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Wearable technologies in clinical trials for drug development: trends and emerging opportunities

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Device Form Factors

We analyzed the Form Factors that the authors split wearables into, assessing their advantages and disadvantages and their perceived convenience to patients

Type of wearable (1/3) | We believe wrist-based, ring, and garment are the most convenient, due to their ability to blend into normal life, ease of placement and lack of invasiveness

Form Factor	Details	Convenience	Patient Advantages	Patient Disadvantages
Wrist-based	Smartwatch-style or band-style devices		• Familiar, easy to wear, and usually low-stigma. • Can feel like a normal consumer device rather than "trial equipment." • Easy to remove, charge and reapply.	• Can be annoying during sleep, showering or exercise. • Visible device may make patients feel "tracked.". Skin irritation or discomfort can occur with prolonged wear.
Ring	Finger-worn wellness rings		• Discreet and less medical-looking than many wearables. • Often easier to tolerate overnight than a watch. Low interference with clothing and daily activities.	• Poor fit can make it uncomfortable or unusable. • Finger swelling, arthritis or manual work may reduce acceptability. • Easy to remove and forget. Some patients may dislike wearing jewellery-style devices.
Garment	Sensor-integrated shirts or socks		• Potentially easier than multiple separate sensors. • Can blend into normal clothing if designed well. Useful for patients who dislike adhesive patches or hard devices. • May feel less "monitored" if it looks like a normal shirt or vest.	• Sizing, fit and body shape can make or break comfort. • Washing and garment care add hassle. • Tight-fitting garments may be unacceptable for some patients.

Sources: Form Factors taken from Nature Review; Patient advantages and disadvantages taken from various other literature and brainstorming; analysis by Sivan Consulting to address convenience

Type of wearable (2/3) | The next set of factors may cause inconvenience in everyday life due to how or where they are worn, interfering with clothes, skin or existing eye wear

Form Factor	Details	Convenience	Patient Advantages	Patient Disadvantages
Strap	Chest straps to be worn under clothing		• May feel familiar to patients who exercise or use chest straps. • Less visible if worn under clothing. • Can provide reassurance that more precise measurements are being collected.	• Comfort can be poor, especially during long wear periods. • May interfere with bras, clothing, sleep or movement. • Placement may be fiddly, especially for patients with limited dexterity.
Patch (non-invasive)	Adhesive chest patches		• Once applied, can be largely passive. • Less likely to be forgotten than removable devices. • Useful for short monitoring windows where patients can “put up with it” for a defined period.	• Adhesive irritation, itching or rashes can be a major issue. • Can feel medical, visible or awkward depending on placement. • Showering, sweating and clothing friction may cause detachment.
Glasses	Smart glasses with camera and eye-tracking sensors		• Familiar form factor for people who already wear glasses. • Hands-free design may be practical during daily activities. • Could feel less medical if styled well.	• Uncomfortable or unusable for patients with existing prescription glasses. • Camera or eye-tracking features may raise privacy concerns. Calibration, fit and battery life may frustrate patients. • Highly visible, so patients may feel self-conscious in public.
Head-mounted	Headbands or headsets for sleep, stress and attention monitoring		• Can enable at-home neurological, sleep or cognitive monitoring. • May reduce need for specialist clinic visits.	• High visibility and high “cyborg energy.” • Can be uncomfortable with hair, glasses, headaches or sleep.

Type of wearable (3/3) | The minimally invasive patch and ingestible pill were our lowest-ranked for patient convenience due to their relatively "invasive" nature

Form Factor	Details	Convenience	Patient Advantages	Patient Disadvantages
Patch (minimally Invasive)	Subcutaneous filament-based monitoring systems		• May reduce clinic visits or invasive sampling burden. • Continuous measurement may feel reassuring in some conditions. • Once inserted/applied, may require little active effort.	• "Minimally invasive" still sounds invasive to many patients. • Potential concerns around pain, infection, bruising or skin reactions.
Ingestible Pill	Ingestible event-marker capsules paired with a wearable receiver		• Can capture internal or adherence-related data without clinic visits. • May reduce the need for repeated invasive tests. • Passive after swallowing, assuming the process works smoothly.	• Highest "absolutely not" potential for many patients. • Swallowing a sensor may feel strange, invasive or anxiety-provoking. • Not suitable for patients with swallowing difficulties or certain GI conditions.

Sources: Form Factors taken from Nature Review; Patient advantages and disadvantages taken from various other literature and brainstorming; analysis by Sivan Consulting to address convenience

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