SUMMARY OF SAFETY AND EFFECTIVENESS DATA (SSED)

I. GENERAL INFORMATION

Device Generic Name: Endovascular Graft

Device Trade Name: Relay®Pro Thoracic Stent-Graft System

Device Procode: MIH

Applicant's Name and Address: Bolton Medical, Inc.
799 International Parkway
Sunrise, FL 33325 USA

Date(s) of Panel Recommendation: None

Premarket Approval Application (PMA) Number: P200045

Date of FDA Notice of Approval:

II. INDICATIONS FOR USE

The Relay®Pro Thoracic Stent-Graft System is indicated for the endovascular repair of fusiform aneurysms and saccular aneurysms/penetrating atherosclerotic ulcers in the descending thoracic aorta in patients having appropriate anatomy, including:

- Iliac or femoral access vessel morphology that is compatible with vascular access techniques, devices, and/or accessories;
- Non-aneurysmal aortic neck diameter in the range of 20 – 42 mm;
- Non-aneurysmal proximal aortic neck lengths of:
  - 15 mm for the 24 – 28 mm device diameters (***Bare Stent Configuration***)
  - 20 mm for the 30 – 38 mm device diameters (***Bare Stent Configuration***)
  - 25 mm for the 40 – 46 mm device diameters (***Bare Stent Configuration***)

  - 25 mm for the 24 – 38 mm device diameters (***Non-Bare Stent Configuration***)
  - 30 mm for the 40 – 46 mm device diameters (***Non-Bare Stent Configuration***)
- Non-aneurysmal distal aortic neck lengths of:
  - 25 mm for the 24 – 38 mm device diameters
  - 30 mm for the 40 – 46 mm device diameters

III. CONTRAINDICATIONS

The Relay®Pro Thoracic Stent-Graft System is contraindicated in the following:

- Patients with a known allergy or intolerance to device materials (Nitinol, polyester, platinum-iridium).
- Patients with a condition that threatens to infect the graft

IV. WARNINGS AND PRECAUTIONS

The warnings and precautions can be found in the Relay®Pro Thoracic Stent-Graft System labeling.

V. DEVICE DESCRIPTION

The Relay®Pro Thoracic Stent-Graft System (referred to as RelayPro hereafter) is designed to treat fusiform aneurysms and saccular aneurysms/penetrating atherosclerotic ulcers in the descending thoracic aorta. The RelayPro consists of two types of implants, namely the proximal bare stent configuration and the non-bare stent (NBS) configuration. The RelayPro is a next generation endovascular graft of the currently marketed existing RelayPlus Thoracic Stent-Graft System (P110038).

Each patient receives at least one RelayPro Stent-Graft (**Figure 1**). Each implant configuration is preloaded into its own RelayPro delivery system that is advanced under fluoroscopy to the location of the lesion. Upon deployment, the stent-graft creates a blood flow channel, excluding the lesion from blood pressure and flow.

RelayPro Stent-Grafts

All stent-grafts are comprised of self-expanding Nitinol stents sutured to a woven polyester fabric. The stent scaffold is a series of sinusoidal springs stacked in a tubular configuration. These stents are spaced along the length of the graft fabric to provide radial support and allow for the self-expansion of the stent-grafts. A spiraled ("S" shaped) Nitinol strut is sewn to the proximal section of the fabric to provide longitudinal support. The stents and the curved wire are sewn to the graft fabric with polyester suture. Radiopaque markers (platinum-iridium) are placed on the stent-graft to aid in visualization and accurate placement.

The RelayPro Stent-Graft is available in two proximal configurations: the proximal bare stent and non-bare stent (NBS). Other than the proximal configuration, the two implants are identical in design as described above.

The proximal bare stent configuration incorporates a bare stent that is mostly uncovered and is made of a slightly larger Nitinol wire than the other stents in the implant. The proximal apexes are designed with larger radii of curvature as compared to all other apexes on all other stents. Additionally, the bare stent has the lowest radial load of all stents on the RelayPro stent-graft. The combination of the large apexes and low radial force of the bare stent is intended to minimize the stress on the aortic wall. There is one bare stent per implant. The proximal stent (just distal to the bare stent) has the highest radial load and is designed to seal with the aortic wall. There are two proximal stents per implant.

The NBS configuration incorporates a crown stent that consists of a series of apices that are connected by flat sections. The crown stent is designed to support the edge of the graft to appose the vessel wall and to minimize graft infolding. There is one crown stent per implant. The NBS proximal stent (just distal to the crown stent) has the same design intent as proximal stent in the proximal bare stent configuration and has a slightly modified design. There are two NBS proximal stents per implant.

