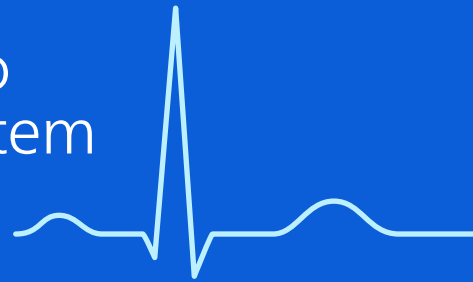


PHILIPS

Integrating wearable biosensors into the open patient monitoring ecosystem

Easing the low-acuity patient pathway in the hospital and at home



Wearable medical devices are revolutionizing healthcare delivery, accelerating the shift toward smarter, more connected care. Trailblazing hospitals are seizing the moment, harnessing this breakthrough technology to deliver personalized, proactive care like never before. With real-time, continuous insights into a patient's health – both in the hospital and at home – health systems can close critical care gaps, streamline transitions, and ease the strain on overwhelmed teams. Patient journeys are shaped by individual characteristics, potential complications and transitions across multiple care settings – each representing points of vulnerability that can impact outcomes. Along this journey, challenges arise at every stage.

Following admission, postoperative deaths are a global concern. Whether they're for unplanned or elective procedures, they rank as the third leading cause of death worldwide,¹ and most often occur on general wards due to complications associated with undetected or unaddressed changes in vital signs.^{2,3} Then, after discharge, risks persist: an estimated 20% of patients experience complications within 30 days of returning home.⁴ These numbers are especially alarming because health systems – facing increasing resource constraints – are shifting toward models that treat acute patients in lower-acuity environments, including at home.⁵ This is where wearable technology can make a meaningful difference: filling critical visibility gaps across care transitions by continuously monitoring vital signs and alerting care teams to subtle changes before they escalate.

Postoperative hospital-to-home strategies aim to address these challenges by supporting patients throughout their entire care journey. Encouragingly, such approaches have demonstrated improved patient experience and clinical outcomes, while reducing per-patient costs when compared to traditional care delivered in EDs, general wards and intensive care units.^{6,7,8,9}

However, their successful implementation has been difficult. A major barrier is the lack of interoperability between medical devices and systems. When devices fail to communicate smoothly, the flow of patient data is disrupted during routine workflows as well as during critical moments that require timely clinical responses. This can compromise decision-making, delay interventions, and undermine the continuity of care that these models aim to support. For perioperative pathways to reach their full potential, we believe that consistent, real-time data exchange across care settings needs to become the norm.

This is why at Philips, we've moved away from proprietary standards and closed systems to an open patient monitoring infrastructure, where clinicians are free to use third-party devices and wearable biosensors of choice that communicate effortlessly across the platform to all users. It's in this open ecosystem that we'll offer clinicians the flexibility to monitor patients before, during, and after hospitalization for a unified patient view.





The move toward continuous monitoring in low acuity environments

Low-acuity areas of the hospital bear a heavy burden from today's clinical staffing shortage and budget cuts, as sicker patients are moved into those spaces sooner. Intermittent spot-checks can miss acute vital sign alterations and delay a diagnosis and the treatment of complications.^{10, 11} The strain has forced health systems to rethink care models and technological capabilities to alleviate the burden.

Spot-check devices are still commonplace for most general care and step-down units, but continuous monitoring with an open ecosystem may help clinicians detect deteriorate sooner for certain at-risk patients. For example, the Philips Patient Monitoring ecosystem integrates with third-party devices like wearables that provide continuous data even in lower-acuity areas. This allows for the centralization of data across high and low acuities and helps to provide early warning of patient deterioration before a critical event, such as sepsis or pneumonia.

