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URGENT: MEDICAL DEVICE COMMUNICATION

HeartWare™ Ventricular Assist Device (HVAD™) System:

Communication update regarding failure/delay to restart pump events

August 23, 2023

Dear Health Care Professional,

This letter is a follow-up to our December 2020, May 2021, December 2021, and October 2022 communications titled "Urgent Medical Device Communication," where Medtronic communicated that an identified subpopulation (defined as subgroups 1 and 2) of HeartWare™ Ventricular Assist Device (HVAD™) Systems may experience a delay to restart or failure to restart at a higher rate than the overall population of HVAD Systems. **Medtronic is providing this letter (1) to inform you about an additional subgroup population, subgroup 3, defined below; (2) to communicate current failure rates associated with a failure/delay to restart pump event and (3) to reiterate existing patient management recommendations.** Medtronic is sending this communication to all clinicians with patients currently on HVAD support. **It is important to note that this issue does not cause a running HVAD pump to stop; rather, the pump may fail to restart after a pump stop event.**

Summary Information:

1. Initially, the restart failure rate of pumps in **subgroup 3** was in line with that of the general HVAD population. However, as the duration of support has increased, the failure rate has risen and now resembles the higher rate observed in subgroup 1. See Appendix A for a detailed description of subgroups and patient events, including clinical experience with unapproved controller software. See Appendix D for the list of serial numbers of devices in subgroup 3.

2. **Patient management recommendations previously communicated for subgroups 1 and 2 have not changed and also apply to subgroup 3. (See Appendix C).**

3. Table 1 below presents the cumulative probabilities of experiencing a pump stop resulting in either a failure or delay to restart, or a failure or delay to restart leading to a device exchange, decommission, or death after three (3) years. See Appendix B for additional information on cumulative failure rates over time for each device population.

Group	Patients on Support	Cumulative probability of experiencing a pump that results in a failure or delay to restart (at 3 years)	Cumulative Probability of Device Exchange, Decommission, or Death Due to a failure or delay to restart pump event (at 3 years)
Subgroup 1	38	2.7%	1.4%
Subgroup 2	17	31.0%	27.5%
Subgroup 3	~300	3.3%	3.0%
General Population Pumps	~2,000	0.5%	0.1%

Table 1. Cumulative probabilities for each subgroup and general population at 3 years

Detailed Information:

Appendix A — Descriptions of subgroups 1-3 and event information, including clinical experience with unapproved controller software.

Appendix B – Competing risks analysis: cumulative failure rates over time for each device population

Appendix C – Patient management recommendations

Appendix D – Model and serial numbers of active devices included in the existing and expanded subgroups. Device serial numbers for pumps that are confirmed to no longer be in use are not included in the Appendix D list.

Please discuss this new information with your patients as appropriate. Medtronic has provided a Patient Communication Template to facilitate your discussions with patients (attached).

Customer Actions:

- Complete the enclosed Customer Confirmation Form. When complete please return the form to rs.cfqfca@medtronic.com.
- Please share this notice with all those who need to be aware within your organization.

Additional Information:
Adverse reactions or quality problems experienced with this product may be reported to the FDA's MedWatch Adverse Event Reporting program either online, by regular mail, or by fax.

- Complete and submit the report online: www.fda.gov/medwatch/report.htm
- Regular Mail or Fax: Download form from www.fda.gov/medwatch/getforms.htm or call 1-800-332-1088 to request a reporting form, then complete and return to the address on the pre-addressed form, or submit by fax to 1-800-FDA-0178

We appreciate your prompt attention to this matter. If you have any questions regarding this communication, please contact your Medtronic Field Representative.

Sincerely,

Gail Schroeder
Vice President, Quality and Regulatory
Medtronic Mechanical Circulatory Support

Appendix A: Current Failure or Delay to Restart Rates

There have been two (2) suppliers (Supplier A and Supplier B) of the HVAD pump impeller component. A pump failure or delay to restart is linked to an interaction between the impeller and the top housing. Medtronic has identified three distinct subgroups from specific impeller manufacturing lots that have a higher occurrence rate than the general pump population. All affected impellers were produced by Supplier B. Previous communications have discussed subgroups 1 and 2. Current data analysis has identified a third subgroup (described below).

