HEALTH **POLICY**
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Integrating remote follow-up into electronic health records workflow ☆

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Abstract
Background: The Colorado Health Medical Group, Cardiology (formerly Heart Center of the Rockies) is a paperless clinic which follows about 4000 cardiac rhythm management device patients and relies heavily on advanced remote follow-up and remote monitoring features.
Methods: Working with a device manufacturer and our own information technology team, we were able to redesign our workflow procedures so that data downloaded from devices could be imported directly into our electronic health records with no need to manually populate any templates. We were able to import device data as discrete information, making records more readily searchable.
Results: With this revised workflow, we were able to transition from about 19 min per patient to about 3.5 min with no compromise in patient care. The new workflow allows device nurses to spend more time engaging with patients and reviewing clinical data and less time managing clerical tasks. Although not captured in this study, our improved workflow also helped us schedule all reimbursable remote and in-clinic follow-ups without fail.
Conclusions: With technical support from the institution and the device company, device clinics can develop systems to import remote follow-up data directly into electronic medical records allowing for more efficient workflows and time savings.
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Introduction

The demands of periodic follow-up of implantable cardiac rhythm management devices, such as pacemakers, implantable cardioverter-defibrillators (ICDs), and cardiac resynchronization therapy (CRT) devices with and without defibrillation, represents a substantial workload for the healthcare teams caring for device patients. With increasing numbers of device patients, economic pressures on clinics to consistently do more with less, and highly complex new devices and therapeutic options, managing device patients has created substantial workflow problems [1]. Up until recently, device follow-up required

regular in-clinic visits to interrogate the device, download diagnostic reports, and adjust parameter settings, as needed. This required patients to report regularly to the clinic and, as these numbers increased, it placed a burden on the clinical staff.

Remote follow-up is defined here as the ability to conduct a routine follow-up check of an implantable device by transmission of device data to a secure website. *Remote monitoring*, defined as the ability of the device to self-report a remarkable event (such as, but not limited to, atrial fibrillation or impending end-of-service) to a secure website, advanced patient safety. Clinical studies have confirmed that remote follow-up and remote monitoring are safe and effective ways of managing device patients [2,3]. Radiofrequency (RF) or "wireless" devices further enhanced remote follow-up, because wireless systems meant patients were not obligated to periodically interact with a transmitter to relay information from their implantable device to the clinic's secure website. Wireless remote monitoring allows for alerts about remarkable events to arrive at the clinic promptly, so that appropriate observation or intervention can occur without delay.

Remote follow-up and remote monitoring options have indeed sped data into pacemaker clinics; however management of these data has become a formidable challenge. Clinics using paper records might simply download the data, print out the reports, and add them to the patient's chart. This is a labor-intensive and time-consuming task. Clinics already using electronic health records (EHRs) may still struggle with compatibility issues when transitioning to remote follow-up. Clinics may find it necessary to have all or part of this information manually input into the EHR. This is not only expensive and tedious, it can lead to data entry errors. Overcoming this hurdle—allowing the remote follow-up data to automatically migrate into the EHR—will increasingly be a subject of future concern for cardiac rhythm management device clinics around the world [4]. This article presents a case report from a large U.S.-based device clinic that has achieved integration of remote follow-up data from secure websites or in-office device checks directly into EHRs, with minimal but clinically relevant interaction by the staff. This integration has created a streamlined, economical, and highly efficient workflow.

Background of the clinic

The Colorado Health Medical Group, Cardiology, formerly Heart Center of the Rockies (Fort Collins, CO) first adopted remote care of device patients in 2006 and today manages about 4000 device patients, including patients from rural areas of Colorado, Wyoming, and Nebraska. The clinic treats patients with pacemakers, ICDs, and CRT systems from all manufacturers. Some patients are "snowbirds," who travel from the Rocky Mountain region to Southern states in the winter. When remote care of device patients was first introduced, patients were given the option of participation. Today, the clinic automatically enrolls all device patients in remote follow-up. With some systems (Merlin@home™, St. Jude Medical, Sylmar, CA or CareLink™ Medtronic, Minneapolis, MN) the clinic is able to pair patients with remote monitoring equipment at implant, so that they are discharged from the hospital with the remote system. Remote follow-up and monitoring have become the clinic's standard of care. The clinic uses Allscripts EHR.

Workflow

Original workflow

This workflow was developed for treating patients using the newest-generation of devices with wireless remote monitoring from St. Jude Medical. The original workflow is depicted in Figure 1. A full-time equivalent (FTE), in our case a registered nurse hired as a contract employee, was engaged to review the device clinic schedule in advance and manually populate a proprietary template in the EHR. The template was an electronic form created by our clinic, into which the FTE entered information about the device, including programmed settings. This step was necessary because the copy-forward feature in the EHR did not provide the needed information (customization issues). The template was created to integrate electronically into the EHR. The initial concept of the template was to create an efficient pathway for device data to be incorporated into the EHR, but the only way to populate the template was by hand. It took between nine and 10 min per patient to fill out the template, depending on the device.

Next the patient's "red chart" was pulled. (We are a paperless clinic, but we still initiate sessions using a paper "red chart," a quick reference tool with basic device data developed for use in outreach clinics.) From a timing point, the EHR template may have been prepared minutes or days in advance. The device nurse logs onto both the EHR and the device website. The device nurse downloads and reviews the follow-up data and acknowledges the patient in the clinic's schedule, setting up the next remote follow-up. This action typically takes fewer than 3 min. The device nurse then populates the proprietary template with the transmitted data—this takes three or 4 min. The transmission data are also archived electronically on the device company site. In our clinic, we contact our patients by telephone to tell them follow-up was conducted. In most instances, the phone call is brief and informs the patient that the device is operating properly. At this time, the device nurse also asks about the patient's health and can respond to any questions the patient has. If there is a problem that might necessitate the patient's coming to the clinic, an appointment is made. In our workflow studies, we timed several workflows, but the patient phone call is variable; it typically lasts a few minutes but can last longer.

The device nurse signs off on the report in the EHR and, in the lingo of our EHR system, "tasks" (sends a message to) the physician with a report to sign. In our clinic, the physician must sign off on all such reports by the close of the business day. The device nurse then goes to the EHR and enters the diagnosis and billing codes. When the physician sign-off is complete, this generates a billing, and the "red chart" is returned to the file room. In other clinics, it may be that the device reports are printed out, signed by the physician, and scanned back into the system; device reports may also be available in some systems as PDF files which can be attached to the EHR.

This original workflow timed out to be about 19 min per device follow-up. See Figure 1. This represented a considerable amount of time for a "remote follow-up" that should have offered us time-saving efficiencies. Furthermore, our use of this method required us to hire an FTE to help manage the integration of remote follow-up data into EHR, a necessary but expensive addition to our clinic.