



## Future Perspective of CIED Remote Monitoring in Korea

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Severance Hospital, South Korea

# terminology

용어	정의
디지털헬스케어 (digital healthcare)	보건의료 산업과 ICT가 융합되어 개인을 중심으로 건강과 질환을 관리하는 산업 생태계
원격의료 (telehealth)	진료의 범위를 넘은 보다 넓은 의미로 전자정보통신기술(ICT)을 사용하여 원격진료, 원격모니터링, 원격수술, 원격상담(교육) 등을 포함
원격진료 (telemedicine)	IT 기술을 이용해 먼 거리의 의사가 환자의 증상을 듣거나 간단한 기기들로 검사를 진행하는 진료방식
원격모니터링 (telemonitoring)	병원 밖의 환경에서 디지털헬스케어기기 등 다양한 방식으로 측정된 '환자데이터'를 병원등으로 전송해 의료인에게 데이터를 분석받고, 이에 따른 진료 등의 권고를 받는 것
디지털치료기기 (digital therapeutics)	질병 또는 장애를 예방, 관리 및 치료하기 위해 환자에게 직접 적용되는 근거기반(evidence-based)의 소프트웨어 제품

Source :  
원격의료 합법화를 고려한 건강보험 정책 제언: 원격진료플랫폼, 원격모니터링기기, 디지털 치료기기 및 재택치료의료기기 중심으로, 한구영 외, HIRA RESEARCH 2022;2(1):36-46 | pISSN 2765-6764 eISSN 2765-7353 <https://doi.org/10.52937/hira.22.2.1.36>



# What is remote monitoring?



## 1 SCHEDULE

Clinic schedules dates for the patient to send information from their device to the clinic.

## 2 SEND

Device information is sent automatically (for wireless ICDs) or manually by the patient (for pacemakers).

## 3 TRANSMIT

Device information travels from the remote monitor to the clinic.

## 4 REVIEW

The clinic reviews the device information on a secure website.



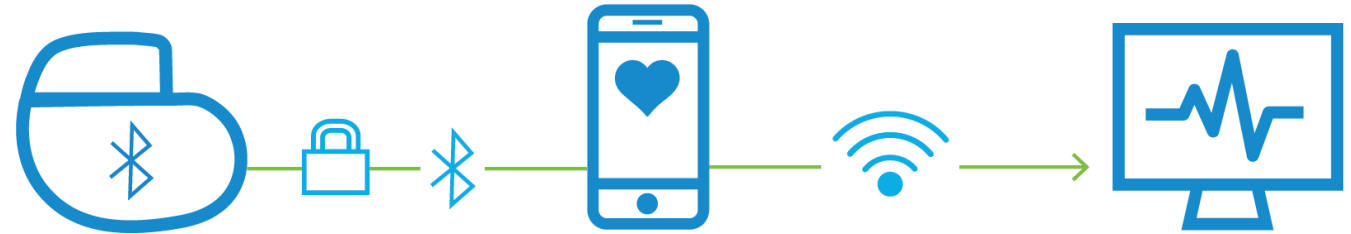
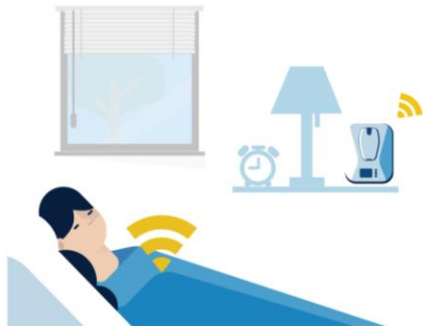
# What is remote monitoring?



## TRADITIONAL

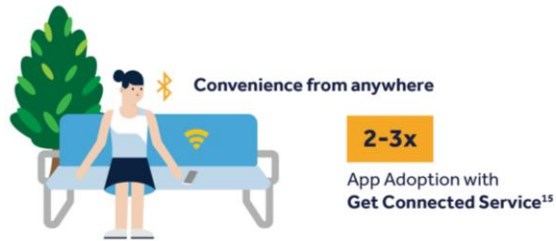
The majority of cardiac devices still require dedicated hardware.