The RelayPro Stent-Graft is available in the following configurations and sizes maximizing device selections available to the physician:

- Two proximal configurations: Proximal Bare Stent & Non-Bare Stent (NBS)
- Covered Lengths (Bare Stent): 100mm (± 10mm depending on graft diameter) to 250 mm
- Covered Lengths (Non-Bare Stent): 109mm (± 10mm depending on graft diameter) to 259mm
- Diameters: 24mm – 46mm in 2 mm increments
- Straight and Tapered Configurations
  - Straight: Consistent diameter through the implant length
  - Standard Taper: Diameter of device decreases proximal to distal (typical 4mm transition; availability from 2mm and up to 18mm transition)
  - Reverse Taper: Diameter of device increases proximal to distal (availability from 2mm and up to 18mm transition)

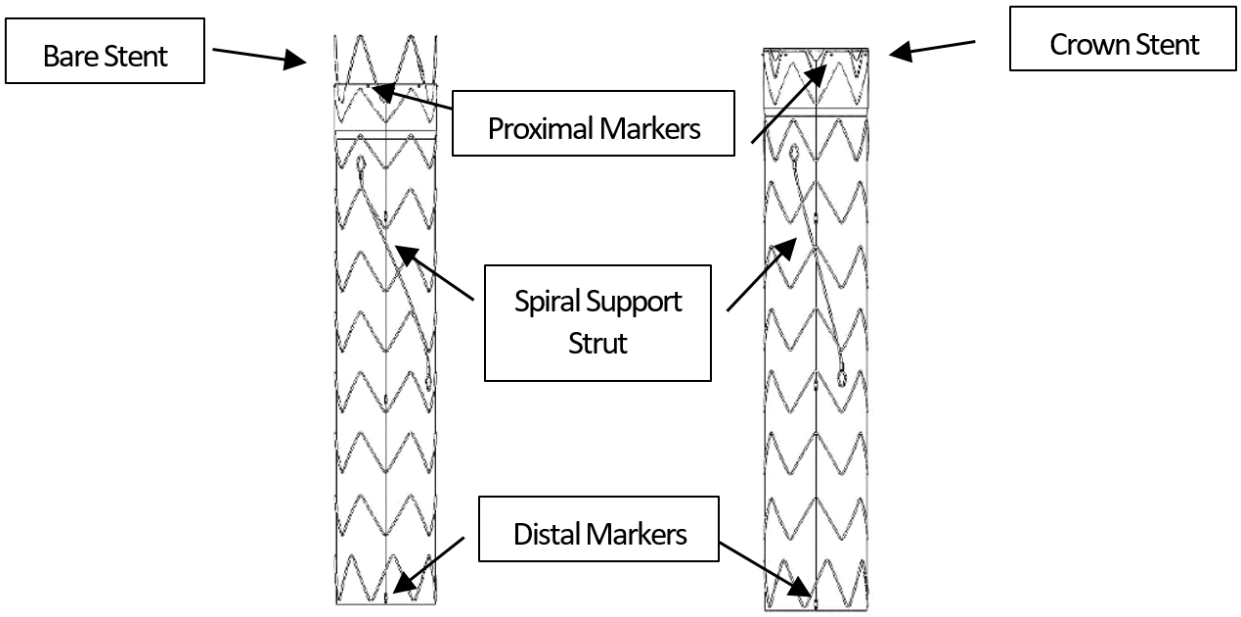

Figure 1. RelayPro Thoracic Stent-Graft, with bare stent and with non-bare stent, illustrating stents and spiral support strut

Delivery System Description

The RelayPro Delivery System consists of a series of coaxially-arranged sheaths and catheters (outer introduction sheath, inner delivery sheath, through lumen), handle and apex release mechanism. The stent-graft is constrained within the inner sheath, which is further constrained within the outer sheath. The tapered tip and introducer sheath have a lubricious hydrophilic coating. The radiopaque, polymeric outer sheath is tracked over a guidewire to facilitate introduction of the device through the femoral and iliac arteries. Once the outer sheath reaches the distal end of the treatment site, the deployment grip of the delivery system is advanced to exit the inner sheath from the outer sheath. The inner sheath is advanced to the proximal landing zone in preparation for deployment. The inner sheath, which is connected to the delivery catheter and the delivery handle, can be retracted to deploy the constrained stent-graft in a controlled fashion. The apex release mechanism constrains the most proximal stent of the stent-graft. Sliding the outer control tube over the guidewire lumen after the deployment from the inner sheath controls this mechanism. This provides a controlled apposition of the stent to the vessel wall.

The delivery systems used for the RelayPro NBS and Bare Stent configurations are functionally and operationally equivalent. There are minor differences to accommodate the NBS configuration which do not change the mode of operation. **Figure 2** illustrates the delivery system for the Bare Stent and NBS configuration. Item 16 in **Figure 2** (support wires) are not present in the Bare Stent configuration delivery system. The two Nitinol wires, called support wires, control the expansion of the inferior portion of the stent-graft, which helps avoid asymmetrical deployment of the NBS configuration. The support wires are attached to the delivery system catheter at one end. The other end of the support wires are atraumatic teardrop-shaped and are tethered to the inferior portion of the graft with loops of suture. The support wires control the expansion of the proximal end of the stent-graft to ensure proper apposition against the anatomical inner curvature and are for NBS graft diameters 32mm to 46mm only. In addition, the design of Item 2 in both figures (apex holder) differs slightly between the configurations. The NBS delivery system introducer (outer) sheath diameter ranges up to 23Fr depending on the stent-graft diameter whereas the Bare Stent configuration ranges up to 22Fr.