- **SUBGROUP 1** includes 316 distributed pumps manufactured from the first lot of impellers from supplier B, exhibiting 13 events of a delay or failure to restart, 4of which involved a patient death. Our records indicate there are currently 38 patients on support with a pump from subgroup 1.
- **SUBGROUP 2** includes 174 distributed pumps manufactured from the 2 subsequent lots of impellers from supplier B, exhibiting 43 events of a delay or failure to restart, 14 of which involved a patient death. Our records indicate that there are currently 17 patients on support with a pump from subgroup 2.
- **SUBGROUP 3** includes 1,027 distributed pumps manufactured from the remaining 8 additional lots of impellers from supplier B, exhibiting 32 events of a delay or failure to restart, 9 of which involved a patient death. Our records indicate there are approximately 300 patients on support with a pump from subgroup 3. The failure rate in this population initially aligned with the general population; however, it has increased over time and is now similar to the rate of subgroup 1.
- **GENERAL POPULATION PUMPS.** Pumps in the general population are manufactured with impellers from supplier A. Our records indicate there are currently approximately 2,000 patients on support in the general population.

Table 2 below summarizes the 88 patient events reported in Subgroups 1, 2 and 3:

Category	# of Events
Death	27
Reoperation with VAD exchange	22
Intraoperative Pump Exchange	6
Cardiac Arrest	1
Hospitalization	11
Worsening Heart Failure	1
Hypoperfusion	1
Asymptomatic VAD stop event	19
Total # of Events	**88**

Table 2: Total number of events categorized for Subgroup 1, 2 and 3 combined

Clinical experience with unapproved controller software

To provide clinicians information on the use of the unapproved controller software in order to make informed decisions, clinical experience information is included below. There have been six instances where the unapproved controller software was used in attempting to restart a pump. The pump restarted in four of the six instances. Of the four restarts, one (1) was in subgroup 2, one (1) was in subgroup 3 and two (2) were in the general population. For the pumps that restarted with the unapproved controller software, no adverse events have been reported from use.

- The first instance was for a patient who required a controller exchange in March 2022. This patient's pump was in the subgroup 2 population, and the patient was not a candidate for a pump exchange. During the three years preceding this event, the pump had multiple successful restarts with a standard controller. In this instance, a standard back-up HVAD controller failed to restart the pump after five attempts. The clinician then used the HVAD controller with the unapproved software and was able to restart the pump on the first attempt. Hence, the unapproved software controller became the patient's primary controller.
- The second instance was for a patient who required a controller exchange in July 2022. This patient's pump was in the general population and the patient was not a candidate for a pump exchange. The patient's pump had been off for over 18 hours. After five failed restart attempts using a standard back-up HVAD controller, the clinician exchanged to the HVAD controller with the unapproved software. After multiple attempts with the unapproved software HVAD controller, the pump did not restart. The patient was placed under hospice care.
- The third instance was for a patient who required a controller exchange in March of 2023. The patient's pump was in the subgroup 3 population. The controller exhibited a controller fault alarm and the patient exchanged the controller. The standard back-up controller failed to restart and the patient switched back to the primary controller where the pump successfully restarted. The patient was hospitalized for observation and the controller exhibited a controller fault alarm again. A controller exchange was performed directly to the controller with the unapproved controller software and the pump started after 5 attempts. Hence, the unapproved controller became the patient's primary controller.
- The fourth instance was for a general population patient that required a controller exchange due to a high priority alarm in April of 2023. The pump did not restart with the standard back-up controller, however restarted after 2 attempts with the controller with the unapproved software. Hence, the unapproved controller became the patient's primary controller.
- The fifth instance was for a general population patient that required a controller exchange due to a controller fault alarm, also in April of 2023. After the standard back-up controller was not able to restart the pump, a controller with the unapproved software was used and able to restart the pump. Hence, the unapproved controller became the patient's primary controller.

