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CARDIOLOGY®

# HOME-BASED CARE WORKBOOK

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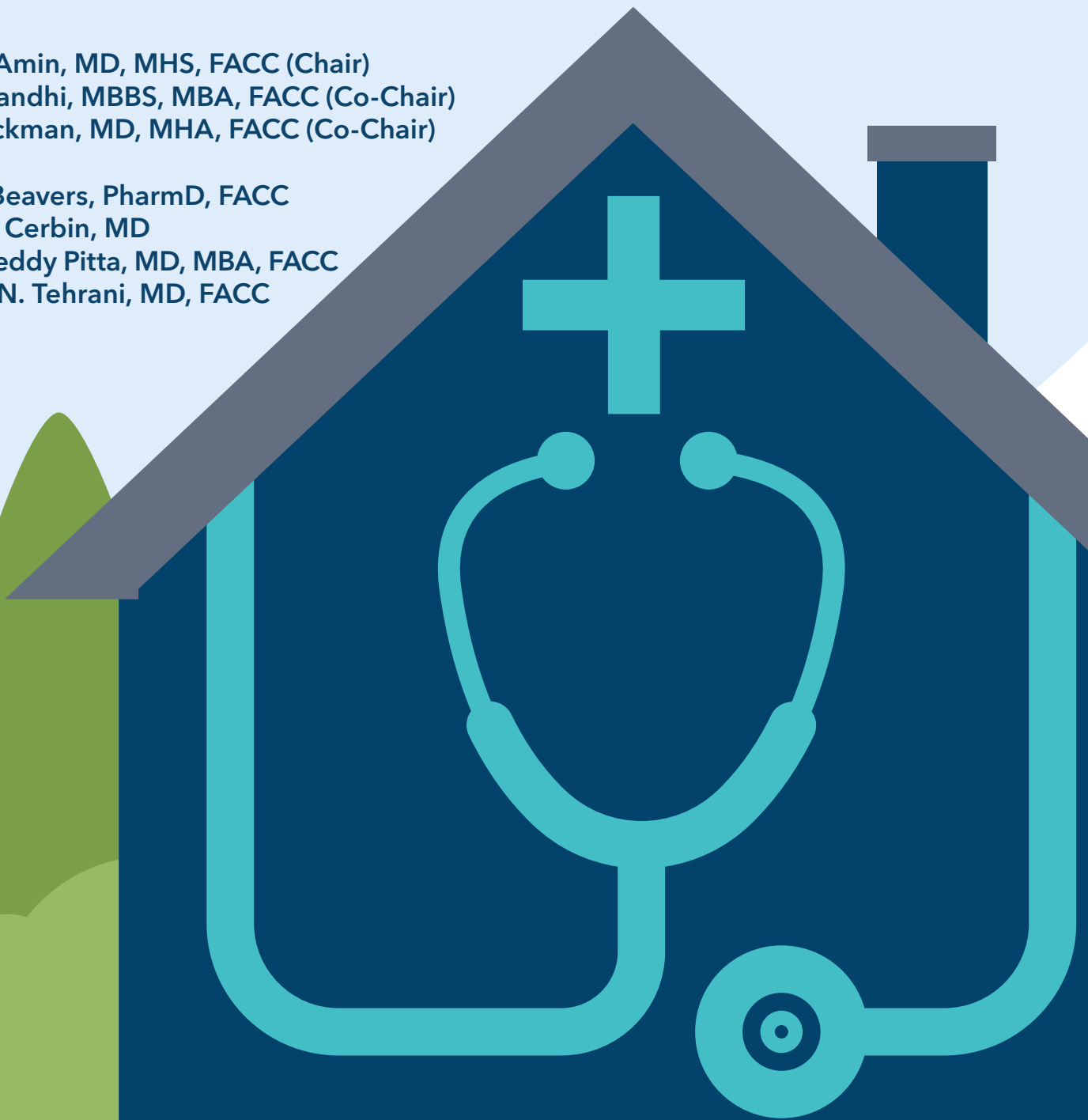
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# INTRODUCTION

Home-based care refers to any form of medical care that takes place in the home of a patient, with or without additional in-person care delivered in a health care office or other medical facility. During the COVID-19 pandemic, virtual care experienced significant acceleration, driven by increased consumer demand, greater clinician interest, and conducive regulatory changes.

For centuries, house calls and home-based clinical care have been regular components of health care delivery. After 1997, the U.S. saw a significant decline in the number of house calls, reserving home-based care for those that are older, home-bound, or recipients of palliative/hospice care. Other countries, such as England, Canada, Israel, and Australia, however, have successfully integrated home-based care models. Health care systems, such as Johns Hopkins Medicine (Baltimore, Maryland) have also been able to implement hospital-at-home models with lower associated length of stay and cost. Provision of home-based care as a covered service dates back more than 100 years.<sup>1</sup> Expansion increased in the 1960s through coverage under Medicare and Medicaid,<sup>2</sup> until benefits were capped with the *Balanced Budget Act of 1997* to help control Medicare costs.<sup>3</sup> While payer support for these care approaches remains a significant barrier to more widespread adoption, accountable care organizations and value-based payment models may help accelerate home-based care.<sup>4</sup>

Despite the promise of home-based care models in primary care, financial benefits of such programs remain limited. The Independence at Home (IAH) program for Medicare beneficiaries demonstrated that home-based primary care led to a non-significant \$41 per beneficiary per month (PBPM) reduction in health care costs in year six, without a reduction in hospital admissions or emergency department visits.<sup>5</sup>

However, consensus exists among industry experts that cardiovascular care will be increasingly delivered in non-traditional ambulatory settings. As just one example, there is data to support delivery of virtual cardiac rehabilitation from home. A prior study showed that in a demographically diverse patient population with medical complexity, home-based cardiac rehabilitation resulted in significantly lower rates of hospitalization at 12 months with similar medical adherence, compared to center-based cardiac rehabilitation.<sup>6</sup> Additional data shows that there are improved outcomes and reduced cost, along with better access and convenience.<sup>7</sup> As technology improves, and as consumer/patient preferences evolve, there is a need to provide basic and advanced cardiac care in the home. Some of the associated advantages and disadvantages of this approach are outlined in [Table 1](#).



**Table 1: ADVANTAGES AND DISADVANTAGES OF BASIC AND ADVANCED CARDIAC CARE IN THE HOME**

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Expanded capacity/access</li> <li>• Reduced cost</li> <li>• Individually tailored treatment</li> <li>• Scheduling convenience</li> <li>• Reduced transportation barriers</li> <li>• Greater privacy while receiving treatment</li> <li>• Integration with the home routine</li> <li>• Eyes and ears in the patient’s home</li> <li>• Environmental benefits (reduced carbon footprint)</li> </ul>	<ul style="list-style-type: none"> <li>• Potential reimbursement challenges</li> <li>• Safety concerns</li> <li>• Equipment limitations</li> <li>• Limit on invasive treatment or monitoring options</li> <li>• More limited physical exam</li> </ul>

**Drivers For Home-Based Care**

There are several factors that have contributed to a shift of care to home-based settings including:

1. Rise in health consumerism: Consumers expect convenience and care outside of traditional brick and mortar health care settings.
2. Payer pressure: Increased emphasis on value-based care demands innovation in how and where care is delivered.
3. Growth opportunity: Virtual and home-based care expands the physical reach of clinics, hospitals, and health care systems, providing a means to potentially expand market share.
4. Advancement in digital technology: An ever-expanding array of digital tools allow for meaningful remote clinician-patient interactions.
5. New entrants: Entry of non-traditional players in health care has rapidly accelerated innovation in this space.

## **GUIDING PRINCIPLES AND OBJECTIVES FOR DEVELOPING A HOME-BASED CARE PROGRAM**

**For any home-based care model to be successful, the following principles should be considered to deliver on key objectives:**

### ***Guiding Principles***

1. It is important to provide easy access for consumers to minimize barriers to care.
2. Care delivery should be flexible and seamless between virtual and in-person care.
3. The clinician-patient relationship needs to be maintained regardless of where and how care is delivered.
4. The program needs to be team-based and patient-centered.
5. Care delivery teams should be agile and empowered to innovate and adapt as needed.
6. Care delivery should address social determinants of health and prioritize care equity.
7. The environment should be safe for clinicians.

### ***Key Objectives***

1. Increase patient engagement with their care.
2. Empower patients using tools that allow them to access care in a place, time, and format of their choosing.
3. Improve patient outcomes.
4. Transform both the clinician and patient experience.
5. Lower total cost of care.
6. Lower resource utilization and its environmental impact.

We recommend the following key performance indicators to measure the success of home-based care programs ([Table 2](#)).