The delivery system is provided in outer diameters ranging from 19 up to 22 French for the Bare Stent Configuration and from 19 up to 23 French for the NBS Configuration, depending on the corresponding stent-graft diameter, with a working length of 90 cm.

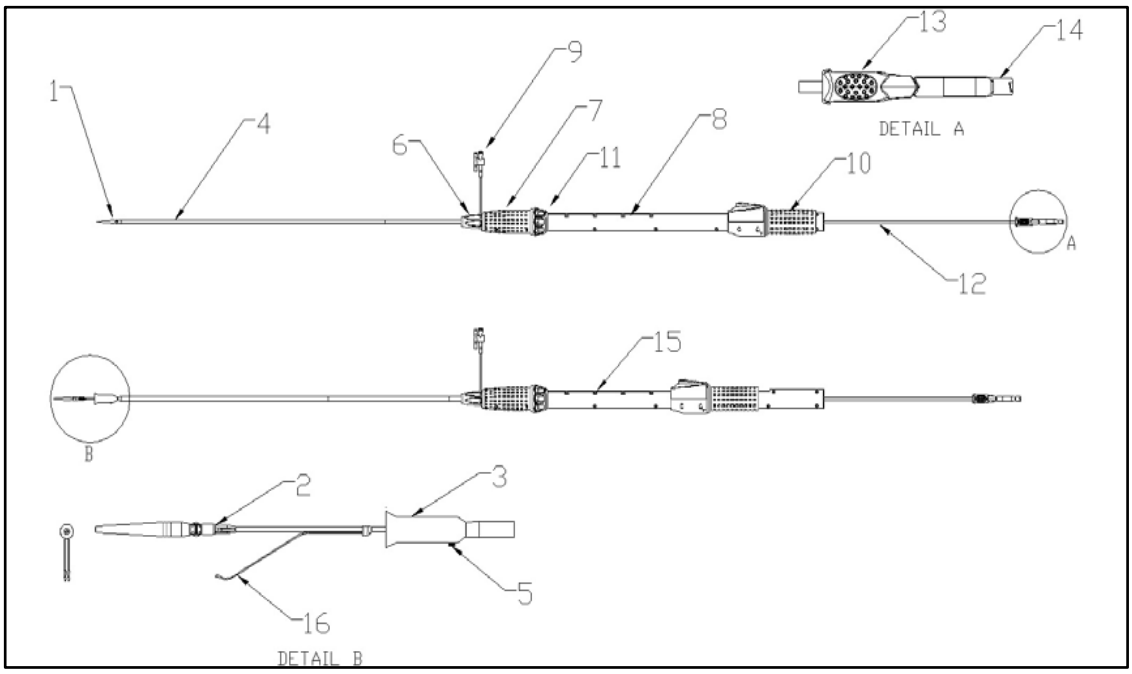

Figure 2. RelayPro Bare and Non-Bare Stent Configuration Delivery System

1. Delivery System Tip
2. Apex Holder
3. Inner Sheath
4. Outer Sheath
5. Radiopaque Marker
6. Front Nose Cap
7 Gray Grip
8. Handle Body
9. Flush Port
10. Deployment Grip
11. Controller
12. Stainless Steel Rod
13. Apex Holder Knob
14. Guidewire Luer
15. Arrow Marker
16. Support Wire (Non-Bare Stent only)

VI. ALTERNATIVE PRACTICES AND PROCEDURES

There are several alternatives for the treatment of fusiform aneurysms and saccular aneurysms/penetrating atherosclerotic ulcers in the descending thoracic aorta including medical management, open surgical repair, and endovascular repair using other endovascular grafts. Each alternative has its own advantages and disadvantages. A patient should fully discuss these alternatives with his/her physician to select the method that best meets expectations and lifestyle.

VII. MARKETING HISTORY

The RelayPro is commercially available in the following regions and countries: the European Union, Chile, Colombia, Hong Kong, India, Lebanon, Singapore, South Africa, Thailand, UK and Vietnam since 2018.

The RelayPro has not been withdrawn from the market for any reason related to its safety or effectiveness.

VIII. POTENTIAL ADVERSE EFFECTS OF THE DEVICE ON HEALTH

Below is a list of the potential adverse effects (e.g., complications) associated with the use of the device:

Table 1. Potential Adverse Events	
Access Failure	Incision site complications
Allergic Reaction (to contrast, antiplatelet therapy, stent-graft materials)	Infection / Sepsis
Amputation	Intercostal pain
Anesthetic reactions/complications (e.g., aspiration)	Intramural Hematoma
Aneurysm Sac Enlargement	Ischemia (spinal cord, perfusion pathways)
Aneurysm / Lesion Rupture	Limb ischemia
Angina	Lymphocele
Aortic damage (perforation, dissection, bleeding, rupture)	Neuropathy
Arteriovenous fistula / aorto-esophageal fistula	Pain
Blindness	Paralysis/Paresthesia/Paraparesis/Paraplegia
Blood Loss	Perforation
Bowel complications (e.g., adynamic ileus, transient ischemia, infarction, obstruction, necrosis)	Peripheral Nerve injury
Cardiac events (e.g., arrhythmia, tachyarrhythmia, cardiac tamponade, congestive heart failure, myocardial infarction, hypotension, hypertension, tachycardia, bradycardia)	Post Implantation Syndrome
Catheter Breakage	Post-procedural bleeding
Cerebral vascular accident (stroke)	Pseudoaneurysm
Change in mental status	Pulmonary complications
Claudication (e.g., buttock, lower limb)	Pulmonary embolism
Coagulopathy	Radiation overexposure or reaction
Compartment Syndrome	Reaction to anesthesia
Contrast toxicity / anaphylaxis	Reaction/pain at catheter insertion site
Conversion to Open Repair	Renal failure or Complications
Death	Reoperation
Delivery system failure	Seizure