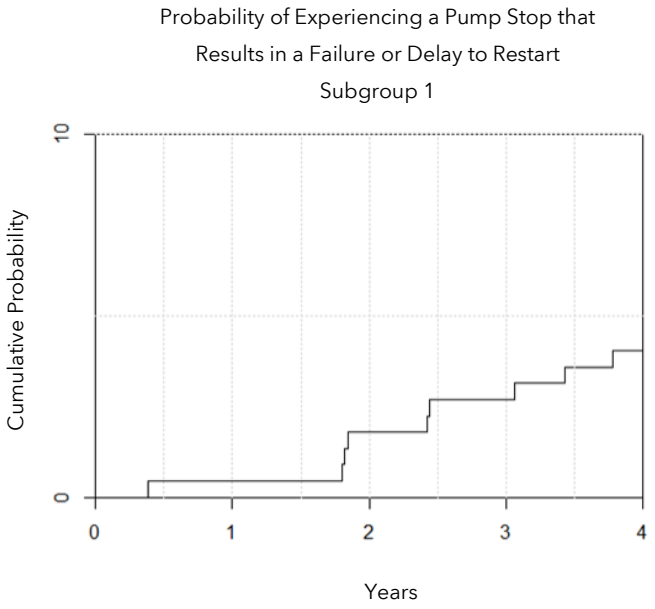
- The sixth instance was for a general population patient who experienced an unexpected pump stop and VAD Stop alarm at home. The patient exchanged the controller to the back-up controller, which failed to restart. The patient was transferred to the hospital where the controller with the unapproved software was attempted, but unsuccessful and the pump remained off. The next day, the patient received a pump exchange to a commercially available device.

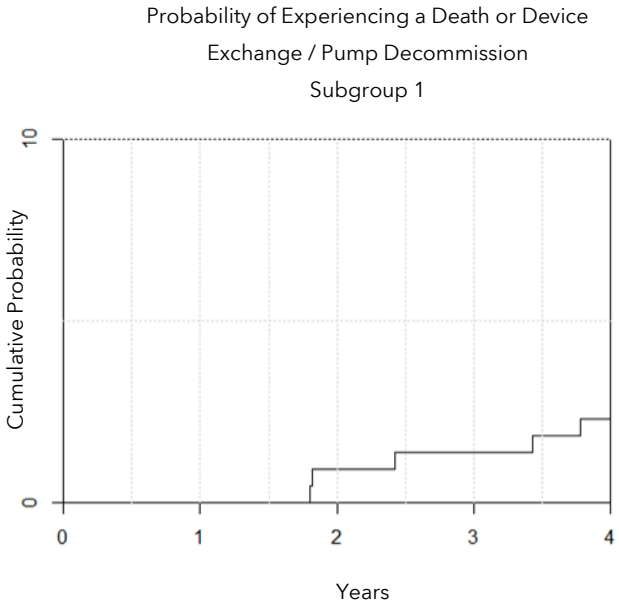
It is not known if any of these results will be typical or representative.

Appendix B: Cumulative Failure Rates for each Device Population

Note: Figures on the left illustrate the rate of pumps failing/delaying to restart at each year on support. Figures on the right illustrate the rate of pumps failing to restart that resulted in death or device exchange at each year on support. Based upon the implant duration for each subgroup the occurrence rates were analyzed to include all available data.