- Typically plugged in at bedside
- 77% patient adherence<sup>14</sup>

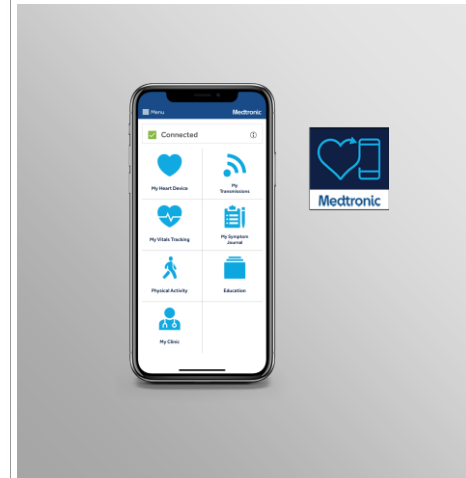
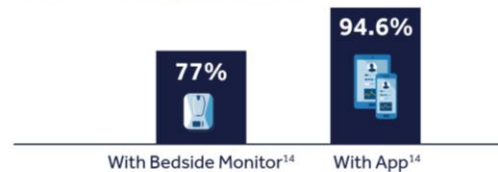


## MEDTRONIC

- Patients can use their own smartphone.
- ✓ Available across all Medtronic cardiac device types.



Patient Adherence to remote transmission guidelines



# CareLink - Medtronic

## Medtronic CareLink™ Network

### Transmission Views

- New Transmissions** 8
  - With Events
  - Without Events
- CareLink Express Transmissions
- Viewed Today** 1

Customize Transmission Views

### Manage My Patient Views

- New Patients
- Missed Transmissions** 94
- No Schedules** 137
- Device Replacements** 1
- Disconnected Monitors** 79
- Device Programming Status** 2
- Unsuccessful Alert Changes
- No Transmissions** 16
- Pending Patient Transfers

Customize Manage My Patient Views

### Medtronic

Introducing CareLink SmartSync™ MRI Access

### Quick Links

[Add a Patient Transmission Schedule](#)

### Announcements

Medtronic CareLink™ Network

Clinician website for monitoring Medtronic cardiac devices.

[Access CareLink](#)

Related Sites  
[Patient Information Site](#) | [Medtronic Support Personnel](#)

Keyword Search

patient name or ID; device model or serial number

100 per page

Alerts	Event Summary	Status	Device	HF Risk	Battery
20	No Events	Viewed	Cobalt™ DR 30-Nov-1993	Unavailable	3.07 V
20	No Events	Viewed	Cobalt™ DR 30-Nov-1993	Unavailable	3.07 V
20	No Events	Viewed	Cobalt™ VR 30-Nov-1993	Unavailable	3.14 V
Patton, Charles	1:44 AM (Initial Setup) 04-Sep-2020 4:17 PM (Initial Setup)	Viewed	Crome™ VR 30-Nov-1993	Unavailable	3.11 V
Pete, Joseph (2)	08-Jul-2020 9:47 AM	Viewed	Micra VR TCP 30-Nov-1993	Unavailable	2.94 V
	09-Jun-2020 9:47 AM	Viewed	Micra VR TCP 30-Nov-1993	Unavailable	2.94 V
Farrel, Victoria (2)	07-Jul-2020 9:44 AM	Viewed	Micra VR TCP 30-Nov-1993	Unavailable	3.02 V
	06-Jul-2020 9:44 AM	Viewed	Micra VR TCP 30-Nov-1993	Unavailable	3.02 V
Norwood, Roger	24-Nov-2013 2:28 PM (Initial Setup)	Viewed	Viva™ XT CRT-D 30-Nov-1993	Unavailable	3.01 V



# Merlin.net - Abbott

Abbott Signed in as **E Cunningham** Help Switch to Sign Out

**Merlin.net™ Patient Care Network**

Recent Transmissions Patient List Tools Clinic Administration

My Patients All Search by Name, ID, Dx Archive Print More Actions

Patient	Transmission	Schedule	Device	DirectAlerts™	Alerts List
Craft (VT w/ ATP), Mr.	07-06-2012, 09:08 AM Patient initiated	09-17-2012 73 days	Current™ VR RF, 1207-36 : 60391	🚩	Successful ATP; Alert Episodes: 2
Aybar (AT/AF burden), Mr.	07-06-2012, 06:16 AM Scheduled	05-21-2014 684 days	Accent™ DR RF, 2210 : 60351	🚩	AT/AF burden; PMT detection;
Craft (VT w/ ATP), Mr.	07-06-2012, 02:40 AM	09-17-2012 73 days	Current™ VR RF, 1207-36 : 60391	🚩	Successful ATP; Alert Episodes: 2
Harris (VT), Mrs.	07-28-2012, 06:40 AM Alert initiated	10-16-2012 80 days	Fortify™ DR, 2231-40 : 60371	🚩	Successful ATP;
Harris (VT), Mrs.	07-24-2012, 06:00 AM	10-16-2012 84 days	Fortify™ DR, 2231-40 : 60371	🚩	Successful ATP;
Harris (VT), Mrs.	07-21-2012, 06:38 AM	10-16-2012 87 days	Fortify™ DR, 2231-40 : 60371	🚩	Successful ATP;
Miller (VT/VF Shock), Mr.	07-30-2012, 04:50 AM Alert initiated	10-22-2012 84 days	Current™ VR RF, 1207-36 : 60401	🚩	HV therapy;

Merlin.net™ Patient Care Network

**Abbott**

Welcome to Merlin.net™

First ID:

Password:

[Sign In](#)

Forgot user ID or password.

