms for wearables, this policy could be supplemented by offering an innovation prize for the development of an app that can detect a number of common diseases like heart disease and cancer to a specified level of accuracy.
- **Data sharing:** Current wearable users could be asked to share their data with researchers to accelerate progress towards detection algorithms, with the data-sharing consent functionality embedded into the health-monitoring app.
- **Future eligibility:** As costs fall and functionality improves over time, we should aim to include all adults in the scheme.
- **Future mobile app:** In the future, validated disease-detection functionality will be included in the NHS app used to set activity targets and monitor progress.

Recommendations

The benefits that wearables could bring now and in the near future are clear. Many previous attempts at large-scale prevention programmes have either lacked ambition or floundered for a lack of political will and funding. In addition, consideration should be given to the fact that different communities and demographics react to incentives in different ways, so initiating several schemes is likely to be more successful than a one-size-fits-all approach.

1. The government should set a target of 30 per cent of adults actively participating in a wearable device-enabled public-health intervention by 2027. In addition to setting out this target, the government should lay out how data-privacy issues will be addressed and how data collected from the scheme will be used, in order to allay concerns of potential participants.
2. Different groups react differently to incentives, and are embedded in different communities and peer groups. Achieving large-scale uptake of wearables for public health with high levels of engagement will likely require a number of schemes, each tailored to specific groups.
3. Pilot a scheme that offers wearables for no upfront cost, with payments spread over two years that are reduced if participants meet activity targets. The scheme should initially be limited to people over 50 and those identified by their doctors as in need of more physical activity.
4. Carry out the Fit Miles pilot that was initially announced in October 2021 but has been delayed.
5. Develop and pilot further wearable-enabled public-health interventions. For example, launch a scheme based on the Cycle-to-Work model with tax exemptions conditional on meeting physical-activity targets.
6. Prepare to rapidly roll out multiple nationwide schemes based on evidence obtained from the pilots. Also, take steps to address the associated policy issues to ensure that the NHS is well placed to benefit from future advances in the tech – for example, by passing modern data-privacy legislation and building supporting technological infrastructure.

Conclusion

Wearable devices have the potential to become an increasingly important part of our national health infrastructure. The pilots and national rollouts of NHS programmes using wearable devices, and the supporting work on policy issues such as standards for evidence and interoperability, are encouraging. But as is often the case with government policy, they have so far failed to consider the rapid progress being made in wearable devices and disease-detection algorithms.

The government should set an ambitious public target of 30 per cent of adults actively participating in a wearable-enabled public-health intervention by 2027. It is likely that several large-scale wearables schemes will be required to meet this target. As a first step, the government should explore multiple options for using wearables to increase rates of physical activity, and take the steps required to be able to benefit from mass-scale early detection from wearables once detection algorithms are sufficiently accurate.

Consumers are adopting wearables as quickly as they adopted smartphones 15 years ago, but our population is ageing rapidly. Fifteen years may be too long to wait.

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Appendix: Illustrative Cost-Benefit Analysis

The rough cost-benefit analysis laid out below aims only to quantify benefits from increased rates of physical activity. Early disease detection and improved disease surveillance are expected to contribute significantly to the social benefits of the programme once sufficiently accurate algorithms are available. A more in-depth analysis should be carried out before piloting the subsidy.

Cost

A £100 subsidy with an assumed intervention lifetime of two years would cost £50 per participant per year (or less, taking into account that some users may choose wearables that cost less than £100).

Benefit

Physical inactivity costs the UK £7.4 billion per year. This costs an average of £110 per person. Seen another way, that figure is also the "benefit value", because an active person will remove that cost. If an intervention can prevent physical inactivity for less than £110 per participant per year, then the intervention would pay for itself in reduced health-care costs. The public-health benefits would accrue over time, with benefits from the prevention of cardiovascular disease and mental-health issues taking around two years to be realised, and benefits from reduced cancer rates taking ten years or more to be realised. However, the actual economic value of the health benefit from the subsidy is likely to be less than £110 per participant per year for two reasons:

1. **Participants are not those most in need of increased physical activity:** The £7.4 billion cost of physical inactivity is not spread equally across the population. While the subsidy is available only to groups that are more likely to need more physical activity, it may be the case that those who are more active would be more likely to participate in the scheme. However, only 61 per cent of 55- to 74-year-olds and 39 per cent of 75+ year-olds are active (defined as exercising more than 150 minutes per week), and all of those who are prescribed the scheme will be in need of more physical activity. Given that the scheme will initially be limited to people over 50 years old and those prescribed the scheme by health-care providers, a conservative estimate for the percentage of participants in need of more physical activity is 60 per cent.
2. **Not all participants will sufficiently increase activity to offset costs:** Of those participants who need to increase their level of physical activity, the increase in activity from participation may not be enough to fully offset the cost of inactivity. This is unlikely to result in a large reduction in expected benefit, as the subsidy is paid out only to participants who meet their activity targets. A

conservative estimate for the percentage of participants who do enough exercise to offset the cost of physical inactivity as a result of the scheme is 90 per cent.

Cost-Benefit Analysis

We can calculate a rough overall benefit by multiplying the "benefit value" stated above (£110) by the proportion of participants we think would actually need more physical activity and the proportion of those participants who would do enough physical activity as a result of the scheme to realise the social benefits of increased physical activity (as stated above: 60 per cent and 90 per cent respectively). Using these figures, the benefit of the scheme works out at £59.40 per participant per year. This is greater than the £50 per participant per year cost.

Other Benefits

As noted above, this analysis does not capture all the potential benefits large-scale wearables could bring (early disease detection, improved disease surveillance and medical research). Further, it does not capture benefits from participants who continue to exercise after the scheme is over because of owning a wearable device and having built healthy habits.

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