SUBGROUP 1



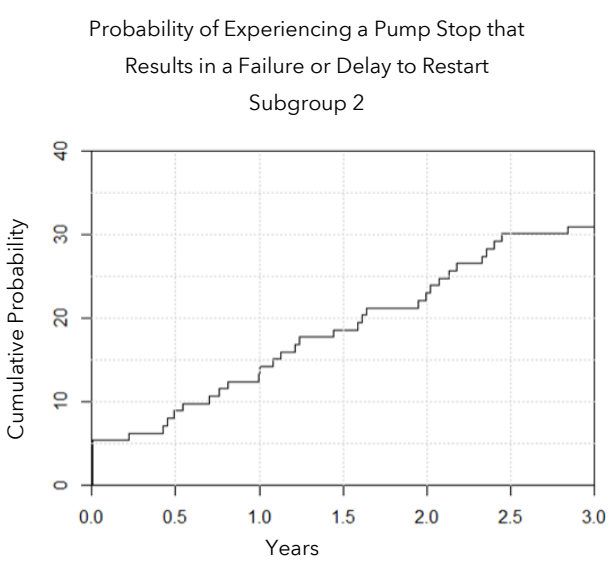


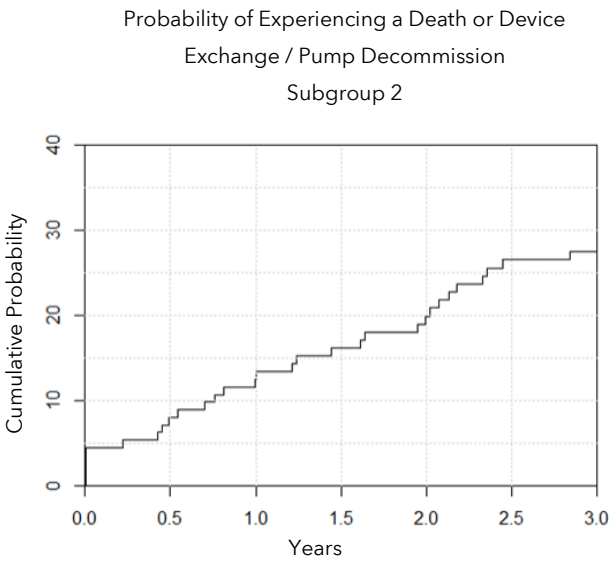
Year	Probability of Failure (95% confidence interval)
1	0.4% (0.1%, 3.2%)
2	1.8% (0.7%, 4.7%)
3	2.7% (1.2%, 5.9%)
4	4.0% (2.1%, 7.7%)

Year	Probability of Failure (95% confidence interval)
1	0%
2	0.9% (0.2%, 3.6%)
3	1.4% (0.4%, 4.2%)
4	2.3% (1.0%, 5.5%)

Figure 1: Cumulative incidence of experiencing a pump stop with delay/failure to restart (left) and the cumulative incidence of failures leading to a pump exchange or death (right) in Subgroup 1.

SUBGROUP 2



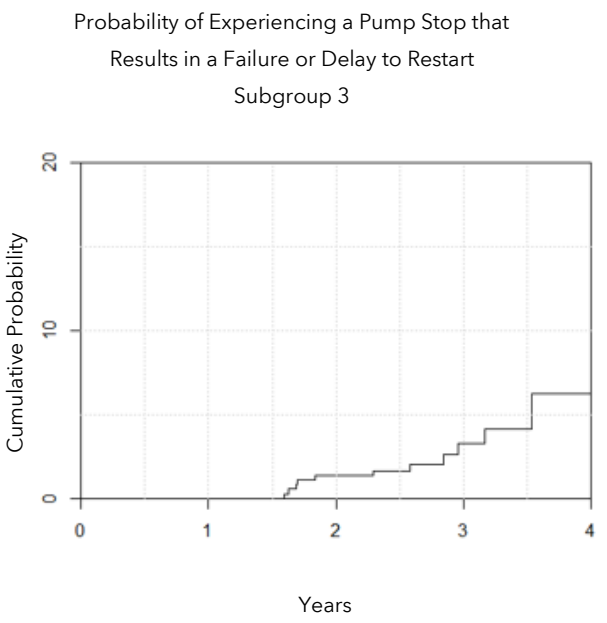


Year	Probability of Failure (95% confidence interval)
1	13.3% (8.3%, 21.3%)
2	23.0% (16.4%, 32.2%)
3	31.0% (23.5%, 40.8%)

Year	Probability of Failure (95% confidence interval)
1	12.5% (7.6%, 20.3%)
2	19.9% (13.7%, 29.0%)
3	27.5% (20.3%, 37.4%)

Figure 2: Cumulative incidence of experiencing a pump stop with delay/failure to restart (left) and the cumulative incidence of failures leading to a pump exchange or death (right) in Subgroup 2.