Table 1. Potential Adverse Events	
Deployment failure (partial or inaccurate deployment)	Seroma
Device Dehiscence	Shock
Device Insertion or Removal Difficulty	Stenosis of native vessel
Dysphagia	Stent fracture / break
Edema	Stent-Graft failure (e.g., improper component placement, graft material wear or tear, suture break, dilatation, erosion, graft twisting or kinking, puncture, perigraft flow)
Embolism (micro and macro) with transient or permanent ischemia or infarction	Stent-Graft Infection
Endoleak	Stent-Graft migration
Fever and localized inflammation	Tissue necrosis
Fistulas	Transient Ischemic Attack
Gastrointestinal complications	Vascular Spasm
Genitourinary complications (e.g., ischemia, erosion, femoral-femoral artery thrombosis, fistula, incontinence, hematuria, infection)	Vascular Trauma (perforation / dissection)
Hematoma (surgical)	Vessel Damage
Hemorrhage	Vessel Dissection
Hepatic failure	Vessel Occlusion/Thrombosis
Impotence	Wound complications (dehiscence, infection, hematoma, seroma, cellulitis)

For the specific adverse events that occurred in the clinical study, please see **Section X** below.

IX. SUMMARY OF NONCLINICAL STUDIES

Nonclinical studies were completed to evaluate the RelayPro device, including non-clinical bench testing, biocompatibility, sterilization, packaging, shelf-life, and animal studies. These are described in detail in the following sections.

A. Laboratory Studies

RelayPro underwent testing for design verification and validation, including long-term durability and corrosion testing. Testing was performed in accordance with ISO 25539-1: 2017, "*Cardiovascular implants – Endovascular devices – Part 1: Endovascular prostheses"* and ISO 25539-1: 2003/A1, "Cardiovascular implants – Endovascular devices – Part 1: Endovascular protheses, Amendment 1: Test Methods." For evaluation of the RelayPro, a subset of device components and sizes were used for each test or alternatively, the worst-case configuration /size was selected. A four-corners approach was utilized for sample selection. This sample selection represented the full size range available for RelayPro. A summary of this testing is provided in **Table 2** and

Table 3. Asterisk (*) indicates that the testing was performed at baseline and after aging (accelerated or real time to the shelf life duration).

Table 2. Non-Clinical Testing: Implant

Test Name	Test Purpose	Acceptance Criteria	Results
MR Compatibility	To provide the recommended scan conditions for use with the device	Non-clinical testing completed at worst-case conditions for displacement & deflection force, torque force, RF heating, and MRI artifact demonstrated that the RelayPro is MR Conditional. A person with this device can be safely scanned in an MR system meeting the following conditions: • Static magnetic field strength (B_0) of 1.5 Tesla and 3 Tesla • Maximum spatial field gradient of 3,000 gauss/cm (30 T/m) • Circularly Polarized RF Excitation • Whole-body transmit coil • Maximum Whole-Body SAR of 2W/kg (Normal Operating Mode) • Maximum Head SAR of 3.2 W/Kg (Normal Operating Mode)	Pass
Graft Apposition Test	To determine if the stent-graft can be deployed in a tight radius of a simulated vessel	Must be deployed in a 15mm radius section of the aortic model with complete apposition up to the first proximal stent	Pass
Sealing	To determine if the fixation points are against the mock completely in order to address the sealing characteristics	Complete contact around the simulated vessel must be visually verified	Pass

Test Name	Test Purpose	Acceptance Criteria	Results
Migration Resistance	To determine the force required to displace the stent-graft in a mock artery. This test provided an indication of the resistance to migration provided by the fixation mechanisms of the stent-graft	The RelayPro migration resistance must meet the requirements per diameter and stent-graft configuration (bare or non-bare stent): *Bare Stent (minimum value)*: 24mm – 28mm: 5.4N (1.2lbf) 30mm – 28mm: 5.2N (1.2lbf) 40mm – 46mm: 5.6N (1.3lbf) *Non-Bare Stent (minimum value)*: 24mm – 28mm: 3.5N (0.79lbf) 30mm – 28mm: 4.5N (1.0lbf) 40mm – 46mm: 5.0N (1.1lbf)	Pass
Separation Force for Overlapping Endovascular Prostheses	To determine the force required to separate the modular components of the stent-graft or to separate overlapping stent-grafts in the deployed state	Results must meet a minimum modular pull out force of 4.0 N.	Pass
Compression Resistance	To determine the deformation of the stent-graft in response to a localized compressive force, perpendicularly applied to the longitudinal axis of the stent-graft, and if it recovers to its original geometry after testing.	Observations were documented as pass/fail. A force was applied until displacement of 50% occurred. The pre and post-compression outer diameters must be within 1mm of each other with no permanent deformation.	Pass
Crush Resistance	To determine the force required to cause buckling and permanently radially deform or fully collapse the stent-graft and to determine if it recovers to its original geometry after testing	Observations were documented as pass/fail. If any permanent deformation occurred to the stent-graft, the test was considered a failure. The force used to crush the stent-graft at 50% diameter and full collapse as well as the deflection was recorded.	Pass