**Table 2: KEY PERFORMANCE INDICATORS TO MEASURE THE SUCCESS OF HOME-BASED CARE PROGRAMS**

<b>Key Performance Indicators</b>	
<b>Clinical Outcomes</b>	<ul style="list-style-type: none"> <li>• Mortality</li> <li>• Escalation of care (e.g., emergency department visit, hospitalization)</li> <li>• Readmission rate</li> <li>• Length of stay</li> <li>• Appropriate and timely follow-up</li> <li>• Condition-specific clinical outcomes (e.g., guideline-directed medical therapy for HF)</li> </ul>
<b>Patient Experience</b>	<ul style="list-style-type: none"> <li>• Patient satisfaction scores</li> <li>• Ease of use of patient portal</li> <li>• Likelihood to recommend home-based care</li> <li>• Patient retention rates</li> </ul>
<b>Clinician Experience</b>	<ul style="list-style-type: none"> <li>• Effect on clinician well-being</li> <li>• Clinician engagement</li> </ul>
<b>Health Care System/Operational</b>	<ul style="list-style-type: none"> <li>• Patient volume</li> <li>• Related revenue</li> <li>• Improved care coordination</li> <li>• Cost of care</li> <li>• Return on capital investment</li> <li>• Improved access to care</li> <li>• Participation and performance in value-based care</li> </ul>
<b>Payer Related</b>	<ul style="list-style-type: none"> <li>• Total cost of care</li> <li>• Per patient per month cost</li> </ul>

HF = heart failure

## ONGOING CHALLENGES RELATED TO HOME-BASED HEALTH CARE

Interest in home-based care has grown immensely since 2020, fueled in part by the COVID-19 pandemic and expanded access to supportive technology (e.g., telehealth, remote patient monitoring).<sup>8</sup> Nonetheless, these services are often underutilized, particularly in support of acute and specialty care.<sup>9</sup>

With an aging population that is coping with multiple chronic conditions<sup>10</sup> and a strong desire by most older Americans to stay in their homes rather than move to long-term care and assisted living facilities<sup>11</sup>, appreciable growth in home-based care is expected.<sup>3,12</sup> Despite this, multiple challenges, such as affordability, access, and health equity exist. We propose some mitigation strategies to address these challenges in [Table 3](#).

Because hospitalization represents a major portion of annual health care expenditures<sup>13</sup>, payer interest in home-based care to limit hospital-based services continues to grow.<sup>14</sup> Some have regarded Centers for Medicare and Medicaid Services (CMS) Independence at Home program as its most successful primary care demonstration project to date.<sup>15</sup> However, many Medicare beneficiaries who qualify for health care at home have difficulty affording it.<sup>16</sup> Until this is more fully addressed, cost will remain a significant barrier.

Among the large number of older adults eligible for home-based care, most do not access it, likely driven by system-based limitations. In a 2011-2017 survey of fee-for-service Medicare beneficiaries, home-based care was utilized by only about 5%.<sup>17</sup> Decreased reimbursement has likely been a major driver, at least in limiting clinician participation.<sup>18</sup> With a large percentage of accountable care organizations (ACOs) offering these services, access will likely improve as adoption of global payment models increases.<sup>17</sup> Finally, home-based care represents a potential means to address ongoing health inequities.





**Table 3: CHALLENGES AND MITIGATION STRATEGIES FOR HOME-BASED CARE**

<b>Challenges</b>	<b>Mitigation Strategies</b>
<i><b>Patient-Related</b></i>	
Traditional view of health care delivery outside the home	Integration with traditional brick and mortar systems
Technical challenges	Easy digital tools/technology support
Social aspect of being in the hospital versus isolation at home	Team-based care delivery to build trust and relationship
<i><b>Clinician-Related</b></i>	
Longer visit/smaller panel size for in-person/in-home care	Value-based reimbursement that helps reduce the cost of care through greater access to widely available telehealth/virtual care technologies
Clinician safety	Pairing with a second team member and incorporation of safety protocols
Medical training	Incorporation of home-based care in medical education curriculums
<i><b>Infrastructure-Related</b></i>	
Lack of assistive DME for the home	Boost DME supply chain
Need for in-home support services (e.g., cooking, bathing)	Expanded coverage of in-home services
Need for other support services (e.g., laboratory, pharmacy, information technology)	Centralized management of mobile support services
Need for uniform electronic medical record and data integration	Standardized interoperability of electronic medical record systems
<i><b>Patient Safety</b></i>	
Environmental hazards (e.g., fall risk, infection prevention)	In-home assessment for home-based care and safety assessments
Challenges with caregiver hand-off and communication	Simplified and standardized hand-off check lists
Escalation of service, when needed	Appropriate monitoring equipment and ability to access emergency care
<i><b>Regulatory</b></i>	
No uniform standards for care delivery	Standardized methods to define and measure quality and outcomes in home-based care
State-based licensure for health care professionals	Interstate licensure for remote care

DME = durable medical equipment



## HOME-BASED HEALTH CARE SCOPE

An integrated model can support virtual-first, home-based care to patients with widely varying wellness and health care needs without time constraints (Figure 1). This model is built on a team-based approach with the patient at the center of care. Attention is given to shared decision making while addressing social determinants of health and health outcomes along the care continuum. [Figure 2](#) shows a pathway of traditional vs. innovative care continuum in acute coronary syndrome transitioning from acute to chronic care. The model/approach may be applied to different cardiovascular conditions, highlighted in use cases later in the document.

1. Outpatient care including wellness visits, chronic disease management, remote patient care, and behavioral health.
2. Urgent/emergency care at home.
3. Transition care, including following procedures, that facilitates early hospital discharge.
4. Hospital care ranging from lower acuity to that with more intensive needs.
5. Post-acute care including home rehabilitation and occupational and/or physical therapy.
6. Home-based palliative care.