Abbott Signed in as **T Marks** Help Switch to Sign Out

**Merlin.net™ Patient Care Network**

Recent Transmissions Patient List Tools Clinic Administration

Active Clinic Patients All Search by Name, ID, Dx Enroll a new patient More Actions

Patient	Patient Status	Device	Implant Date	Transmitter Software Version	All Transmissions	Latest Transmission	Next Transmission	Connectivity	Last Transmitter Communication	Latest Comments
Aybar (AT/AF burden) Mr.		Accent® DR RF, 2210 60351	12-04-2009		0 Remote 0 In-clinic		05-21-2014 --	🚫 Inductive Not monitored	07-29-2017	📝 On vacation until September 20th and leaving transmitter at ...
Baur Jake		Promote Quadra®, 3237-40 204490			0 Remote 0 In-clinic		none	🔌 Not Paired		📝
Bennett Tony		Ellipse DR, 2411-36 128810	10-10-2011	v8.2.2	0 Remote 0 In-clinic		04-02-2014 --	✅	06-23-2020	📝
Bickford (AT/AF Episodes) Ms.		Accent® DR RF, 2210 60421	06-03-2010	v8.2.2	10 Remote 4 In-clinic	07-06-2012 04:23 AM	08-30-2012 55 days	✅	06-23-2020	📝
Childs (Shock) Mr.		Promote® RF, 3207-36 60311	07-09-2008		3 Remote 1 In-clinic	07-28-2012 10:39 PM	03-28-2014 608 days	🚫 No Communication >30 days	08-02-2017	📝 Increased shortness of breath, Drop in daily activity level.
Freeman (AT/AF) Mr.		Accent® DR RF, 2210 60301	07-07-2010	v8.2.2	0 Remote 0 In-clinic		08-26-2012 --	🕒 Snoozed 1 days remaining		📝
Freeman (lead extraction) Mrs.		Fortify® DR, 2231-40 60441	09-02-2010	v8.2.2	3 Remote 2 In-clinic	07-26-2012 06:56 AM	08-14-2012 19 days	✅	06-23-2020	📝
Garcia Alex		Accent® SR RF, 1210 60901	08-03-2017		0 Remote 0 In-clinic		08-24-2017 --	🚫 Disabled	08-02-2017	📝



# Why remote monitoring is needed?



Increase clinic efficiency



Reduce time to decision



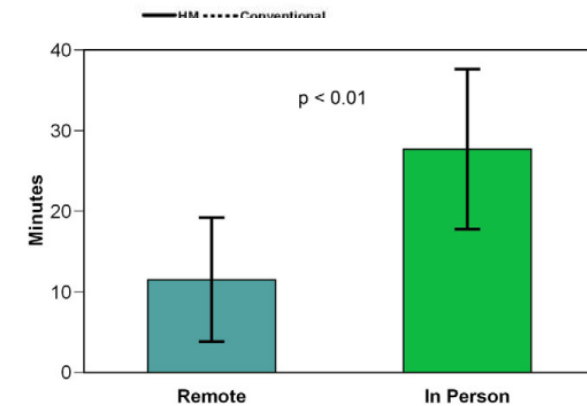
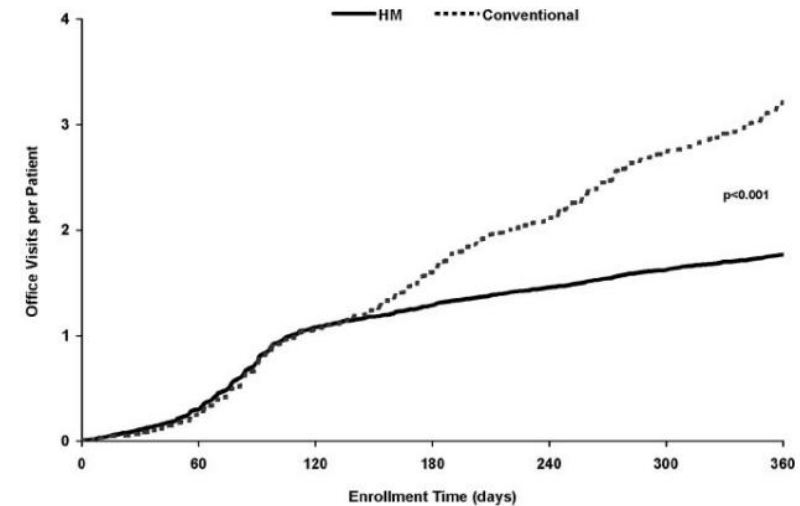
Increase survival rate