Test Name	Test Purpose	Acceptance Criteria	Results
Radial Force (Self-Expanding Endovascular Prostheses)*	To determine the force exerted by a self-expanding implant as a function of the implant diameter	The RelayPro radial force must meet the requirements per diameter and stent-graft configuration (bare or non-bare stent): *Bare Stent (minimum force at proximal landing zone)*: 24mm – 28mm: 7.6N (1.7lbf) 30mm – 28mm: 5.4N (1.2 lbf) 40mm – 46mm: 6.0N (1.3lbf) *Bare Stent (minimum force at middle)*: 24mm – 28mm: 9.9N (2.2lbf) 30mm – 28mm: 6.9N (1.6 lbf) 40mm – 46mm: 6.0N (1.3lbf) *Bare Stent (minimum force at proximal landing zone)*: 24mm – 28mm: 9.8N (2.2lbf) 30mm – 28mm: 7.3N (1.6lbf) 40mm – 46mm: 7.4N (1.7lbf)	Pass
		Non-Bare Stent (minimum force at proximal landing zone): 24mm – 28mm: 6.0N (1.3lbf) 30mm – 28mm: 7.0N (1.6lbf) 40mm – 46mm: 6.8N (1.5lbf) *Non-Bare Stent (minimum force at middle)*: 24mm – 28mm: 9.2N (2.1lbf) 30mm – 28mm: 7.5N (1.7lbf) 40mm – 46mm: 7.5N (1.7lbf) *Non-Bare Stent (minimum force at distal landing zone)*: 24mm – 28mm: 4.5N (1.0lbf) 30mm – 28mm: 3.6N (0.81lbf) 40mm – 46mm: 3.9N (0.88lbf)	
Resistance to Kinking (Flexibility)	To determine the minimum radius of curvature that the stent-graft can accommodate without kinking and if it can recover to its original geometry	The graft must conform to the "S" shape of the model while not kinking and/or permanent deformation occurring (if kinking occurs before deformation, only the kinking diameter will be recorded). Kinking is defined as approximately 25% or	Pass

Test Name	Test Purpose	Acceptance Criteria	Results
		more of the graft lumen is not patent.	
Integral Water Leakage	To determine the rate of water leakage through the entire stent-graft, incorporating all modular components and extension devices	Results must be comparable to the previously approved Relay device (P110038).	Pass
Water Permeability (Textile Materials)	To determine the rate of fluid flow through the wall of the stent-graft as virgin material	Textile Component Native Permeability: < 120 ml / min / cm²	Pass
Dimensional Verification of the Endovascular Prosthesis	To determine the dimensions of the stent-grafts in the deployed state for verification to design specifications	*The length of the stent-graft must be within specification*	
		Length = ± 2mm	Pass
		*Relaxed outer diameter post deployment**	
		Outer diameter must be within -1mm / +2mm of the nominal diameter at the proximal, middle and distal ends.	Pass
Stent-Graft Integrity (post-deployment)*	To demonstrate that the stent-graft retains its physical integrity after the deployment process	The sample must not exhibit physical damage that will negatively impact the performance of the device (e.g., stent fracture, graft fabric tear, broken suture, etc.).	Pass
Burst / Circumferential Strength	To determine the pressurized burst strength or circumferential strength of the stent-graft if used with an accessory balloon.	The stent-graft must withstand 1.5 ATM of pressure without damage.	Pass
Longitudinal Tensile Strength (Stent-Graft)*	To determine the longitudinal tensile strength of the stent-graft.	Tensile Force: ≥ 50 lbf (222.5 N)	Pass
Graft Seam (Factory Anastomotic) Strength	To determine the tensile strength of the suture/fabric seam	Tensile Force: ≥16lbs/2cm (71.2 N/2cm)	Pass
Graft Seam (Factory Anastomotic) Durability	To evaluate the long-term durability of the fabric and seam over 380 million cycles of	The seam must not exhibit signs of wear or separation under magnification.	Pass