From low acuity to discharge and the role of wearables

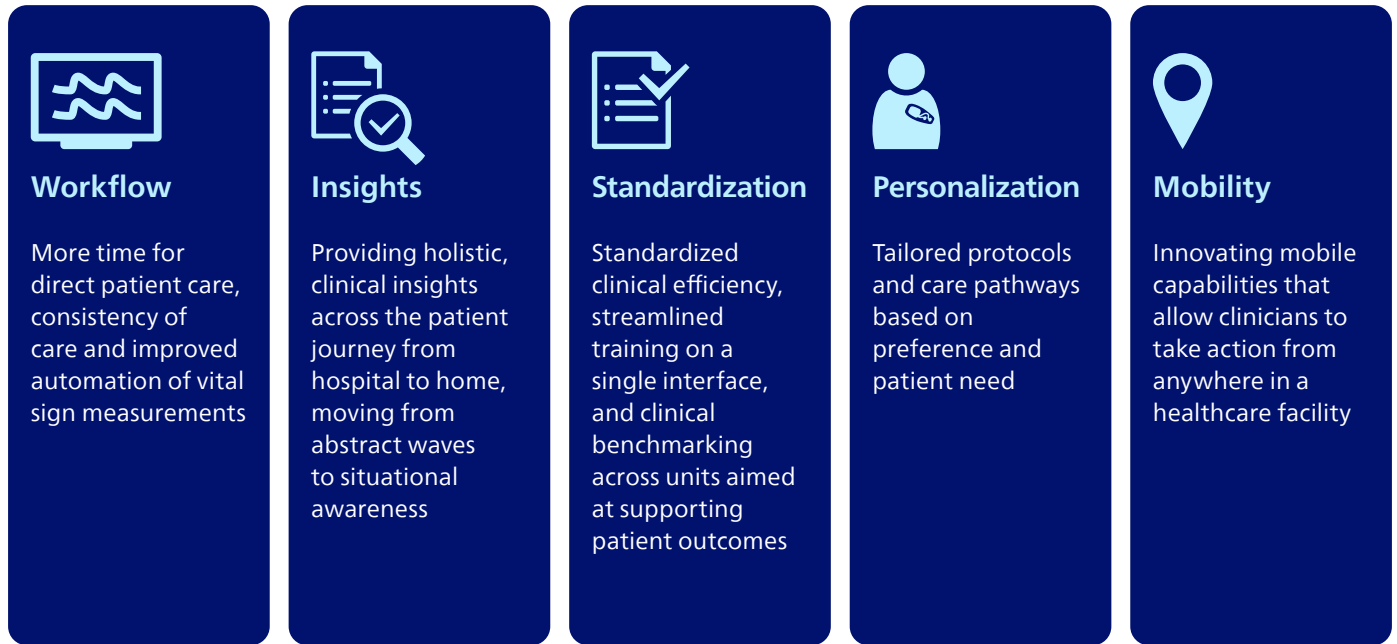
Philips solutions, including wearable continuous vital sign monitors and automated notification systems, have the potential to positively impact patient outcomes via early detection of clinical deterioration on general wards and subsequently lower costs.^{12, 13} Reduction of these costly complications may benefit hospital margins as well.¹⁴

There is a growing interest in clinical-grade wearables, possibly driven by factors such as an aging population facing increased frailty and complex health conditions, along with a limited supply of experienced healthcare professionals. Patient needs and care environments differ widely, making it unlikely that a single wearable device can meet every clinical scenario.¹⁵ Additionally, wearables that depend solely on patient-initiated data collection offer limited clinical utility. When integrated into Philips comprehensive, data-rich ecosystem, these devices support continuous data flow between sensors and hospital systems across the entire care journey. This integration transforms raw data into actionable insights, allowing care teams to intervene proactively, without relying on patients taking action.

The goal of our open patient monitoring ecosystem is to allow clinicians to select wearables that suit their individual patient and clinician needs. Some may offer critical prediction algorithms and real-time decision support while others may capture a patient's activity, gait, and risk of falling. The goals? To reduce the time between likely deterioration and effective intervention, to keep a unique patient population as stable as possible, to avoid ICU admissions, and introduce the capability to scale solutions easily.



Open ecosystem benefits at scale



Using the appropriate wearable for greater visibility into a patient's status after discharge offers the following potential benefits:



Enhanced clinical workflow
with patient information where and when clinicians need it.



Patient satisfaction
as continuous monitoring eliminates the need for disruptive spot checks, and the lightweight, comfortable design of wearable biosensors can enhance patients' sense of security.



Vigilant patient monitoring
through continuous, smooth data flow during patient transport or between scheduled spot checks, via a reliable system that operates independently of patient action or internet connectivity.^{12, 13}



Preparing for the future

Technological advances are moving quickly – whatever the care area. AI will soon enhance low-acuity monitoring.

By leveraging digital technologies such as wearable biosensors, valuable insights derived from data can be readily accessed by the treatment team, with the goal of supporting better workflows and patient outcomes. Philips stands ready to assist health systems in preparing for the future by collaboratively addressing challenges.



Let's work together to leverage the technological advances of today, facilitate a patient's smooth transition to home, and prepare for the challenges of tomorrow.