# Why remote monitoring is needed?

## Increase Clinic Efficiency

- The mean number of in-clinic and hospital visits was 2.1 per patient-year in the HM group compared with 3.8 per patient-year in the conventional group. Hence, **total in-office visits were reduced 45% in the HM group at 12 months.**
- The mean time spent per transmission was  $11.5 \pm 7.7$  minutes, which was **less than in-person interrogations** ( $27.7 \pm 9.9$  minutes).



**Figure 1** Time to process remote transmissions and in-person follow-ups. Processing of remote transmissions was faster than in-person follow-ups, taking  $11.5 \pm 7.7$  minutes vs  $27.7 \pm 9.9$  minutes.

Source :

- Efficacy and Safety of Automatic Remote Monitoring for Implantable Cardioverter-Defibrillator Follow-Up The Lumos-T Safely Reduces Routine Office Device Follow-Up (TRUST) Trial, Niraj Varma etc, Circulation. 2010;122:325-332.
- Remote monitoring of cardiovascular devices: a time and activity analysis. Edmond M. cronin etc, Heart Rhythm 2012;9:1947-1951

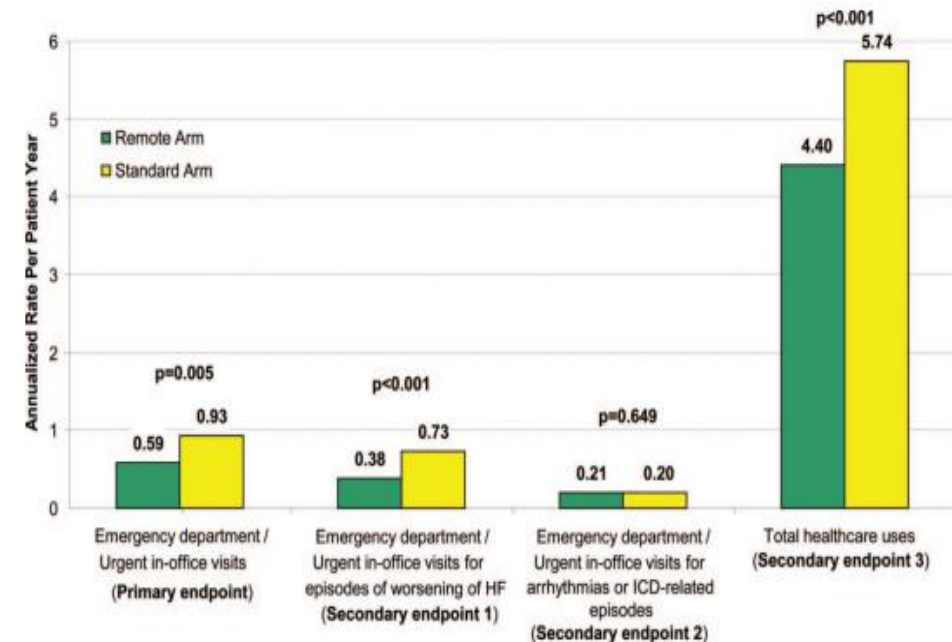




# Why remote monitoring is needed?

## Increase Clinic Efficiency

- Over 16 months, such visits were **35% less frequent in the remote arm** (75 versus 117; incidence density, 0.59 versus 0.93 events per year)



Source :

Remote Monitoring Reduces Healthcare Use and Improves Quality of Care in Heart Failure Patients With Implantable Defibrillators The Evolution of Management Strategies of Heart Failure Patients With Implantable Defibrillators (EVOLVO) Study, Maurizio Landolina etc, Circulation. 2012;125:2985-2992



# Why remote monitoring is needed?

## Reduce time to clinical decision

- The median time from clinical event to clinical decision per patient was reduced from 22 days in the in-office arm to **4.6 days in the remote arm**

