March 16, 2018

Edwards Lifesciences, LLC
Lisa Gilman
Senior Manager, Critical Care Regulatory Affairs
One Edwards Way
Irvine, CA 92614

Re: DEN160044
Trade/Device Name: Acumen Hypotension Prediction Index (HPI) Feature Software
Regulation Number: 21 CFR 870.2210
Regulation Name: Adjunctive predictive cardiovascular indicator
Regulatory Class: Class II
Product Code: QAQ
Dated: September 23, 2016
Received: September 26, 2016

Dear Lisa Gilman:

This letter corrects our previous classification order dated March 16, 2018.

The Center for Devices and Radiological Health (CDRH) of the Food and Drug Administration (FDA) has completed its review of your De Novo request for classification of the Acumen Hypotension Prediction Index (HPI) Feature Software, a prescription device under 21 CFR Part 801.109 with the following indications for use:

> The Edwards Lifesciences Acumen Hypotension Prediction Index feature provides the clinician with physiological insight into a patient's likelihood of future hypotensive events (defined as mean arterial pressure < 65 mmHg for at least one minute in duration) and the associated hemodynamics. The Acumen HPI feature is intended for use in operating room (OR) patients receiving advanced hemodynamic monitoring. The Acumen HPI feature is considered to be additional quantitative information regarding the patient's physiological condition for reference only and no therapeutic decisions should be made based solely on the Hypotension Prediction Index (HPI) parameter.

FDA concludes that this device should be classified into class II. This order, therefore, classifies the Acumen Hypotension Prediction Index (HPI) Feature Software, and substantially equivalent devices of this generic type, into class II under the generic name adjunctive predictive cardiovascular indicator.

FDA identifies this generic type of device as:

> **Adjunctive predictive cardiovascular indicator.** The adjunctive predictive cardiovascular indicator is a prescription device that uses software algorithms to analyze cardiovascular vital signs and predict

future cardiovascular status or events. This device is intended for adjunctive use with other physical vital sign parameters and patient information and is not intended to independently direct therapy.

Section 513(f)(2) of the Food, Drug and Cosmetic Act (the FD&C Act) was amended by section 607 of the Food and Drug Administration Safety and Innovation Act (FDASIA) on July 9, 2012. This new law provides two options for De Novo classification. First, any person who receives a "not substantially equivalent" (NSE) determination in response to a 510(k) for a device that has not been previously classified under the Act may request FDA to make a risk-based classification of the device under section 513(a)(1) of the Act. On December 13, 2016, the 21st Century Cures Act removed a requirement that a De Novo request be submitted within 30 days of receiving an NSE determination. Alternatively, any person who determines that there is no legally marketed device upon which to base a determination of substantial equivalence may request FDA to make a risk-based classification of the device under section 513(a)(1) of the Act without first submitting a 510(k). FDA shall, within 120 days of receiving such a request, classify the device. This classification shall be the initial classification of the device. Within 30 days after the issuance of an order classifying the device, FDA must publish a notice in the Federal Register classifying the device type.

On September 26, 2016, FDA received your De Novo requesting classification of the Acumen Hypotension Prediction Index (HPI) Feature Software. The request was submitted under section 513(f)(2) of the FD&C Act. In order to classify the Acumen Hypotension Prediction Index (HPI) Feature Software into class I or II, it is necessary that the proposed class have sufficient regulatory controls to provide reasonable assurance of the safety and effectiveness of the device for its intended use. After review of the information submitted in the De Novo request, FDA has determined that, for the previously stated indications for use, the Acumen Hypotension Prediction Index (HPI) Feature Software can be classified in class II with the establishment of special controls for class II. FDA believes that class II (special) controls provide reasonable assurance of the safety and effectiveness of the device type. The identified risks and mitigation measures associated with the device type are summarized in the following table:

Identified Risk	**Mitigation Method**
Delayed or incorrect treatment due to erroneous device output resulting from software malfunction or algorithm error	Software verification, validation, and hazard analysis Non-clinical performance testing Clinical performance testing Labeling
Delayed or incorrect treatment due to user misinterpretation or overreliance on indicator	Usability assessment Labeling

In combination with the general controls of the FD&C Act, the adjunctive predictive cardiovascular indicator is subject to the following special controls:

1. A software description and the results of verification and validation testing based on a comprehensive hazard analysis and risk assessment must be provided, including:

    a. A full characterization of the software technical parameters, including algorithms;

b. A description of the expected impact of all applicable sensor acquisition hardware characteristics and associated hardware specifications;
c. A description of sensor data quality control measures;
d. A description of all mitigations for user error or failure of any subsystem components (including signal detection, signal analysis, data display, and storage) on output accuracy;
e. A description of the expected time to patient status or clinical event for all expected outputs, accounting for differences in patient condition and environment; and
f. the sensitivity, specificity, positive predictive value, and negative predictive value in both percentage and number form.