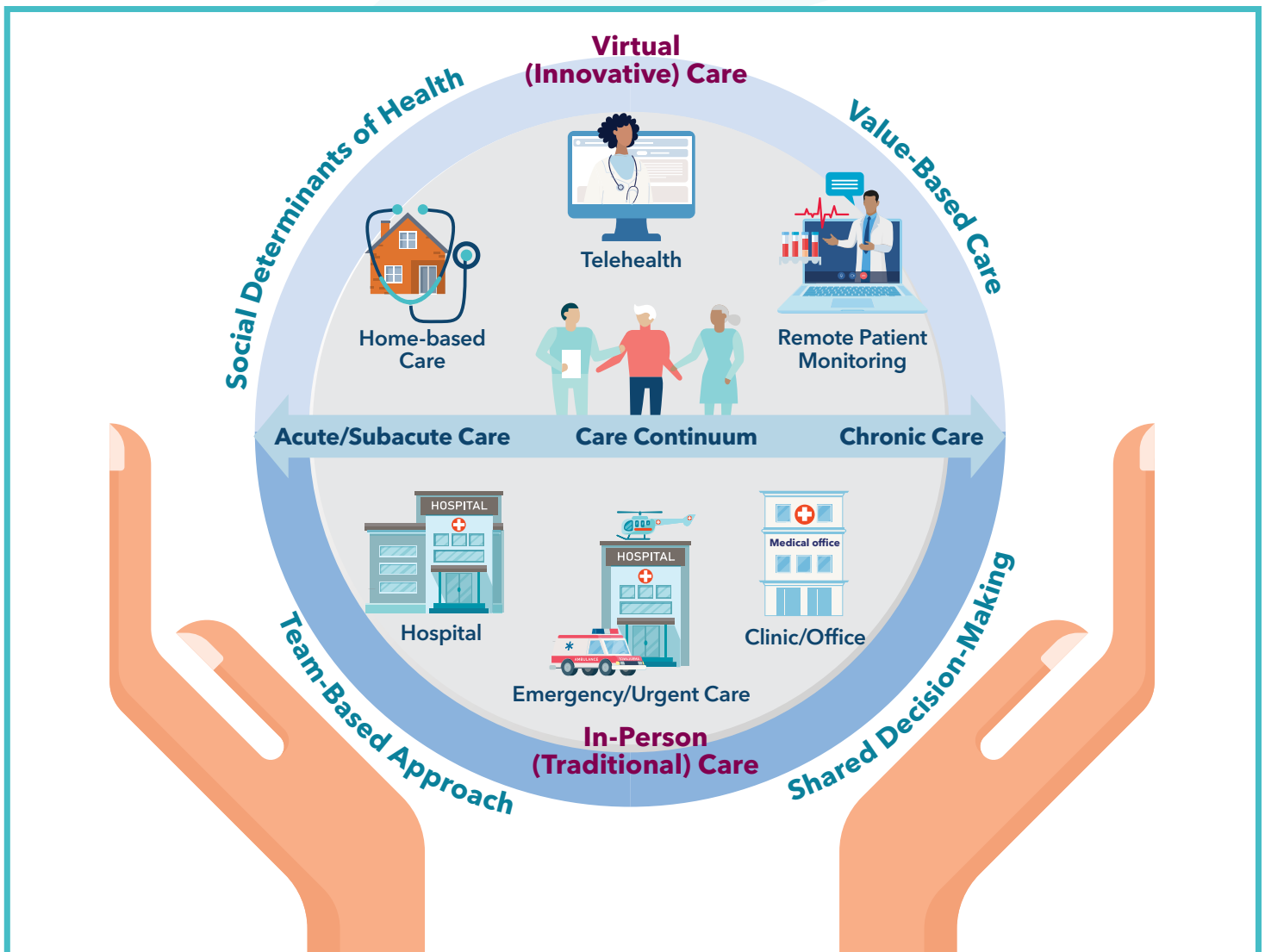
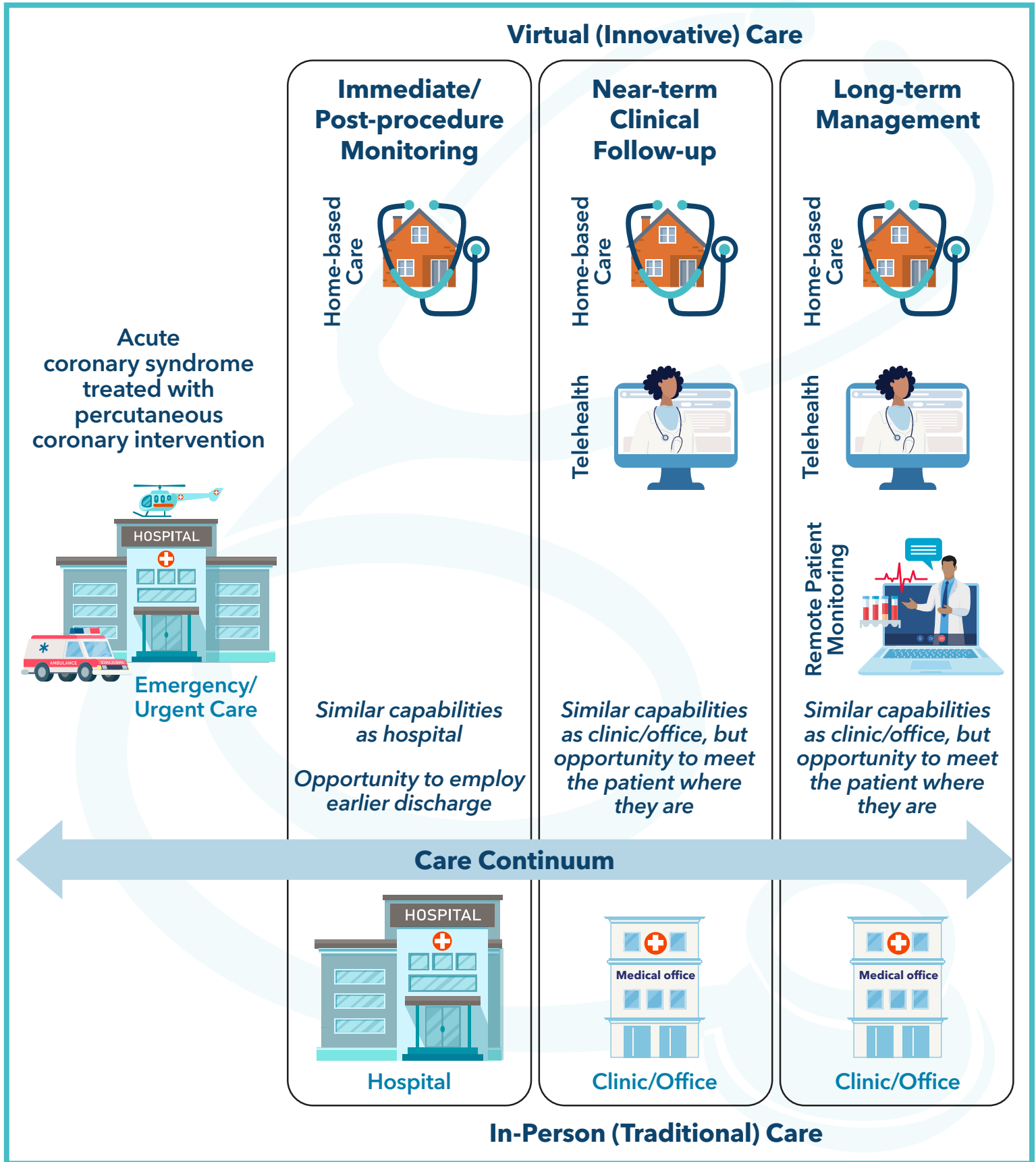




Figure 2: **EXAMPLE PATHWAY: TRADITIONAL VS. INNOVATIVE**



## PROGRAM CONSIDERATIONS FOR HOME-BASED CARE

**Building a successful program based on home-based care requires both commitment from health care leaders and resources for successful implementation.**

**Here we outline a few key components:**

1. A centralized, technology-enabled platform to coordinate care and clinical teams.
2. Clinical care teams complemented by in-home care delivery tailored to meet patient needs.
3. Ancillary support services including care coordinators, information technology specialists, and financial assistance experts.
4. Provision of medication, durable medical equipment, laboratory testing, and imaging services in health care settings or the home.
5. Documentation/integration within the health care system's electronic medical record.
6. Digital health tools to support patients and caregivers, including social services support, nutrition, treatment adherence, pharmacy services, and monitoring.

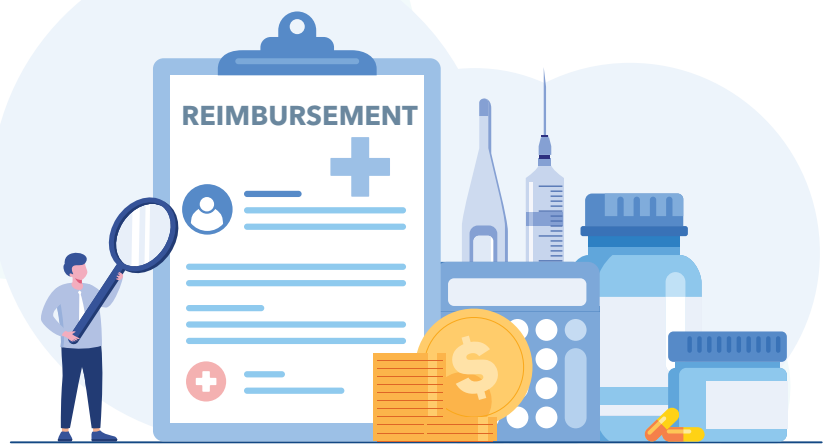


## REIMBURSEMENT

Despite advances in technological capabilities for home-based care and increased demand for these services, reimbursement continues to lag. Prior to the COVID-19 pandemic, limited services were covered by Medicare under the Home Health Prospective Payment System (e.g., part-time skilled nursing, physician-in-training services, and some physical/occupational therapy).<sup>19</sup> With rising interest in acute care home services and increased comfort with telehealth, however, CMS has allowed hospitals to request waivers to change monitoring and nursing oversight for acute care.<sup>20</sup>

Additionally, CMS' newly created Acute Hospital Care at Home program provides fee-for-service reimbursement for select hospital-at-home programs. While this represents an expansion of covered services, challenges to reimbursement still exist. Accordingly, health care systems may need to absorb some up-front costs until a broader range of payers and deliverers of health care agree to cost sharing for this. Incentives for health care systems to do so include cost-savings with at-home models, as well as the benefit of freeing up hospital space for alternative use.<sup>21</sup> In fact, hospitals utilizing the hospital-at-home model to generate savings and maintain or increase quality will be eligible for quality-adjusted incentives under these models.

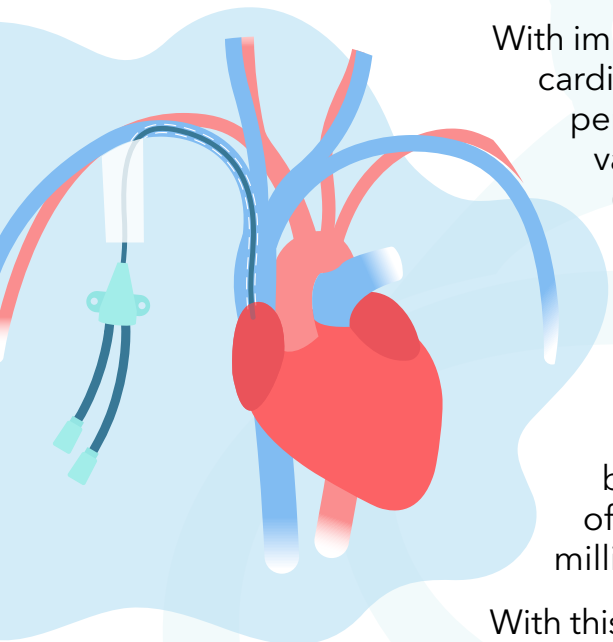
Ultimately, it is anticipated that ongoing shifts in patient demand, resource-constrained challenges to care delivery, and improvement in care capabilities will drive increased payment for at-home care services.



## CLINICAL SCENARIOS

As discussed previously, there are numerous potential applications for home-based care within cardiovascular medicine, and ongoing innovation will likely expand its use. Given differences in clinical practices, health care systems, and technologic capabilities, however, contemporary use of home-based care varies. Accordingly, we provide a *general* framework for integration of home-based care across different clinical scenarios, with consideration of the relevant data and potential impact.