Test Name	Test Purpose	Acceptance Criteria	Results
	pulsatile fatigue loading		
Strength of the Connection(s) or Bond(s) Between the Graft material and the stent(s) or attachment system(s)	To determine the strength of the fixation or bonds between the graft material and the stent/attachment system	≥ 10 lbf (44.5 N) per apex	Pass
Visibility	To evaluate the ability to visualize the stent-graft using the imaging techniques specified in the IFU	Test units must be visible under fluoroscopy.	Pass
Corrosion	To evaluate the corrosion resistance properties of the stent-graft (all Nitinol) metallic components	All samples display breakdown potentials equivalent or better to comparator devices.	Pass
Fatigue and Durability – Computational Analyses	Finite element analysis (FEA) was used to compute the maximum strains in all of the RelayPro design's sizes when subjected to catheter loading and an *in-vivo* pulsatile loading environment.	Characterization study. The worst-case component size was identified and used to select the worst-case prosthesis oversizing for *in-vitro* fatigue testing.	Pass
Fatigue and durability – *In-vitro* testing	Pulsatile Fatigue Testing: To evaluate the long-term durability of the stent-graft design over 380 million cycles of pulsatile fatigue loading.	The samples must not exhibit physical damage that would represent a failure of their safety or function due to: 1. Component deformation, separation or fractures leading to ineffective proximal or distal seals, migration or severed pieces into the bloodstream 2. Fabric holes larger than 0.5 mm^2 3. Modular disjunctions 4. Compromised luminal integrity due to twisting or component collapse	Pass**
	Dynamic Bending Testing: To evaluate the long-term durability of the stent-graft design over 380 million cycles of bending loads.		Pass**

Test Name	Test Purpose	Acceptance Criteria	Results
		All anomalies must be studied on a case-by-case basis. Anomalies due to test artifacts will not be representative of failure in safety or function of the design.	

** The RelayPro in-vitro durability evaluation included accelerated fatigue testing (intended to represent 10 years of physiologic loading) under a variety of loading conditions. Fractures were observed in samples tested under radial pulsatile and longitudinal bending loading conditions. An evaluation of the potential impact on device performance was conducted that evaluated materials and components, manufacturing processes, anatomical data, biomechanical analysis, computational modeling, bench top performance testing of fractured test samples, and as-applied in-vitro fatigue testing displacements per test article. Additionally, available clinical stent fracture assessments were compared to accelerated fatigue testing time duration estimates until first stent fracture. There were no reported stent fractures that were found in the pivotal study out of the 88.6% of patients with adequate imaging to evaluate stent fractures at 1 year. Additionally, there have been no reported stent fractures beyond 1-year, although patient data with adequate imaging to evaluate stent fractures is limited beyond 1 year (50.5% at 2 years, 21.2% at 3 years). Results of the investigation and comparison suggest that the high rate of stent fractures reported during in-vitro testing may be attributable to test artifact. In particular, test articles subject to supraphysiological displacements at high cycle counts appear to be associated with high rates of in-vitro stent fractures

Table 3. Non-Clinical Testing: Delivery System

Test Name	Test Purpose	Acceptance Criteria	Results
Dimensional verification of the endovascular system*	To evaluate the conformance of the RelayPro's dimensions to their design specifications, and to evaluate the compatibility of the RelayPro with its accessory devices listed in the IFU. Also, to determine the maximum diameter at the loaded stent- graft section (largest profile) in order to evaluate the dimensional compatibility between the aged delivery system and the vasculature.	System must be compatible with 0.035" guidewire.	Pass
		Delivery system sheath outer diameter (OD) must meet predetermined tolerances: 19F = 0.252" ± 0.003" (6.40mm ± 0.08mm) 20F = 0.265" ± 0.003" (6.73mm ± 0.08mm) 21F = 0.278" ± 0.003" (7.06mm ± 0.08mm) 22F = 0.291" ± 0.003" (7.39mm ± 0.08mm) 23F = 0.304" ± 0.003" (7.72mm ± 0.08mm)	Pass
		All test samples must meet the nominal labeled profile.	Pass
		Useable length (deployed): 90 cm +2cm / -3cm	Pass
Simulated Use (Including Force to Deploy and Tracking)*	An overall assessment of the RelayPro was conducted during which qualitative and quantitative measurements were made. The system was prepared, deployed and the delivery system removed from an anatomical model. The anatomical model was designed to challenge both access as well as implant site requirements. Assessments included:		
	• Forces required to deploy system	Deployment Force: ≤25lbs (111.3N) Advancement Force: ≤48.4lbs (215.3N) Clasp Release: ≤ 10 lbf (44.5N)	Pass
	• Ability to prepare system (flushing) • Ability to track system to landing zone, while ensuring direct assessment of attributes such as guidewire acceptance, kink resistance, pushability, tracking and torqueability • Ability to accurately deploy the stent-graft at the target landing zone	All qualitative assessments (pass/fail) must meet acceptance criteria: • System must be able to be prepped with saline passing through guidewire lumen and out the distal end of the sheath (sheath flushing required 20cc). •System must be able to track through the anatomical model and through a stent-graft. •System must be able to accept the guidewire.	Pass