SUBGROUP 3

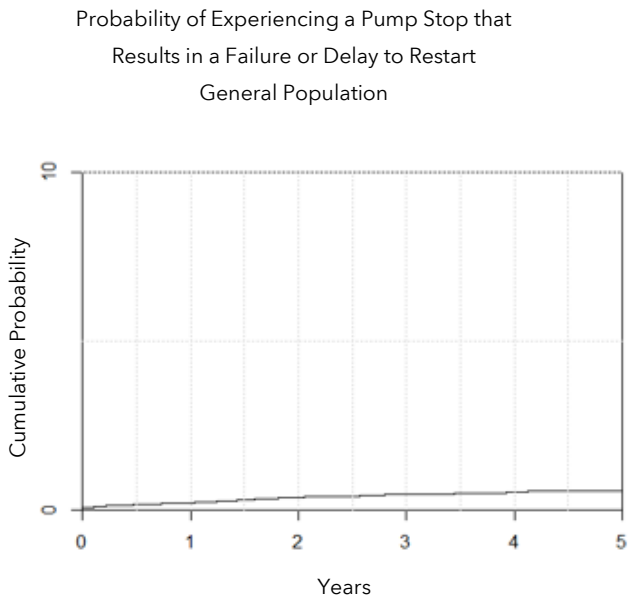


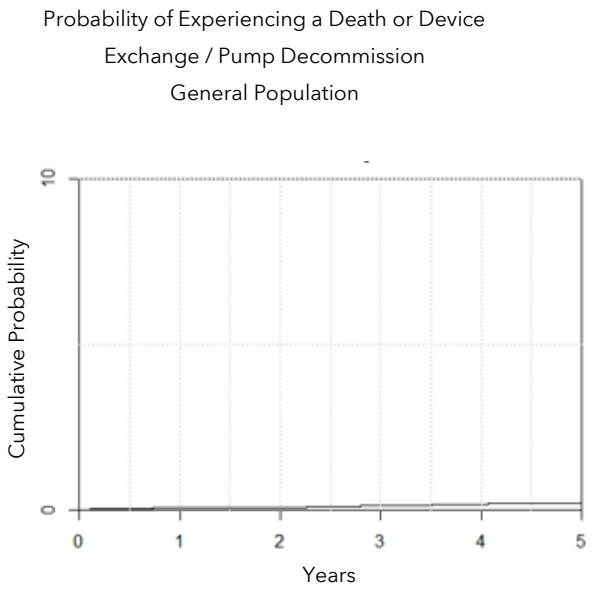
Year	Probability of Failure (95% confidence interval)
1	0%
2	1.3% (0.6%, 3.2%)
3	3.3% (1.7%, 6.6%)
4	6.2% (2.9%, 13.3%)

Year	Probability of Failure (95% confidence interval)
1	0%
2	1.1% (0.4%, 2.8%)
3	3.0% (1.5%, 6.3%)
4	3.9% (1.9%, 7.9%)

Figure 3: Cumulative incidence of experiencing a pump stop with delay/failure to restart (left) and the cumulative incidence of failures leading to a pump exchange or death (right) in Subgroup 3.

GENERAL POPULATION PUMPS





Year	Probability of Failure (95% confidence interval)
1	0.2% (0.1%, 0.3%)
2	0.4% (0.3%, 0.5%)
3	0.5% (0.3%, 0.6%)
4	0.5% (0.4%, 0.7%)
5	0.5% (0.4%, 0.7%)

Year	Probability of Failure (95% confidence interval)
1	0.04% (0.01%, 0.1%)
2	0.05% (0.02%, 0.1%)
3	0.1% (0.07%, 0.2%)
4	0.2% (0.1%, 0.3%)
5	0.2% (0.1%, 0.3%)

Figure 4: Cumulative incidence of experiencing a pump stop with delay/failure to restart (left) and the cumulative incidence of failures leading to a pump exchange or death (right) in the general population.

Appendix C: Patient Management Recommendations

It is recommended that management of patients in the new subgroup 3 follow the recommendations previously provided for subgroups 1 and 2 (see below) and to have prepared an individualized care plan for each subgroup patient, especially patients in subgroup 2. Described below are the patient management recommendations previously provided regarding the delay or failure to restart issue, including considerations for formulating individualized patient management plans.

All Patients on support

- It is recommended that all HVAD healthcare professionals and all HVAD patients, when possible, attach a Controller AC adapter to the controller being used to restart a stopped pump (e.g., during a controller exchange connect the AC adapter to the oncoming controller). Using an AC adapter will provide consistent power and allow for the most efficient troubleshooting and restart attempts. During a sustained period of high-power consumption (i.e., when the HVAD pump is attempting to restart repeatedly), the battery may be temporarily unable to provide power.

Patients in Subgroups 1, 2, and 3

In consultation with our Independent Practitioner Quality Panel, composed of cardiologists, surgeons and VAD coordinators, Medtronic recommends that treatment decisions for patients with a pump identified in the subpopulation of devices (subgroup 1, subgroup 2 and subgroup 3) should be determined on an individual case-by-case basis, and that healthcare providers speak with their patients with affected devices to emphasize avoidance of unnecessary pump stops. It is important to note that this issue does not cause a running VAD to stop; rather, a failure to restart may follow a pump stop event.