### Elective Outpatient PCI and PVI



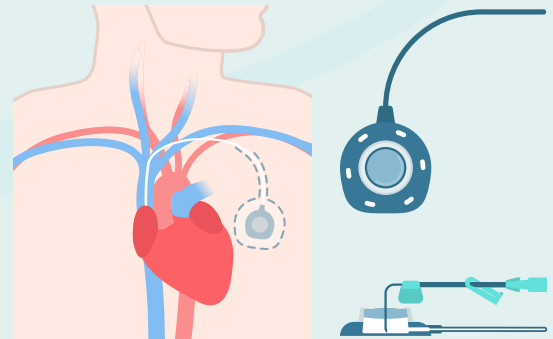
With improved safety and efficacy of transcatheter-based cardiovascular therapy, many patients receiving elective percutaneous coronary intervention (PCI) and peripheral vascular intervention (PVI) are eligible for same-day discharge (SDD).<sup>22</sup> The benefits of early discharge are substantial and not only include greater patient preference and satisfaction, but increased availability of hospital resources for patients requiring inpatient admission.<sup>23,24</sup> Economic incentives also exist with SDD, with significant reduction in PCI-related labor- and other- associated costs, amounting to as much as \$5,000 in savings per case.<sup>25</sup> In fact, it has been estimated that implementation of SDD in up to 50% of elective PCIs would yield annual savings of up to \$500 million for the U.S. alone.<sup>26,27</sup>

With this approach, however, close follow-up post-procedure is ideal. This may include a phone call or video visit at 24 hours by a registered nurse, advanced practice clinician, or pharmacist to ensure acquisition of and adherence to the prescribed medication regimen (particularly dual antiplatelet therapy).<sup>28</sup> Home-based care affords a means to provide an in-home check-in and assessment of the access site, while addressing any ongoing symptoms. In addition, in-home testing: e.g., a 12-lead electrocardiogram (ECG), point of care ultrasound could be performed if needed.

Thereafter, follow-up visits could be conducted in-person or virtually, addressing health maintenance issues, titrating medications, and reinforcing lifestyle considerations, such as diet, exercise, and tobacco cessation. The cadence of these follow-up visits is likely to be directed by illness severity. [Figure 3](#) demonstrates how home-based care could be incorporated as part of post-procedural care, including after PCI or PVI.

## CIED Placement

Traditionally, patients undergoing cardiac implantable electronic device (CIED) placement have been monitored overnight after the procedure, with clinical assessment, inspection of the incision and pocket, interrogation of the device, and completion of a chest X-ray prior to discharge.<sup>29</sup> Recent studies have demonstrated the safety of SDD after these procedures<sup>30</sup>, with a paucity of complications 6 and 24 hours post-implant.<sup>31</sup> Patients eligible for SDD could be evaluated at home early after device implant, obviating the need for an in-clinic appointment. While home-based device interrogation would ideally be performed by a technician that is able to obtain lead thresholds, clinics may opt for remote transmissions early after implant, with in-person interrogation one month post-procedure. Such an approach could help alleviate demand for in-person electrophysiology (EP) and device-based services, while helping to mitigate costs related to CIED placement.<sup>32</sup> [Figure 3](#) shows a potential process for home-based procedural care.

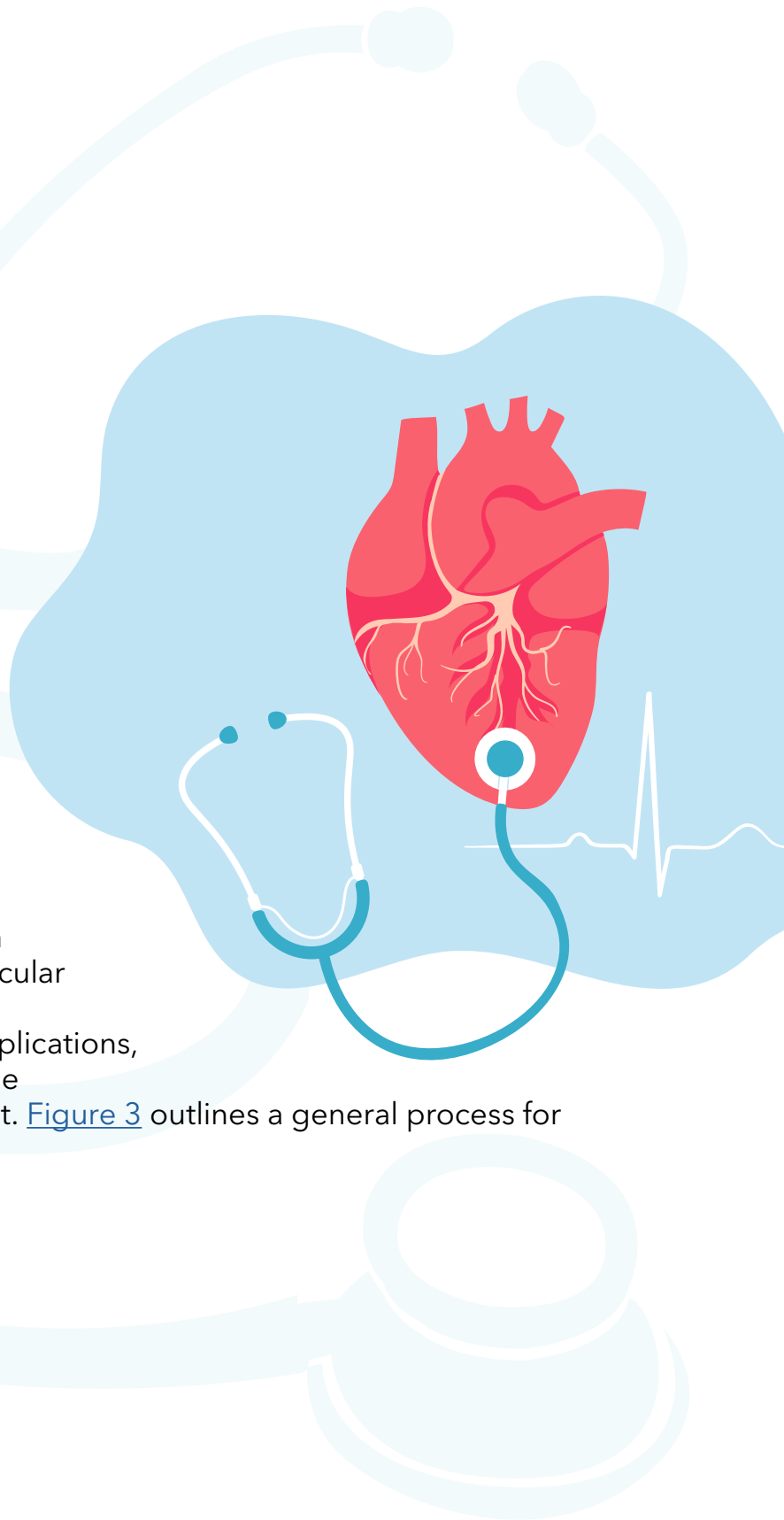


## EP Catheter Ablation

Despite the wide mix of patients undergoing catheter ablation for arrhythmias, there is increased interest in having these patients undergo SDD. Atrial fibrillation (AFib) is described here for illustrative purpose, as SDD has been studied in those that have undergone AFib ablation<sup>33,34</sup> and this population has historically required overnight observation in the hospital. Given projected increases in the prevalence of AFib<sup>35</sup>, home-based care presents a means to monitor patients in order to reduce the need for inpatient resources. A home-based visit might entail medication reconciliation, assessment of the access site, lab work (if necessary), and a potential virtual visit with the procedural/EP team. [Figure 3](#) outlines a potential workflow for this clinical scenario.