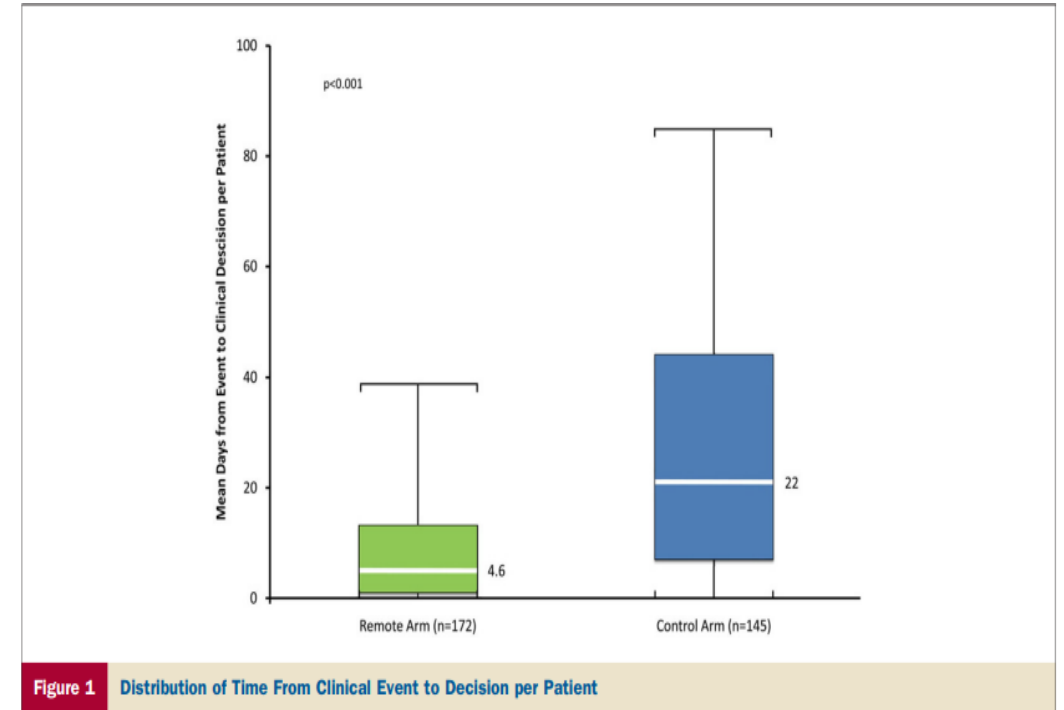


Figure 1 Distribution of Time From Clinical Event to Decision per Patient

Source :

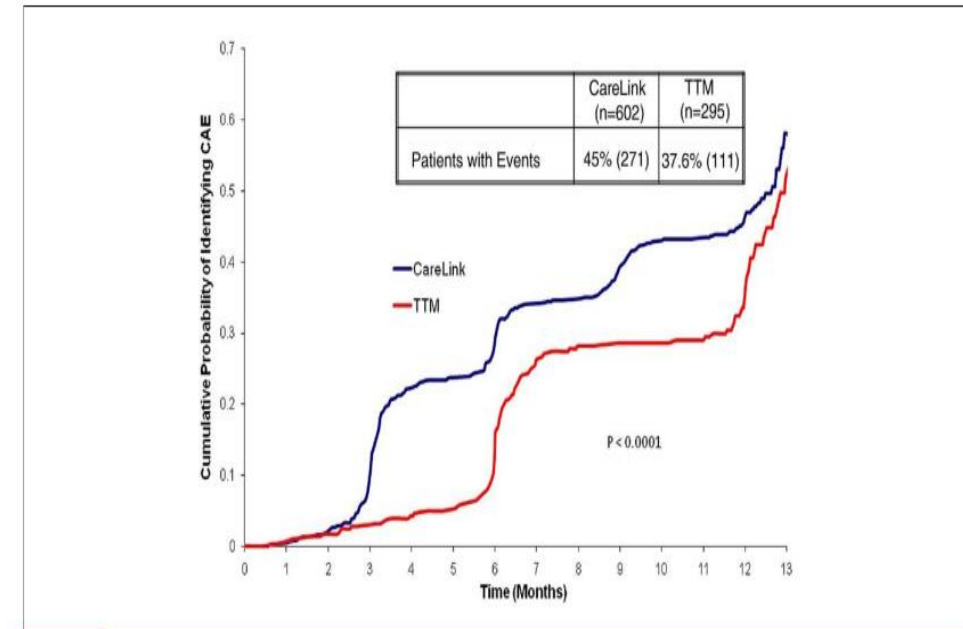
The CONNECT (Clinical Evaluation of Remote Notification to Reduce Time to Clinical Decision) Trial, George H. Crossley etc, J Am Coll Cardiol 2011;57:1181-9



# Why remote monitoring is needed?

## Reduce time to clinical decision

- The mean time to first diagnosis of clinically actionable events was **earlier in the Remote arm (5.7 months)** than in the Control arm (7.7 months).