For more information:

1. Nepogodiev D, Martin J, Biccard B, Makupe A, Bhangu A; National Institute for Health Research Global Health Research Unit on Global Surgery. Global burden of postoperative death. *Lancet*. 2019;393:401. doi: 10.1016/S0140-6736(18)33139-8.
2. Fowler AJ, Wan Yi, Prowle JR, et al. Long-term mortality following complications after elective surgery: a secondary analysis of pooled data from two prospective cohort studies. *Br J Anaesth*. 2022;129:588e97. doi: 10.1016/j.bja.2022.06.019.
3. Spence J, LeManach Y, et al.; Vascular Events in Noncardiac Surgery Patients Cohort Evaluation (VISION) Study Investigators. Association between complications and death within 30 days after noncardiac surgery. *CMAJ*. 2019;191(30):E830-E837. doi:10.1503/cmaj.190221.
4. Agency for Healthcare Research and Quality. Readmissions and Adverse Events After Discharge. Published June 15, 2024. Accessed July 3, 2025. <https://psnet.ahrq.gov/primer/readmissions-and-adverse-events-after-discharge>.
5. Coffey A, Leahy-Warren P, Savage E, et al. Interventions to Promote Early Discharge and Avoid Inappropriate Hospital (Re)Admission: A Systematic Review. *Int J Environ Res Public Health*. 2019;16(14):2457. Published 2019 Jul 10. doi:10.3390/ijerph16142457
6. Edgar K, Iliffe S, Doll HA, Clarke MJ, Gonçalves-Bradley DC, Wong E, Shepperd S. Admission avoidance hospital at home. *Cochrane Database Syst Rev*. 2024 Mar 5;3(3):CD007491. doi: 10.1002/14651858.CD007491.pub3
7. Khanna AK, Flick M, Saugel B. Continuous vital sign monitoring of patients recovering from surgery on general wards: a narrative review. *Br J Anaesth*. 2025;134(2):501-509. doi:10.1016/j.bja.2024.10.045
8. Wong A, Cooper C, Evans CJ, Rawle MJ, Walters K, Conroy SP, Davies N. Supporting older people through Hospital at Home care: a systematic review of patient, carer and healthcare professionals' perspectives. *Age Ageing*. 2025 Feb 2;54(2):afaf033. doi: 10.1093/ageing/afaf033.
9. Cheng SA, Tan SI, Goh SLE, Ko SQ. The Value of Remote Vital Signs Monitoring in Detecting Clinical Deterioration in Patients in Hospital at Home Programs or Postacute Medical Patients in the Community: Systematic Review. *J Med Internet Res*. 2025 May 26;27:e64753. doi: 10.2196/64753.
10. Saab R, Wu BP, Rivas E, et al. Failure to detect ward hypoxaemia and hypotension: contributions of insufficient assessment frequency and patient arousal during nursing assessments. *Br J Anaesth* 2021; 127: 760e8. doi: 10.1016/j.bja.2021.06.014
11. Khanna AK, O'Connell NS, Ahuja S, et al. Incidence, severity and detection of blood pressure and heart rate perturbations in postoperative ward patients after noncardiac surgery. *J Clin Anesth* 2023; 89, 111159
12. Holmes E, Lloyd Williams H, Hughes D, Naujokat E, Duller B, Subbe CP. A model-based cost-utility analysis of an automated notification system for deteriorating patients on general wards. *PLoS One*. 2024;19(5):e0301643. Published 2024 May 2. doi:10.1371/journal.pone.0301643
13. Vroman H, Mosch D, Eijkenaar F, Naujokat E, Mohr B, Medic G, Swijnenburg M, Tesselar E, Franken M. Continuous vital sign monitoring in patients after elective abdominal surgery: a retrospective study on clinical outcomes and costs. *J Comp Eff Res*. 2023 Feb;12(2):e220176. doi: 10.2217/cer-2022-0176. Epub 2023 Jan 16. Erratum in: *J Comp Eff Res*. 2023 Apr;12(4):e220176c1. doi: 10.57264/cer-2022-0176c1.
14. Haidar S, Vazquez R, Medic G. Impact of surgical complications on hospital costs and revenues: retrospective database study of Medicare claims. *J Comp Eff Res*. 2023 Jul;12(7):e230080. doi: 10.57264/cer-2023-0080. Epub 2023 Jun 23.
15. Frost & Sullivan. Global Clinical-grade Wearables Growth Opportunities, An Influx of Consumer Wearables Companies Entering the Healthcare Space Boosts Future Growth Potential, September 6, 2022. Accessed September 8, 2025.