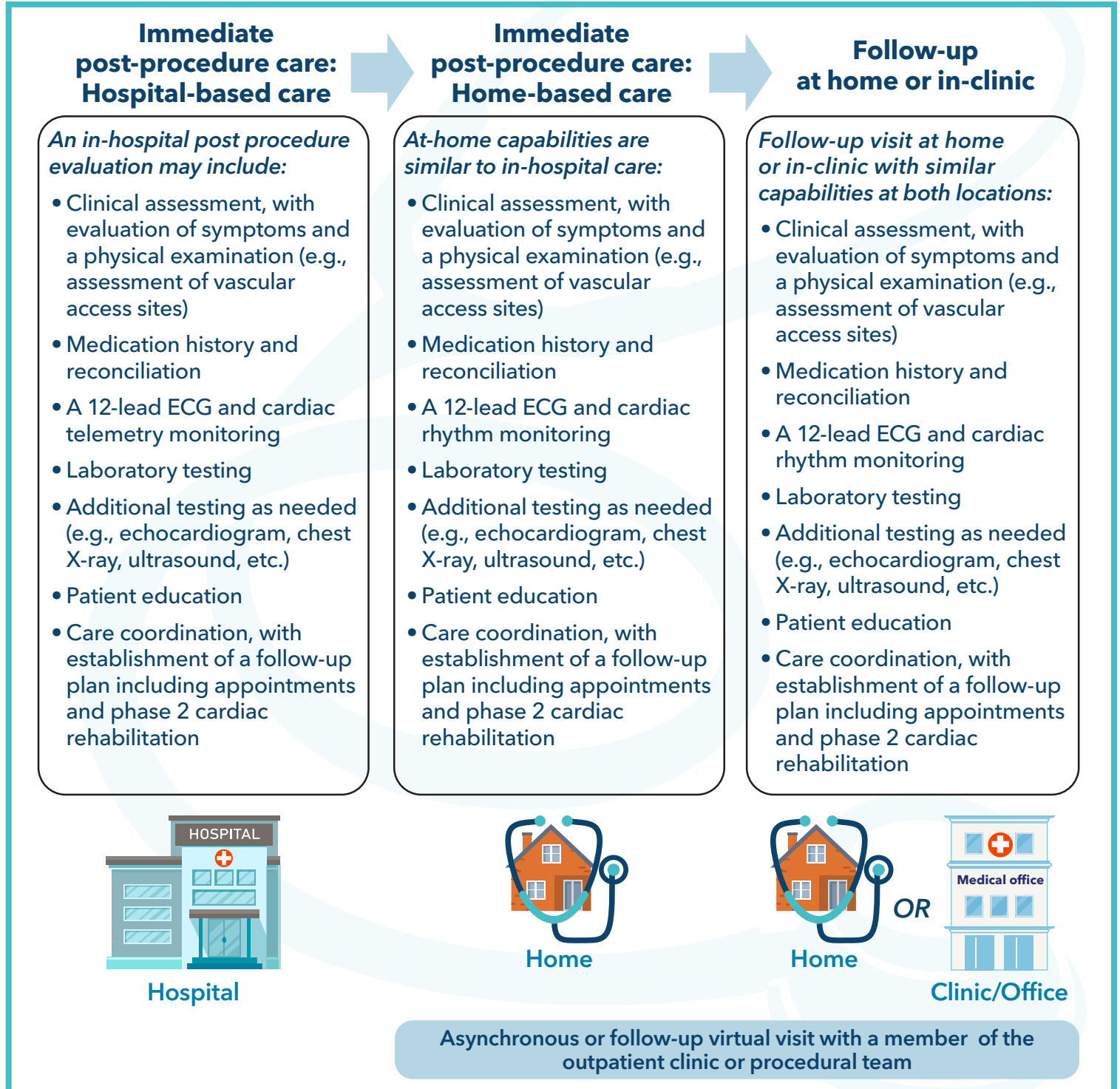
## Home Care After an ACS or CLI

Accumulated evidence suggests that home-based solutions have the potential to mitigate cost after an acute coronary syndrome (ACS). While early hospital discharge (i.e., within 72 hours) is encouraged for all but the most complex ACS cases<sup>36</sup>, risk of readmission is highest during the first few days after an ACS and approximates 10% at 30 days.<sup>37</sup> Early evaluation (within 1 week of discharge) is key in this population.<sup>38</sup> Beyond clinical assessment, home-based care should include review of medications and associated adherence, evaluation of vascular access sites (if applicable), an ECG, and appraisal of the patient's support structure. Similar follow-up in the home setting is warranted for those with critical limb ischemia (CLI), with meticulous attention paid to the neurovascular exam.<sup>39</sup> In patients with cardiopulmonary deterioration or evidence of vascular complications, additional expedited evaluation (e.g., in the emergency department) should be sought. [Figure 3](#) outlines a general process for home-based care following ACS/CLI.



## Figure 3: HOME-BASED CARE FOLLOWING HOSPITALIZATION AND/OR AN INPATIENT PROCEDURE

This pathway illustrates analogous capabilities in-hospital and at home. Examples include, but are not limited to, follow up after hospitalization for acute cardiac care, and after interventional (e.g., PCI, PVI), and electrophysiology (e.g., catheter ablation, CIED placement) procedures.



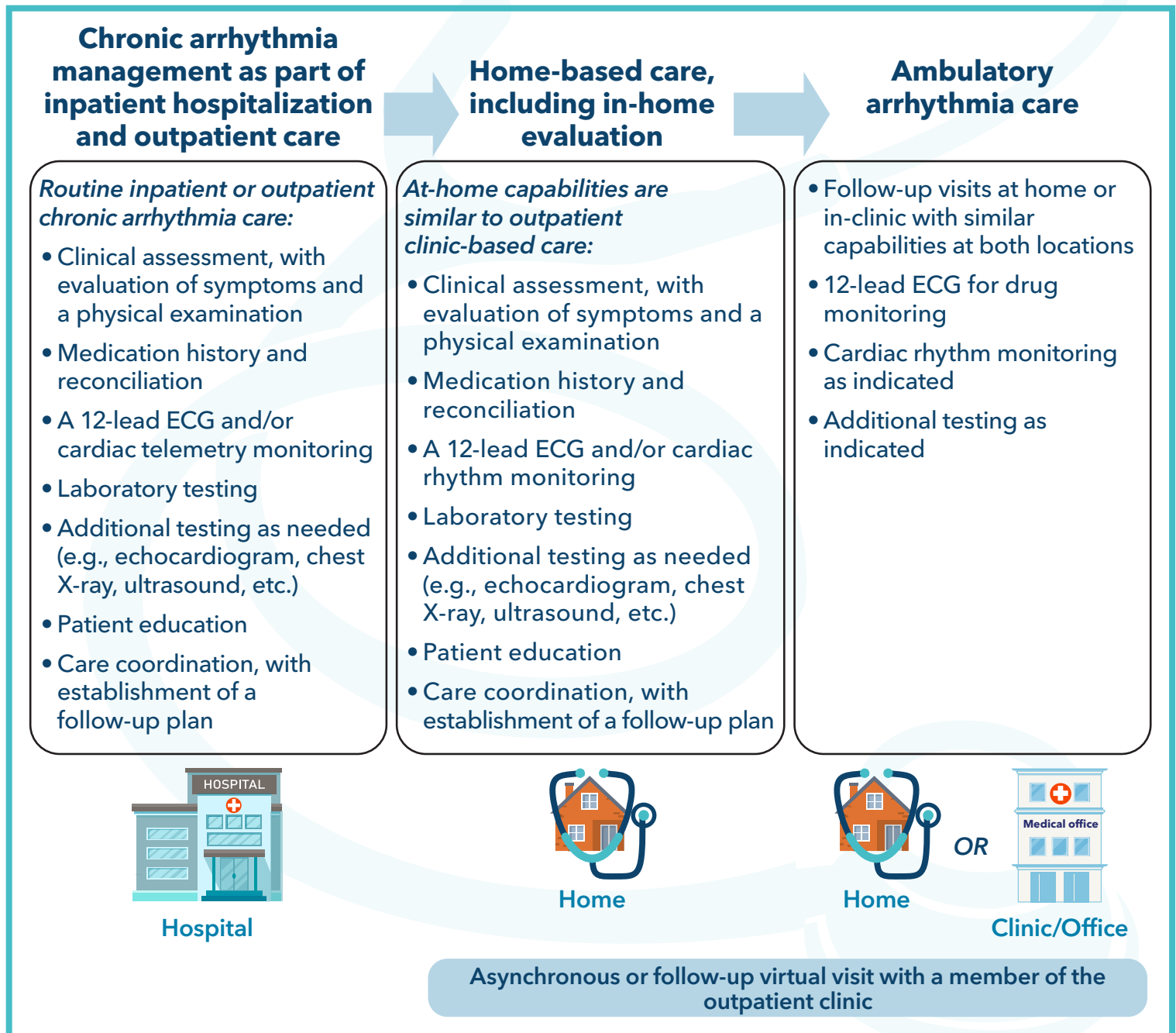
CIED = cardiovascular implantable electronic device; ECG = electrocardiogram; PCI = percutaneous coronary intervention; PVI = peripheral vascular intervention



## Chronic Arrhythmia Management

With a sizeable increase in arrhythmia (notably AFib) prevalence predicted, coordinated evaluation and management is paramount.<sup>38</sup> Home-based care should be a consideration, as demonstrated by a 2015 randomized controlled trial that evaluated an integrated care approach in chronic AFib and demonstrated decreased rates of hospitalization and mortality.<sup>40</sup> Such an approach could leverage telehealth visits with the care team, lab work if needed for those on anticoagulant and/or antiarrhythmic drug therapy, an ECG, other arrhythmia monitoring, and cardiovascular imaging. Figure 4 outlines a general roadmap for integrating home-based care of patients with chronic arrhythmia.