Source:

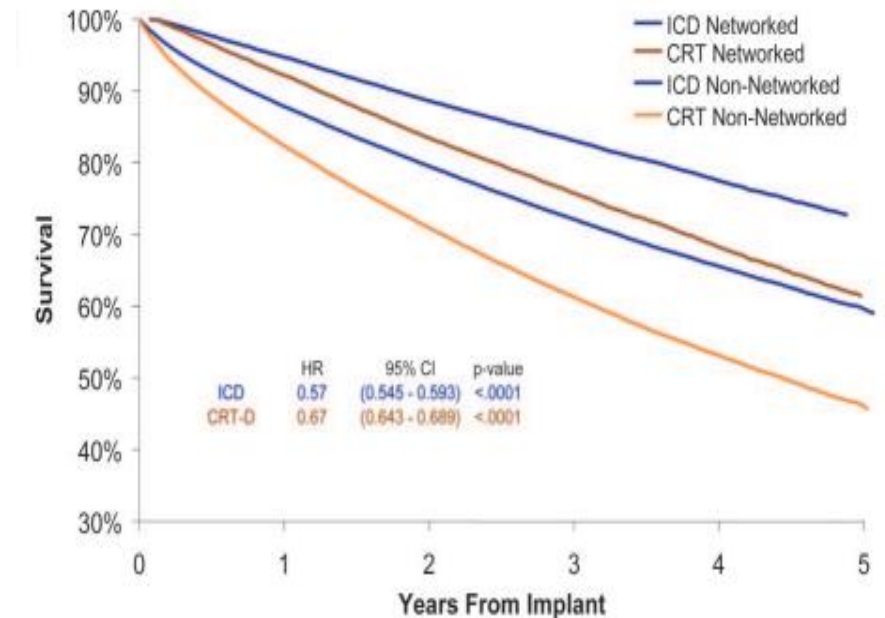
Clinical Benefits of Remote Versus Transtelephonic Monitoring of Implanted Pacemakers, George H. Crossley etc, J Am Coll Cardiol 2009;54:2012-9



# Why remote monitoring is needed?

## Increase survival rate

- For the 69,556 ICD and CRT-D patients receiving remote follow-up on the network, 1- and 5-year survival rates were higher compared with those in the 116,222 patients who received device follow-up in device clinics only (50% reduction; P0.0001).



Source:

Long-Term Outcome After ICD and CRT Implantation and Influence of Remote Device Follow-Up The ALTITUDE Survival Study, Leslie A. Saxon etc, Circulation. 2010;122:2359-2367.



# Patient perspective on remote monitoring

## Advantages

- Quickly informed in case of lead problems, arrhythmias or ICD shocks
- Feeling reassured
- Possibility for continuous monitoring while being abroad/on vacation
- Subjective symptoms can be objectified quickly without an in-person visit
- No need for manual data transfer

Source :

Hillmann HAK, Hansen C, Przibille O and Duncker D (2023) The patient perspective on remote monitoring of implantable cardiac devices. *Front. Cardiovasc. Med.* 10:1123848.



# Patient perspective on remote monitoring

## Disadvantages

- Unauthorized access of the CIED through a third party
- Data privacy
- Shorter cied-battery life(smartphone as well)
- Considerations regarding the handling of the transmitter
- Electromagnetic interferences
- No feedback if the transmitter/remote monitoring is working fine/if data transfer is working

Source :

Hillmann HAK, Hansen C, Przibille O and Duncker D (2023) The patient perspective on remote monitoring of implantable cardiac devices. *Front. Cardiovasc. Med.* 10:1123848.



# remote monitoring in Korea

- 2020년 2월 코로나19 이후 원격의료라는 용어 대신 비대면 진료라는 용어 사용
- 감염병 유행상황에서 한시적으로 허용된 유선, 무선, 화상통신, 컴퓨터등 정보통신 기술을 활용하여 의료기관 외부에 있는 환자에게 건강 또는 질병의 지속적 관찰, 진단, 상담 및 처방을 하는 것
  - 감염병예방법 제 49조3(의료인, 환자 및 의료기관보호를 위한 한시적 비대면 진료)
- 원격진료에 대한 반대(법적책임,원격진료수가)이유로 인하여 원격진료금지가 현재 진행중.