Reinforcing IFU

- Since failure to restart is predicated on a pump stop event, reinforce directions within the IFU to patients and staff to prevent unnecessary pump stops:
    - Do NOT disconnect the driveline from the controller.
    - NEVER disconnect both power sources (batteries and AC or DC adapter) from the controller at the same time; one external power source should remain connected to the controller at all times.
    - Do NOT exchange the controller unless explicitly directed by a High Priority alarm condition or a VAD team member.
    - Reinforce the proper response to a [Controller Fault] alarm and [Electrical Fault] alarm. These are Medium Priority alarms unrelated to an immediate pump stop. These alarms will result in the word [Call] in the Controller Display, notifying the patient to call their clinician.
    - Reinforce making good connections of power sources and the data cable in the controller ports.

Controller Exchange

- **Inform patients implanted with a pump in subgroup 1, 2 or 3 to contact their VAD coordinator prior to any controller exchange, and to coordinate performing an exchange of controllers in a clinical setting.**
- Factors that should be considered for a controller exchange include but are not limited to:
    - Whether the patient is a candidate for a pump exchange if the pump does not restart.
    - Patients with a Do Not Resuscitate (DNR) order and co-morbidities.
    - Length of time the patient is expected to remain on therapy. Examples include but are not limited to bridge to transplant care and/or therapeutic recovery potential.
    - Distance/time it will take for the patient to reach the hospital/clinic for support.
    - Patient and caregiver understanding/compliance to alarm response protocols and power source management to prevent unnecessary pump stops.

When Considering a Controller Exchange

- If a patient's controller is beyond two (2) years of service, consider proactively scheduling a controller exchange prior to the internal controller battery reaching end of life and triggering a [Controller Fault] alarm.
- Although a [Controller Fault] alarm is a Medium Priority alarm that is not related to a pump stop, proactively scheduling a controller exchange could help avoid a patient reacting to the alarm by exchanging a controller outside of a clinical setting. Per the IFU, patients should call their clinician upon receiving a Medium Priority alarm and not take any action before receiving guidance from their clinician.
    - BE ADVISED: The pump will not stop due to a Medium Priority alarm alone. A Medium Priority alarm can be temporarily muted according to the IFU to allow time to bring the patient into a clinic to determine the next steps while the pump is still functioning. A Medium Priority alarm can also be permanently silenced pursuant to the IFU; however, clinicians should consider this risk before doing so.
    - BE ADVISED: Considerations should be made on an individual case-by-case basis when deciding whether or not to electively perform a controller exchange. Depending on a number of clinical factors that Medtronic does not have visibility to, clinicians should use their clinical judgment in proceeding with individual patient treatment decisions, as noted above.

When a Controller Exchange is Deemed Necessary

- If a controller exchange is deemed necessary for patients implanted with one of these identified pumps, consider the following:

- Controller exchanges should be performed under clinician supervision in a controlled environment with the immediate ability to put the patient on hemodynamic support. Failure to restart can be fatal.
- Upon a pump stop, a High Priority [VAD Stopped] alarm will result in the text [Change Controller] or [Connect Driveline] on the Controller Display. Once power and driveline connections are reestablished, if the pump does not restart:
  - Consider power cycling (disconnect both power sources and reconnect) of the current controller or consider a controller exchange. This will allow the restart algorithm to reset and start over. The controller automatically attempts to restart the pump a maximum of 30 times; the [VAD Stopped] alarm begins after five (5) attempts.
  - If the pump still does not restart, consider proceeding with exchanging to a controller with the unapproved software, if available. Clinical experience using the controller with the unapproved software is documented in Append A. If the pump still does not start, proceed with hemodynamic support, and possible pump exchange.

Use of Controller with Unapproved Software

- Controllers with the unapproved software should **only** be used when a controller exchange has been deemed necessary for a patient after a standard controller has been unable to restart the pump.
- As previously recommended, continue to avoid unnecessary pump stops. It is not known how effective the unapproved controller software will be in restarting pumps.
- Considerations should be made on an individual case-by-case basis when deciding whether or not to electively perform a controller exchange. If you determine in your medical judgment that potentially using a controller with the unapproved software is the best option for your patient, consider waiting to perform an elective exchange until a controller with the unapproved software has been provided to you.
- The availability of a controller with the unapproved software should not influence your decision to perform an elective controller exchange.
- A controller exchange will stop the pump which can result in a pump failure to restart. The controller with the unapproved software may have a low success rate in restarting pumps that do not restart with a standard controller.
- Medtronic will also provide you with a patient informed consent form (ICF) template that you may use, to be completed and signed by the patient prior to use of the unapproved controller software. Prior to use Medtronic asks that you work with your institution's review processes (such as IRB or Risk Management Board). If you use one of the modified controllers in the future, we request that you please return the form to the Medtronic MCS Office of Medical affairs at: rs.mcsmedicalaffairs@medtronic.com.