Test Name	Test Purpose	Acceptance Criteria	Results
	• Ability to successfully withdraw the delivery system.	• Device must not kink prior to or during deployment. •Device must have the ability to be pushed through the anatomical model without buckling. • Device must successfully track to deployment site while assessing for the ability to torque the device. • Device must deploy at designated landing zone. • Delivery system must be withdrawn without catching on deployed stent-graft.	
Manual Alignment	To evaluate the ability of the system to manually align the stent-graft while still in the secondary sheath (2nd stage of deployment)	Manual rotation of 360° must be achieved with no greater than 3 full handle body rotations.	Pass
Tensile Bond Strength* Tubing Tensile Strength	To determine the bond strength of the joints and/or fixed connections of the RelayPro	Sub-assemblies tested must meet pre-determined pull forces depending on the bond or tubing requirements. Acceptance criteria ranged from 5lbs to 48.4lbs (22.2 N to 215.3N).	Pass
Torsional Bond Strength	To determine the torque required to cause failure of the bonded joints of the RelayPro	The delivery system sheath introducer must be torqued at 180 degrees without any damage to the sheath bond.	Pass
Hemostasis*	To evaluate the RelayPro's ability of any seals or valves to maintain adequate hemostasis for the system	Amount of water obtained through leaking in 1 minute should be ≤ 15 cc.	Pass
Lubricity	To determine the lubricity of the hydrophilically coated Tip and Introducer Sheath	The force must meet the current specification for acceptable lubricity tests: - Sheath: ≤30g after 15 cycles - Tip: ≤60g after 15 cycles	Pass
Coating Integrity / Particulate Evaluation	To determine if particles of the hydrophilic coating would be removed from	There must be no statistical difference in the particulate count for uncoated versus coated test samples.	Pass

Test Name	Test Purpose	Acceptance Criteria	Results
	the delivery system during simulated testing		

B. Animal Studies

An Acute *in-vivo* animal study was conducted on the RelayPro and a chronic animal study was leveraged from similar representative stent-grafts including the Relay (first generation device forming the basis of the RelayPlus, P110038) and Treovance (first generation device forming the basis of the TREO, P190015). This data was leveraged for the RelayPro based on design and material similarities:

- The RelayPro graft fabric is the same as the Treovance/TREO.
- The RelayPro Nitinol stents for the Bare Stent configuration are the same material and design as the Relay.

The acute study of the RelayPro consisted of 6 sheep and was focused on evaluating the intra-operative features of delivery. The test articles were 24mm × 100mm Bare Stent configuration stent-grafts in a RelayPro delivery system. The objective of the study was to perform an acute study in an ovine model to evaluate the overall performance of the RelayPro delivery system. The results of the acute study showed successful deployment of all devices in the aorta, and no device-related adverse events occurred during deployment and subsequent recovery.

The results of both the chronic studies support that the device is well-tolerated in the ovine model and does not adversely affect the general health of animals. The results of the chronic animal study showed that the device was successfully deployed, remained intact and patent through study duration, and had appropriate tissue response. There was no device-related mortality and no evidence of adverse systemic effects in either the acute or chronic animal studies.

C. Biocompatibility

The biocompatibility assessment performed on the RelayPro was based on the matrix for body contact and contact duration as specified in ISO 10993-1:2009/(R)2013, "Biological evaluation of medical devices – Part 1: Evaluation and testing within a risk management process." The RelayPro is comprised of an implantable stent-graft and a corresponding delivery system. For purposes of the biocompatibility assessment, the stent-graft was classified as an implant device, permanent contact (> 30 days), while the delivery system was classified as an external communicating device, circulating blood, limited exposure (< 24 hours). All testing was conducted by a qualified contract laboratory in accordance with FDA GLP regulations, 21 CFR 58. All testing performed met the pre-specified acceptance criteria. The results for the biocompatibility evaluation for the delivery system are summarized in **Table 4.**

Biological testing conducted to support the Relay Thoracic stent-grafts (P110038) has been leveraged for the RelayPro Stent-Graft because they share the same stent and suture components as well as the same marker materials and same graft fabric with differing weave. Similarly, biological testing supporting the TREO Abdominal stent-grafts (P190015) was leveraged for the RelayPro Stent-Graft because they share the same graft fabric, marker and suture components. The sponsor provided a detailed discussion regarding why any difference in the subject and reference devices design and manufacturing would not impact the biocompatibility assessment.

Table 4. Biocompatibility Evaluation – Delivery System

Biological Effect (Test)	Purpose	Results	Acceptance Criteria Met?
ISO MEM Elution Cytotoxicity	To determine if delivery system extracts cause cytotoxicity when exposed to L-929 mammalian cells	Non-cytotoxic: Less than Grade 2 (mild reactivity)	Yes
ISO Guinea Pig Maximization Sensitization	To evaluate the allergenic/sensitization potential of delivery system extracts in guinea pigs	The test article did not elicit a sensitization response.	Yes
ISO Intracutaneous Reactivity	To determine if any chemicals that may leach or be extracted from the test article were capable of causing local irritation in the dermal tissues of rabbits	Non-irritant: The difference between the test article extracts overall mean score and corresponding control overall mean score was less than 1.0.	Yes
ISO Acute Systemic Toxicity	To evaluate delivery system extracts for potential toxic effects after single-dose systemic injections in mice	These was no evidence of systemic toxicity from the test article extracts.	Yes
Material Mediated Pyrogenicity	To evaluate the delivery system for the potential of inducing a pyrogenic response in rabbits	Non-pyrogenic: no single animal showed a temperature rise of 0.5°C or more above its baseline temperature.	Yes
Hemocompatibility			
• Hemolysis	To evaluate the potential of the delivery system to cause hemolysis in direct contact or by extraction	Non-hemolytic: Percent hemolyses: Direct contact – 0% Extract – 0%	Yes