**Figure 4: HOME-BASED CHRONIC ARRHYTHMIA MANAGEMENT**



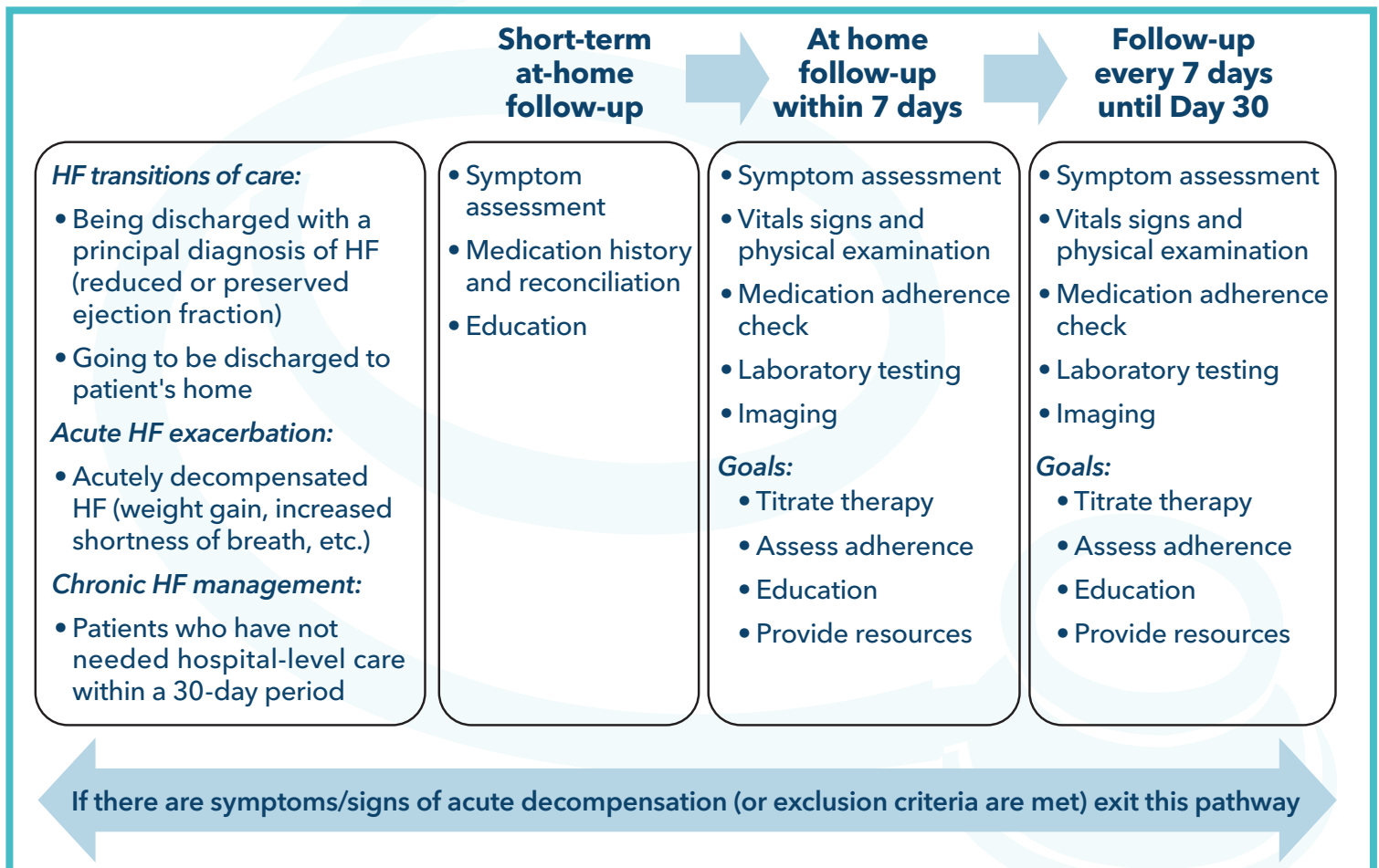
ECG = electrocardiogram



**HF**

Heart failure (HF) is a common, chronic condition with substantial morbidity and mortality, decreased health-related quality of life, increased risk of hospitalization and readmission, and significant cost.<sup>41</sup> Despite the availability of evidence-based therapies<sup>42</sup>, their use remains poor.<sup>43</sup> Home-based care represents a means by which to improve outcomes in this population. More specifically, stable patients with HF who are transitioning out of the hospital and/or those with mild decompensation but without signs of cardiogenic shock, may benefit from multidisciplinary interventions in the home. In a systematic review of 14 randomized controlled trials comparing home-based visits versus usual care, home-based care was associated with a reduction in hospital readmission and mortality up to 6 months after hospitalization.<sup>44</sup> In fact, home-based monitoring has changed the care paradigm for this population<sup>45</sup>, through improved communication, timely insights for those that are worsening, and greater use of evidence-based therapies. Certain acute-care capabilities, such as hospital-at-home, further allow the patient to be managed at home, permitting reappropriation of valuable hospital resources. Figure 5 outlines a potential pathway for home-based care in HF.

**Figure 5: HF CLINICAL CARE PATHWAY INCORPORATING HOME-BASED CARE**



HF = heart failure



# CONCLUSION

As we navigate a rapidly changing environment within health care, this workbook is intended to provide members of the cardiovascular care team with tools and resources on how to incorporate high-quality, patient-centered care in the home setting. Such an approach has the potential to improve clinician well-being, while meeting patient demands. Ideally, such an approach will allow patients and clinicians to navigate seamlessly between traditional and non-traditional care settings.

**Appendix**

Clinical Use Case	Model	Inclusion & Exclusion Criteria	People	Process	Technology & Tools
<p>Post-Procedural Care</p> <p>Elective outpatient PCI or PVI</p>	<p>Transition Care</p>	<p><b>Inclusions:</b></p> <ul style="list-style-type: none"> <li>• Patients with stable IHD and peripheral vascular disease undergoing elective outpatient PCI and PVI, respectively, with SDD</li> </ul> <p><b>Exclusions:</b></p> <ul style="list-style-type: none"> <li>• ACS</li> <li>• Cardiogenic shock</li> <li>• Rutherford Stages 5-6/Fontaine Stages 5-6 claudication (ischemic ulcers, gangrene)</li> </ul>	<ul style="list-style-type: none"> <li>• RN/APP</li> <li>• Physician/APP</li> </ul>	<ul style="list-style-type: none"> <li>• 24-hour follow-up (virtual visit or phone call)</li> <li>• In-home visit 5-7 days after the procedure to evaluate symptoms, arterial access sites, review discharge instructions and medications (e.g., DAPT).</li> <li>• Send to the ED if recurrent angina with new ECG changes, worsening HF, acute limb ischemia, and/or access site complications (e.g., retroperitoneal bleed, pseudoaneurysm).</li> <li>• 3-month follow-up               <ul style="list-style-type: none"> <li>◦ Virtual or in-person</li> <li>◦ Follow up after completion of cardiac or vascular rehab and walking regimen</li> <li>◦ Review the medication regimen</li> <li>◦ Follow up with a limited echocardiogram 3 months after revascularization with referral to EP if the LVEF is &lt;35%</li> <li>◦ Address smoking cessation</li> <li>◦ Health maintenance labs: lipids, HbA1c</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Vital signs</li> <li>• ECG and/or cardiac rhythm monitoring</li> <li>• Phlebotomy</li> <li>• Duplex ultrasound if evidence of access site complications (hematoma, bruits, discomfort)</li> <li>• Transthoracic echocardiogram</li> <li>• EMR integration and access to data</li> </ul>

Clinical Use Case	Model	Inclusion & Exclusion Criteria	People	Process	Technology & Tools
CIED Placement	Transition Care	<p><b>Inclusions:</b></p> <ul style="list-style-type: none"> <li>• Patients undergoing PPM, ICD, or CRT placement</li> </ul> <p><b>Exclusions:</b></p> <ul style="list-style-type: none"> <li>• Post-procedural complication prior to discharge</li> </ul>	<ul style="list-style-type: none"> <li>• Procedural team (physician +/- NP/PA)</li> <li>• RN/MA for access site check</li> <li>• Device company representative</li> <li>• RN/MA for remote transmission monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• In-home visit post procedure day #1 for access site check, removal of pressure dressing, CIED interrogation <ul style="list-style-type: none"> <li>◦ Review discharge instructions, precautions, and medicine changes</li> <li>◦ Review remote transmission technology/ ensure it is set up</li> </ul> </li> <li>• 7 to 14-day follow-up <ul style="list-style-type: none"> <li>◦ At home</li> <li>◦ Access site check</li> <li>◦ Review precautions</li> </ul> </li> <li>• 30-day follow-up <ul style="list-style-type: none"> <li>◦ Synchronous with at-home technician and virtual clinical team member</li> <li>◦ CIED interrogation, reprogramming</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• In-home visit linked with procedural team</li> <li>• Chest X-ray</li> <li>• Home monitoring system</li> <li>• Universal programmer to interrogate CIED</li> </ul>
Cardiac Ablation	Transition Care	<p><b>Inclusions:</b></p> <ul style="list-style-type: none"> <li>• Patients undergoing ablation of AFib, SVT, or idiopathic PVCs</li> </ul> <p><b>Exclusions:</b></p> <ul style="list-style-type: none"> <li>• High risk/complex ablation (at discretion of clinician regarding risk of post-procedural complications based on procedural characteristics)</li> <li>• Post-procedural complication prior to discharge</li> <li>• Post-procedural hemodynamic compromise</li> </ul>	<ul style="list-style-type: none"> <li>• Procedural team (physician +/- NP/PA)</li> <li>• RN/MA for access site check</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to visit as indicated</li> <li>• In-home visit post procedure day #1 for access site check <ul style="list-style-type: none"> <li>◦ Review discharge instructions, precautions, and medicine changes</li> </ul> </li> <li>• 30-day follow-up <ul style="list-style-type: none"> <li>◦ Virtual, with clinical care team member</li> <li>◦ Cardiac rhythm monitoring prior to visit as indicated</li> <li>◦ Discussion with care team about post-procedural concerns and ongoing plan</li> </ul> </li> <li>• Transition to chronic ambulatory care</li> </ul>	<ul style="list-style-type: none"> <li>• In-home visit linked with procedural team</li> <li>• Ambulatory cardiac rhythm monitoring</li> </ul>