Source :

원격의료 합법화를 고려한 건강보험 정책 제언: 원격진료플랫폼, 원격모니터링기기, 디지털 치료기기 및 재택치료의료기기 중심으로, 한구영 외, HIRA RESEARCH 2022;2(1):36-46 | pISSN 2765-6764 eISSN 2765-7353 <https://doi.org/10.52937/hira.22.2.1.36>  
팬데믹 이후 원격의료 시장의 성장과 시사점, 황인창 외, KIRI 리포트 포커스 2022.5.2



# Pre-pandemic restrictions to the use of telemedicine were relaxed in early 2020

Use of telemedicine before and after the start of the COVID-19 pandemic

Medical consultations can only be performed in the physical presence of the patient		Teleconsultations are only allowed if the patient has consulted the health care worker in-person in the past		Real-time (synchronous) teleconsultations are covered by government / compulsory financing schemes		Remote patient monitoring services are covered by government / compulsory financing schemes	
BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
	Korea		Australia*		Australia		Canada
Estonia	Estonia		Czech Republic		Canada		Finland
Hungary	Hungary		Netherlands		Costa Rica		France
Iceland	Iceland		Mexico		Finland		Iceland
Ireland	Ireland	Estonia	Estonia		France		Israel
Luxembourg	Luxembourg	Luxembourg	Luxembourg		Germany		Japan
Mexico	Mexico	France	France		Iceland		Netherlands
Türkiye	Türkiye	Iceland	Iceland		Ireland		Norway
United States	United States	Ireland	Ireland		Israel		Poland
	Australia		Japan		Japan		Portugal
	Austria		Lithuania		Lithuania		Sweden
	Belgium		New Zealand		Netherlands		Türkiye
	Canada		United States		New Zealand		United States
	Costa Rica	Korea	Korea		Norway	Belgium	Belgium
	Czech Republic		Austria		Poland	England	England
	England		Belgium		Portugal	Estonia	Estonia
	Finland		Canada		Slovenia	Germany	Germany
	France		Costa Rica		Sweden	Ireland	Ireland
	Germany		England		Switzerland	Latvia	Latvia
	Israel		Finland		Türkiye	Switzerland	Switzerland
	Japan		Germany		United States	Hungary	Hungary
	Latvia		Hungary		Belgium		Australia
	Lithuania		Israel		Czech Republic		Costa Rica
	Netherlands		Latvia		England		Czech Republic
	New Zealand		Norway		Estonia		Lithuania
	Norway		Poland		Latvia		Luxembourg
	Poland		Portugal		Luxembourg		Mexico
	Portugal		Slovenia		Hungary		Korea
	Slovenia		Sweden		Korea		New Zealand
	Sweden		Switzerland		Mexico		Slovenia
	Switzerland		Türkiye		Austria		Austria

Legend: Yes No Missing

Source: OECD (2023[3]), *The COVID-19 Pandemic and the Future of Telemedicine*, <https://doi.org/10.1787/ac8b0a27-en>.





# remote monitoring in Korea

- 원격진료와 원격 모니터링의 차이에도 불구하고 원격 모니터링을 원격진료에 포함하여 금지하고 있음.
- 원격모니터링 시범사업 진행중.
- 원격모니터링을 위한 건강보험수가 문제.

Source : 보건복지부



## 참고

## 심장질환자 재택의료 시범사업

### □ 사업 개요

- (주요내용) 심장질환으로 삽입형 제세동기(ICD), 심장 재동기화 치료기(CRT), 심박기(Pacemaker)를 삽입한 재택환자를 대상으로 환자 교육·상담 및 비대면 관리 등 의료서비스를 제공하고, 서비스 제공 참여기관에 시범수가를 적용하고자 함
- (대상자) 삽입형 제세동기(ICD), 심장 재동기화 치료기(CRT), 심박기(Pacemaker)를 삽입한 심장질환자로서 시범사업 참여에 동의한 자
- (참여기관) 종합병원급 이상 의료기관으로서
  - 심장질환자 재택의료 서비스 제공에 필요한 인력 기준을 충족\*하고 시범사업 참여 신청 및 선정을 통해 참여 기관으로 등록완료된 기관
    - \* 「의료법」 제3조제2항제3호바목에 따른 종합병원급 의료기관
    - \*\* (의사) 심장내과·흉부외과 진료담당 전문의 또는 전공의 (간호사) 간호사 면허소지자 [해당 분야 실무경력 3년 이상인 자]
- (사업기간) 약 2년 3개월('20.10.14. ~ '22.12.31.)
  - \* '22년 하반기 구간 시범사업 효과평가 결과에 따라 시범사업 기간 연장 또는 본사업 전환여부 검토

### □ 수가 적용방안

- (주요내용) 의료인이 심장질환자에게 체계적인 교육상담과 재택환자관리 서비스를 제공하고, 이에 따른 적정 수준의 교육상담료(대면) 및 환자관리료(비대면) 수가 산정