- It is recommended that you discuss the unapproved controller software with your patients in advance and obtain consent in the event that the unapproved controller software is needed.

How to request a controller with unapproved software

- To request a controller with the unapproved software, please contact your local Medtronic Field representative to help determine next steps, including confirmation of the controller's availability in your country.

When Considering a Pump Exchange

Routine prophylactic explant of the HVAD device is not recommended, as risks associated with explantation may outweigh the potential benefits[1]. The decision regarding explant and exchange of the HVAD pump should be made by physicians on a case-by-case basis, considering the patient's clinical condition and surgical risks. If a physician determines that pump exchange is appropriate, we recommend exchanging to an alternative commercial LVAD.

Whether the patient is a candidate for an elective pump exchange depends on, but is not limited to:

- Whether the patient has a Do Not Resuscitate (DNR) order
- Co-morbidities
- Length of time the patient is expected to remain on therapy, whether the patient is bridge to transplant, or the patient is destination therapy.

[1] Salerno CT, Jorde UP, Molina E, Cantor R, Pagani FD, Kirklin J. Elective HeartWare HVAD to HeartMate 3 Pump Exchange: Risk Mitigation or Increasing Risk? Ann Thorac Surg. 2022 Dec 23:S0003-4975(22)01610-1. doi: 10.1016/j.athoracsur.2022.12.023. Epub ahead of print. PMID: 36572060.

Appendix D: Serial numbers of delivered devices by country. *

***Note: The below lists for each subgroup population only include devices that Medtronic has either confirmed to be active or has not confirmed to be inactive. The below lists do not include confirmed inactive pumps, and accordingly, are not all inclusive of all affected pumps ever sold/implanted.

Devices in Subgroup 1

Country	Model Number	Serial Number
United States	1103	HW30553, HW30942, HW31041, HW31043, HW31099, HW31181, HW31191, HW31212, HW31327, HW31344, HW31568, HW31613, HW31652, HW31765, HW31785, HW32284, HW32312, HW32362, HW32417, HW32425, HW32439, HW40169

Devices in Subgroup 2

Country	Model Number	Serial Number
United States	1103	HW35425, HW40054, HW40732, HW40762, HW40767

Devices in Subgroup 3

Country	Model Number	Serial Number
United States	1103	HW40857, HW40870, HW40875, HW40876, HW40902, HW40905, HW40916, HW40924, HW40925, HW41038, HW41054, HW41058, HW41060, HW41072, HW41073, HW41076, HW41077, HW41084, HW41097, HW41098, HW41100, HW41104, HW41111, HW41124, HW41137, HW41138, HW41154, HW41158, HW41167, HW41172, HW41207, HW41385, HW41388, HW41394, HW41400, HW41410, HW41412, HW41419, HW41421, HW41424, HW41425, HW41427, HW41431, HW41432, HW41435, HW41438, HW41441, HW41443, HW41444, HW41451, HW41453, HW41456, HW41459, HW41461, HW41463, HW41464, HW41468, HW41470, HW41478, HW41481, HW41492, HW41497, HW41517, HW41519, HW41524, HW41525, HW41526, HW41529, HW41541, HW41548, HW41551, HW41556, HW41577, HW41578, HW41588, HW41589, HW41603, HW41614, HW41616, HW41618, HW41626, HW41627, HW41630, HW41631, HW41650, HW41657, HW41659, HW41662, HW41664, HW41666, HW41668, HW41678, HW41679, HW41681, HW41688, HW41692, HW41702, HW41703, HW41712, HW41719, HW41731, HW41735, HW41748, HW41756, HW41787, HW41795, HW41797, HW41807, HW41812, HW41814, HW41816, HW41820, HW41821, HW41822, HW41823, HW41836, HW41841, HW41844, HW41861, HW41866, HW41867, HW41873, HW41880, HW41508