Clinical Use Case	Model	Inclusion & Exclusion Criteria	People	Process	Technology & Tools
ACS/CLI	Transition Care	<p><b>Inclusions:</b></p> <ul style="list-style-type: none"> <li>STEMI/NSTEMI with or without cardiogenic shock and/or cardiac arrest</li> <li>CLI</li> </ul> <p><b>Exclusions:</b></p> <ul style="list-style-type: none"> <li>Stable IHD</li> <li>Stable claudication</li> </ul>	<ul style="list-style-type: none"> <li>Physician/APP</li> </ul>	<ul style="list-style-type: none"> <li>In-home visit 3-5 days post-discharge for evaluation               <ul style="list-style-type: none"> <li>Review discharge instructions, post-procedural precautions and medication reconciliation</li> <li>Ensure patient has a scale and is checking daily weights</li> <li>Access site checks</li> </ul> </li> <li>Send to ED if recurrent angina with new ischemic ECG changes, worsening HF, acute limb ischemia, and/or access site complications (e.g., retroperitoneal bleed, pseudoaneurysm).</li> <li>3-month follow-up               <ul style="list-style-type: none"> <li>Virtual or in-person</li> <li>Daily weights</li> <li>Review medication regimen</li> <li>Follow-up limited echocardiogram 3 months post-revascularization/OMT with referral to EP if the LVEF is &lt;35% (baseline LV function assessment should be conducted prior to hospital discharge); ultrasound/echo dependent on home-based care team resources and health care system needs</li> <li>Lower extremity arterial duplex</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Vital signs</li> <li>ECG and/or cardiac rhythm monitoring</li> <li>Duplex ultrasound if evidence of access site complications (hematoma, bruits, discomfort)</li> <li>Transthoracic echocardiogram</li> <li>Arterial duplex</li> </ul>
Acute Arrhythmia Requiring Urgent Care/Emergency Care/Hospitalization	Acute/Advanced Care	<p><b>Inclusions:</b></p> <ul style="list-style-type: none"> <li>Subtraventricular tachyarrhythmias</li> <li>Stable bradyarrhythmias</li> </ul> <p><b>Exclusions:</b></p> <ul style="list-style-type: none"> <li>Ventricular arrhythmias</li> <li>History of decompensated HF</li> <li>Severely reduced left ventricular systolic function</li> <li>Pulmonary hypertension</li> <li>ACHD</li> </ul>	<ul style="list-style-type: none"> <li>ED, cardiology, or EP team for consultation</li> <li>Home-based team for evaluation (MA/RN)</li> <li>Pharmacy team</li> </ul>	<ul style="list-style-type: none"> <li>Acute evaluation               <ul style="list-style-type: none"> <li>History and physical examination</li> <li>Laboratory testing</li> <li>12-lead ECG</li> <li>Telemetry/cardiac rhythm monitoring</li> <li>Additional diagnostic testing</li> <li>Obtain peripheral IV access</li> </ul> </li> <li>Treatment phase               <ul style="list-style-type: none"> <li>Synchronous or follow up consultation with expert (ED, cardiology, EP)</li> <li>Vagal maneuvers for SVT</li> <li>IV medications (BB, CCB, amiodarone, adenosine)</li> </ul> </li> <li>Triage/Disposition               <ul style="list-style-type: none"> <li>Transfer to ED as indicated (unstable vital signs, severely abnormal lab values, significant oxygen requirement, etc)</li> <li>If arrhythmia terminated, transition to Chronic Management</li> <li>If arrhythmia ongoing, but stable, additional treatment and evaluation per specialty consultation                   <ul style="list-style-type: none"> <li>Hospital-at-home vs. transfer to hospital</li> </ul> </li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Diagnostic evaluation: laboratory testing, ECG, chest X-ray, echocardiogram</li> <li>IV access</li> <li>Medications: BB, CCB, adenosine, amiodarone</li> </ul>

Clinical Use Case	Model	Inclusion & Exclusion Criteria	People	Process	Technology & Tools
Outpatient Arrhythmia Management	Chronic Ambulatory Care	<p><b>Inclusions:</b></p> <ul style="list-style-type: none"> <li>• Chronic arrhythmia</li> <li>• Prior evaluation by and establishment of care with EP/cardiology</li> </ul>	<ul style="list-style-type: none"> <li>• EP/cardiology team</li> <li>• Home-based team for evaluation (MA/RN)</li> <li>• Pharmacy team</li> </ul>	<ul style="list-style-type: none"> <li>• Routine visit               <ul style="list-style-type: none"> <li>◦ History and physical examination</li> <li>◦ Laboratory testing</li> <li>◦ 12-lead ECG</li> <li>◦ Pre-procedure cardiac rhythm monitoring</li> <li>◦ Synchronous virtual visit with clinical team</li> </ul> </li> <li>• AAD therapy and anticoagulation monitoring               <ul style="list-style-type: none"> <li>◦ Medication reconciliation</li> <li>◦ Laboratory testing</li> <li>◦ 12-lead ECG</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Diagnostic evaluation: laboratory testing, ECG, chest X-ray, echocardiogram</li> <li>• Ambulatory cardiac rhythm monitoring</li> <li>• Synchronous virtual visits with clinical team</li> </ul>
HF - Transitions of Care	Transition Care	<p><b>Inclusions:</b></p> <ul style="list-style-type: none"> <li>• Being discharged with a principal diagnosis of HF (reduced or preserved ejection fraction)</li> <li>• Going to be discharged to patients' home</li> </ul> <p><b>Exclusions:</b></p> <ul style="list-style-type: none"> <li>• Patients with signs of acute decompensation or cardiogenic shock</li> <li>• Patients going to a skilled nursing facility</li> <li>• Patients on hospice</li> </ul>	<ul style="list-style-type: none"> <li>• Cardiologist</li> <li>• Cardiovascular APP</li> <li>• Nurse</li> <li>• Pharmacy team</li> <li>• Primary care</li> <li>• Dietitian</li> <li>• Cardiac rehabilitation</li> <li>• Laboratory services</li> <li>• Advance care planning representative</li> <li>• Social work</li> </ul>	<ul style="list-style-type: none"> <li>• Acute evaluation               <ul style="list-style-type: none"> <li>◦ History and physical examination</li> <li>◦ Laboratory testing</li> <li>◦ 12-lead ECG</li> <li>◦ Blood pressure monitoring</li> <li>◦ Assessment of urine output</li> <li>◦ Telemetry/cardiac rhythm monitoring as indicated</li> <li>◦ Echocardiogram</li> <li>◦ Additional diagnostic testing</li> <li>◦ 6MWT</li> <li>◦ Obtain peripheral IV access</li> </ul> </li> <li>• Treatment Phase:               <ul style="list-style-type: none"> <li>◦ Loop/thiazide-like diuretics</li> <li>◦ Electrolyte monitoring (lab)</li> <li>◦ Blood pressure/hemodynamic monitoring</li> <li>◦ Daily weight</li> <li>◦ I/O monitoring</li> </ul> </li> <li>• Access to GDMT</li> </ul>	<ul style="list-style-type: none"> <li>• Diagnostic evaluation: blood pressure monitoring, laboratory testing, ECG, chest X-ray, echocardiogram</li> <li>• IV access</li> <li>• Implantable hemodynamic monitor</li> <li>• Device monitoring equipment</li> <li>• Medications               <ul style="list-style-type: none"> <li>◦ Loop diuretics</li> <li>◦ ACEI/ARB/ARNI</li> <li>◦ Beta-blocker</li> <li>◦ MRA</li> <li>◦ SGLT2 inhibitor</li> <li>◦ Potassium/Magnesium</li> </ul> </li> </ul>