# remote monitoring in Korea

- (본인부담률) 교육상담료 10%\*, 환자관리료 면제

\* 차상위 계층 및 의료급여 수급권자는 본인일부부담금 면제

구분	수가 수준	행위 주체	세부 기준
교육상담료 I	40,520원	의사	<ul style="list-style-type: none"> <li>• 외래에서 산정</li> <li>• 연 4회 이내, 횡수당 15분 이상</li> </ul>
교육상담료 II	25,530원	의사, 간호사	<ul style="list-style-type: none"> <li>• 입원 · 외래에서 산정</li> <li>• 초기연도 연 6회 이내, 차기연도 연 4회 이내</li> <li>• 횡수당 30분 이상</li> </ul>
환자관리료	27,380원	의사, 간호사	<ul style="list-style-type: none"> <li>• 월 1회 환자상태 확인 및 비대면 관리서비스 제공시 월 1회 산정 (연 최대 12회)</li> </ul>

코드명	행위내용	수가(\$)*
CPT 99453	Initial set-up & patient education on equipment (one-time fee): 초기 세팅, 환자 교육(최초 1회 적용)	19.04
CPT 99454	Sply of devices, collection, transmission, and report/summary of services to the clinician: 기기 제공, 수집, 전송, 보고/서비스 요약	55.72
CPT 99457	Remote physiologic monitoring services by clinical staff/MD/QHCP first 20 cumulative minutes of RPM services over a 30-day period: 30일간 최초 20분 누적된 환자생체기록	50.18
CPT 99458	Remote physiologic monitoring services by clinical staff/MD/QHCP for an additional cumulative 20 minutes of RPM services over a 30-day period: 30일간 추가 20분 누적된 환자생체기록	40.82
CPT 99091	Collection and interpretation of data by physician or QHCP, 30 minutes: 데이터 수집 및 해석	56.41
CPT 99441	Telephone consultation (5-10 min): 전화 진료(5-10분)	14.44
CPT 99442	Telephone consultation (10-20 min): 전화 진료(10-20분)	28.15
CPT 99443	Telephone consultation (20-30 min): 전화 진료 (20-30분)	41.14

CPT, current procedural terminology; MD, Doctor of Medicine; QHCP, qualified health care professional; RPM, remote physiologic monitoring.

\*수가는 지역별로 상이하며 변동 가능.

Source :

보건복지부

원격의료 합법화를 고려한 건강보험 정책 제언: 원격진료플랫폼, 원격모니터링기기, 디지털 치료기기 및 재택치료의료기기 중심으로

원격의료 합법화를 고려한 건강보험 정책 제언: 원격진료플랫폼, 원격모니터링기기, 디지털 치료기기 및 재택치료의료기기 중심으로, 한구영 외, HIRA RESEARCH 2022;2(1):36-46 | pISSN 2765-6764 eISSN 2765-7353 <https://doi.org/10.52937/hira.22.2.1.36>



# remote monitoring in Korea

## Remote monitoring 위해 해결해야 할 과제

- 코로나 이후 원격진료를 경험한 환자들의 원격진료 요구 상승.
- 원격 모니터링을 위한 신뢰성 확립(의료인, 환자에 대한 교육 및 자금증해결).
- 의료사고시 책임소재의 세분화, 의료정보 보안 및 관리에 대한 인프라 구축.
- 원격 모니터링에 대한 건강보험 수가 확립 (초기세팅, 사용자교육, 데이터 분석 및 해석).
- 고령화로 인하여 원격모니터링 기기사용의 한계점 극복.
- 의료기관 접근성이 좋고, 대면진료를 선호하는 고령환자의 인식 개선.
- 원격 모니터링으로 인한 대형병원으로의 환자 쏠림문제.

Source :

원격의료 합법화를 고려한 건강보험 정책 제언: 원격진료플랫폼, 원격모니터링기기, 디지털 치료기기 및 재택치료의료기기 중심으로, 한구영 외, HIRA RESEARCH 2022;2(1):36-46 | pISSN 2765-6764 eISSN 2765-7353 <https://doi.org/10.52937/hira.22.2.1.36>  
팬데믹 이후 원격의료 시장의 성장과 시사점, 황인창 외, KIRI 리포트 포커스 2022.5.2



# Conclusions

- 코로나 19 이후 전세계적으로 원격진료 및 원격 모니터링에 대한 규제완화 및 관련 정책이 늘어나고 있음.
- 원격 모니터링은 환자 및 의료기관 모두에게 장점이 있음.
- 한국은 법규 및 집단간 이해관계로 인하여 원격진료가 금지되어 있고 원격모니터링도 금지되어 있음.
- 원격모니터링을 위한 의료인 및 환자의 인식개선, 신뢰성 확보, 건강보험수가 개선 등 수많은 해결과제들이 존재함.