2. A scientific justification for the validity of the predictive cardiovascular indicator algorithm(s) must be provided. This justification must include verification of the algorithm calculations and validation using an independent data set.

3. A human factors and usability engineering assessment must be provided that evaluates the risk of misinterpretation of device output.

4. A clinical data assessment must be provided. This assessment must fulfill the following:

a. The assessment must include a summary of the clinical data used, including source, patient demographics, and any techniques used for annotating and separating the data.
b. The clinical data must be representative of the intended use population for the device. Any selection criteria or sample limitations must be fully described and justified.
c. The assessment must demonstrate output consistency using the expected range of data sources and data quality encountered in the intended use population and environment.
d. The assessment must evaluate how the device output correlates with the predicted event or status.

5. Labeling must include:

a. A description of what the device measures and outputs to the user;
b. Warnings identifying sensor acquisition factors that may impact measurement results;
c. Guidance for interpretation of the measurements, including a statement that the output is adjunctive to other physical vital sign parameters and patient information;
d. A specific time or a range of times before the predicted patient status or clinical event occurs, accounting for differences in patient condition and environment;
e. Key assumptions made during calculation of the output;
f. The type(s) of sensor data used, including specification of compatible sensors for data acquisition;
g. The expected performance of the device for all intended use populations and environments; and
h. Relevant characteristics of the patients studied in the clinical validation (including age, gender, race or ethnicity, and patient condition) and a summary of validation results.

In addition, this is a prescription device and must comply with 21 CFR 801.109.

Section 510(m) of the FD&C Act provides that FDA may exempt a class II device from the premarket notification requirements under section 510(k) of the FD&C Act, if FDA determines that premarket notification is not necessary to provide reasonable assurance of the safety and effectiveness of the device type. FDA has determined premarket notification is necessary to provide reasonable assurance of the safety and effectiveness of the device type and, therefore, the device is not exempt from the premarket notification requirements of the FD&C Act. Thus, persons who intend to market this device type must submit a premarket notification containing information on the adjunctive predictive cardiovascular indicator they intend to market prior to marketing the device.

Please be advised that FDA's decision to grant this De Novo request does not mean that FDA has made a determination that your device complies with other requirements of the FD&C Act or any Federal statutes and regulations administered by other Federal agencies. You must comply with all the FD&C Act's requirements, including, but not limited to: registration and listing (21 CFR Part 807); labeling (21 CFR Part 801); medical device reporting (reporting of medical device-related adverse events) (21 CFR 803); good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820); and if applicable, the electronic product radiation control provisions (Sections 531-542 of the FD&C Act); 21 CFR 1000-1050.

A notice announcing this classification order will be published in the Federal Register. A copy of this order and supporting documentation are on file in the Dockets Management Branch (HFA-305), Food and Drug Administration, 5630 Fishers Lane, Room 1061, Rockville, MD 20852 and are available for inspection between 9 a.m. and 4 p.m., Monday through Friday.

As a result of this order, you may immediately market your device as described in the De Novo request, subject to the general control provisions of the FD&C Act and the special controls identified in this order.

For comprehensive regulatory information about medical devices and radiation-emitting products, please see Device Advice (https://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/) and CDRH Learn (http://www.fda.gov/Training/CDRHLearn). Additionally, you may contact the Division of Industry and Consumer Education (DICE) to ask a question about a specific regulatory topic. See the DICE website (http://www.fda.gov/DICE) for more information or contact DICE by email (DICE@fda.hhs.gov) or phone (1-800-638-2041 or 301-796-7100).

If you have any questions concerning the contents of the letter, please contact Aneesh Deoras at 240-402-4363.

Sincerely,

Angela C. Krueger -S

Angela C. Krueger
Deputy Director, Engineering and Science Review (Acting)
Office of Device Evaluation
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