Clinical Use Case	Model	Inclusion & Exclusion Criteria	People	Process	Technology & Tools
Acute HF Exacerbation	Acute Care	<p><b>Inclusions:</b></p> <ul style="list-style-type: none"> <li>Acutely decompensated HF (weight gain, increased shortness of breath, etc)</li> </ul> <p><b>Exclusions:</b></p> <ul style="list-style-type: none"> <li>Patients with signs of cardiogenic shock/hypoperfusion</li> <li>Patients with incessant ventricular tachycardia</li> <li>Patients enrolled in hospice</li> <li>Patients with heart transplant or LVAD</li> </ul>	<ul style="list-style-type: none"> <li>Cardiologist</li> <li>Cardiovascular APP</li> <li>Nurse</li> <li>Pharmacy team</li> <li>Dietitian</li> <li>Laboratory services</li> <li>Emergency medical services (EMS), if needed</li> </ul>	<ul style="list-style-type: none"> <li>Acute Evaluation <ul style="list-style-type: none"> <li>History and physical examination</li> <li>Laboratory testing</li> <li>12-lead ECG and/or cardiac rhythm monitoring</li> <li>Blood pressure monitoring</li> <li>Urine output</li> <li>Telemetry/remote monitoring as indicated</li> <li>Echocardiogram</li> <li>Additional diagnostic testing</li> <li>Obtain peripheral IV access</li> </ul> </li> <li>Treatment Phase: <ul style="list-style-type: none"> <li>Loop/thiazide-like diuretics</li> <li>Electrolyte monitoring (lab)</li> <li>Blood pressure/hemodynamic monitoring</li> <li>Daily weight</li> <li>I/O monitoring</li> </ul> </li> <li>Access to GDMT when able</li> </ul>	<ul style="list-style-type: none"> <li>Diagnostic evaluation: blood pressure monitoring, laboratory testing, ECG, chest X-ray, echocardiogram</li> <li>IV access</li> <li>Implantable hemodynamic monitor</li> <li>Device monitoring equipment</li> <li>Medications <ul style="list-style-type: none"> <li>Loop diuretics</li> <li>ACEI/ARB/ARNI</li> <li>Beta-blocker</li> <li>MRA</li> <li>SGLT2 inhibitor</li> <li>Potassium/Magnesium</li> </ul> </li> </ul>
Chronic HF Management	Chronic Ambulatory Care	<p><b>Inclusions:</b></p> <ul style="list-style-type: none"> <li>Patients who have not needed hospital-level care within a 30-day period</li> </ul> <p><b>Exclusions:</b></p> <ul style="list-style-type: none"> <li>Patients with signs of acute decompensation or cardiogenic shock</li> <li>Patients with heart transplant or LVAD</li> <li>Patients enrolled in hospice</li> </ul>	<ul style="list-style-type: none"> <li>Cardiologist</li> <li>Cardiovascular APP</li> <li>Nursing</li> <li>Pharmacy team</li> <li>Cardiac rehabilitation</li> <li>Primary care</li> <li>Dietitian</li> <li>Laboratory services</li> <li>Advance care planning representative</li> <li>Social work</li> </ul>	<ul style="list-style-type: none"> <li>Routine Visit <ul style="list-style-type: none"> <li>Symptom assessment</li> <li>Vitals signs</li> <li>Physical exam</li> <li>Medication adherence/tolerability assessment</li> <li>12-lead ECG</li> <li>Laboratory testing</li> <li>Device check (e.g., implantable hemodynamic monitor, ICD, etc)</li> <li>6MWT</li> <li>Could be synchronous virtual visit with clinical team</li> </ul> </li> <li>Treatment/Management: <ul style="list-style-type: none"> <li>Access to GDMT and other pharmacotherapy as needed</li> <li>Infusion-center access or ability (IV iron/diuretics)</li> <li>Educational resources</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Diagnostic evaluation: blood pressure monitoring, laboratory testing, ECG, chest X-ray, echocardiogram</li> <li>IV access</li> <li>Implantable hemodynamic monitor</li> <li>Device monitoring equipment</li> <li>Medications <ul style="list-style-type: none"> <li>Loop diuretics</li> <li>ACEI/ARB/ ARNI</li> <li>Beta-blocker</li> <li>MRA</li> <li>SGLT2 inhibitor</li> <li>Potassium/Magnesium</li> <li>IV iron</li> <li>Digoxin</li> <li>Other therapies (e.g., ivabridine, vericiguat)</li> </ul> </li> </ul>

Clinical Use Case	Model	Inclusion & Exclusion Criteria	People	Process	Technology & Tools
CIED Chronic Management	Chronic Ambulatory Care	<p><b>Inclusions:</b></p> <ul style="list-style-type: none"> <li>History of PPM, ICD, or CRT placement</li> </ul> <p><b>Exclusions:</b></p> <ul style="list-style-type: none"> <li>None</li> </ul>	<ul style="list-style-type: none"> <li>EP team</li> <li>Home-based team for evaluation (MA/RN)</li> <li>Device company representative</li> </ul>	<ul style="list-style-type: none"> <li>Routine device interrogation                             <ul style="list-style-type: none"> <li>Perform every 3-12 months as indicated by device type/patient history</li> <li>Must be performed in home to allow for threshold testing</li> <li>Can alternate in-home visits with remote transmissions if threshold does not need to be checked and device programming/performance stable</li> </ul> </li> <li>Concurrent or post-visit review by EP team                             <ul style="list-style-type: none"> <li>Reprogramming of device per clinician</li> </ul> </li> <li>Ad hoc interrogations/evaluation for device alerts                             <ul style="list-style-type: none"> <li>At home interrogation, patient interview, and additional diagnostic testing as indicated based on event (ICD therapy, arrhythmia detection, lead dysfunction)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Remote/home device monitoring</li> <li>Trained staff member to perform in-home device interrogation and reprogramming</li> <li>Remote monitoring setup</li> <li>Diagnostic evaluation: laboratory testing, ECG, chest X-ray</li> </ul>
Chronic IHD/Stable PAD	Chronic Ambulatory Care	<p><b>Inclusions:</b></p> <ul style="list-style-type: none"> <li>CAD with prior MI, PCI, and/or CABG</li> <li>Ischemic cardiomyopathy</li> <li>History of PAD</li> </ul>	<ul style="list-style-type: none"> <li>Physician/APP</li> <li>Home-based team for evaluation</li> </ul>	<ul style="list-style-type: none"> <li>Routine bi-annual or annual visits</li> <li>Review medications</li> <li>Assess for symptoms (e.g., angina, dyspnea, weight gain, claudication)</li> <li>Health maintenance labs - lipids, HbA1c</li> <li>Ischemia evaluation as dictated by symptoms/signs</li> <li>Arterial duplex exam per symptoms</li> </ul>	<ul style="list-style-type: none"> <li>Vital signs</li> <li>ECG and/or cardiac rhythm monitoring</li> <li>Phlebotomy</li> <li>Arterial duplex</li> </ul>

**When adopting home-based care approach, clinicians may consider assessment of minimum training, quality, or regulatory requirements specific to individual clinical environments, including for specialty services such as remote imaging, POCUS, etc.**

AAD = antiarrhythmic drug; ACEI = angiotensin-converting enzyme inhibitor; ACHD = adult congenital heart disease; ACS = acute coronary syndrome; AFib = atrial fibrillation; APP = advanced practice professional; ARB = angiotensin receptor blocker; ARNI = angiotensin receptor neprilysin inhibitor; BB = beta blocker; CABG = coronary artery bypass graft; CAD = coronary artery disease; CCB = calcium channel blocker; CIED = cardiac implantable electronic device; CLI = critical limb ischemia; CRT = cardiac resynchronization therapy; DAPT = dual antiplatelet therapy; ECG = electrocardiogram; ED = emergency department; EMR = electronic medical record; EP = electrophysiology; GDMT = guideline-directed medical therapy; HF = heart failure; ICD = implantable cardioverter-defibrillator; IHD = ischemic heart disease; I/O = intake/output; IV = intravenous; LVAD = left ventricular assist device; LVEF = left ventricular ejection fraction; MA = medical assistant; MI = myocardial infarction; MRA = mineralocorticoid receptor antagonist; NP = nurse practitioner; NSTEMI = non-ST-segment elevation myocardial infarction; OMT = optimal medical therapy; PA = physician assistant; PAD = peripheral arterial disease; PCI = percutaneous coronary intervention; pIV = peripheral intravenous line; PPM = permanent pacemaker; PVC = premature ventricular contraction; PVI = peripheral vascular intervention; RN = registered nurse; SDD = same day discharge; SGLT2 = sodium-glucose cotransporter-2; STEMI = ST-segment elevation myocardial infarction; SVT = supraventricular tachycardia; 6MWT = 6-minute walk test

## Author Disclosures

Dr. Amin is an employee at Bristol Myers Squibb. Dr. Gandhi is an employee at Philips; and an advisor for Emeritus. Dr. Gluckman reports equity in Doximity; and is a consultant for Premier. All other authors have reported that they have no relationships relevant to the contents of this workbook to disclose.

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