Biological Effect (Test)	Purpose	Results	Acceptance Criteria Met?
• Partial Thromboplastin Time (PTT)	To determine the time citrated plasma exposed to delivery system takes to form a clot when exposed to a suspension of phospholipid particles and calcium chloride	Minimal activator of intrinsic coagulation pathway (the components were tested in two groups): Group 1: Plasma exposed to the test article had an overall average clotting time of 205.9 seconds (73% of the negative control). Group 2: Plasma exposed to the test article had an overall average clotting time of 234.7 seconds (83% of the negative control).	Yes
• Complement Activation	To determine the potential of the delivery system to activate complement	C3a - a low potential for activation of the complement system. SC5b-9 - a low potential for activation of the complement system.	Yes
• *In-vivo* Thrombogenicity	To evaluate the potential of the test device to resist thrombus formation when placed in the vasculature	In the 3 animals that were implanted with the delivery system, at 4 hours post-implantation, the test article was judged to be thromboresistant.	Yes

D. Sterilization, Packaging and Shelf Life

RelayPro is sterilized via gamma irradiation resulting in a sterility assurance level (SAL) of 10^{-6}. The production dose of 25 kGy is supported by a validation study that was executed in accordance with ISO 11137-2. Packaging validation was executed successfully per AAMI/ANSI/ISO 11607-1:2006: Packaging for terminally sterilized devices – Part 1: Requirements for materials, sterile barrier systems and packaging systems. Testing was also successfully performed to support device and packaging integrity after exposure to extremes of environmental conditioning per ISTA 2A. All packaging and shelf life validation testing was performed as per current standards and Terumo Aortic procedures. The RelayPro packaging configuration used in these studies reflects the final package configuration. Specific engineering testing completed to support shelf life are denoted by an asterisk (*) in **Table 2** and **Table 3**. Accelerated aging shelf-life product testing conducted supports a 2-year shelf-life claim.

X. SUMMARY OF PRIMARY CLINICAL STUDY

The applicant performed a clinical study to establish a reasonable assurance of safety and effectiveness of endovascular repair of fusiform aneurysms and saccular aneurysms/penetrating atherosclerotic ulcers in the descending thoracic aorta with the RelayPro in the US and Japan under IDE# G040175/S085. Data from this clinical study were the basis for the PMA approval decision. A summary of the clinical study is presented below.

A. Study Design

Patients were treated between May 10, 2017 and June 24, 2019. The database for this PMA reflected data collected through December 7, 2020 and included 110 patients. There were 36 investigational sites (25 in the United States and 11 in Japan).

The study was a prospective, multi-center, non-blinded, non-randomized, single-arm clinical study.

The primary safety endpoint was defined as the proportion of patients with a major adverse event (MAE) at 30 days post-procedure. The results were tested against a performance goal of 20%, derived from the RelayPlus Pivotal Study data (P110038). The hypothesis tested for the primary safety endpoint at a one-sided alpha level of 0.05 was:

Null hypothesis (H_O): $p \geq 0.20$
Alternative Hypothesis (H_A): $p < 0.20$

Where p is the proportion of RelayPro patients with at least one major adverse event through 30-days post implant procedure.

The primary effectiveness endpoint was defined as the proportion of patients with successful aneurysm treatment after use of the RelayPro through 1-year post implant procedure. The results will be tested against a performance goal of 80%, derived from the RelayPlus Pivotal Study data (P110038). The hypotheses that will be tested for the primary effectiveness endpoint at a one-sided level of 0.05 is:

Null hypothesis (H_0): $p \leq 0.80$
Alternative Hypothesis (H_A): $p > 0.80$

Where p is the proportion of RelayPro patients with successful aneurysm treatment at 12-months post-procedure.

The study sample size was driven by the primary effectiveness endpoint. Historical data from the RelayPlus Pivotal Study (P110038) estimated the rate of successful aneurysm treatment to be 92.1%. Using the Exact Binomial Test and assuming a power of 96%, a one-sided alpha of 0.05, and a performance goal of 80%, the sample size needed was 88 patients. Assuming 20% attrition, this yielded a sample size of 110 patients.

External evaluation groups were used during the course of the Pivotal Study, which are described below:

- *Independent Imaging Core Lab:* The Core Lab confirmed a patient's anatomical requirements for enrollment, as well as reviewed post-implant and follow-up imaging. The Core Lab assessed follow-up imaging endpoints, including endoleak, migration, aneurysm sac size increase, patency, stenosis, and stent fracture.

- *Clinical Events Committee and Data Safety Monitoring Board:* An independent Clinical Events Committee (CEC) and a separate, independent Data Safety Monitoring Board (DSMB) were responsible for assuring the study was conducted ethically, and that the health and welfare of each study patient was protected. The CEC adjudicated events, as specified in the CEC Charter, as identified by the Medical Monitor from regular review of all reported adverse events and classified them as related or not related to the device or the procedure. The DSMB met separately to review the safety data in aggregate and assess the overall safety of the study. The DSMB also assessed whether the continuation of enrollment was appropriate, and if not, whether protocol modifications were necessary or whether the study should be halted.

1. Clinical Inclusion and Exclusion Criteria

   Enrollment in the RelayPro Pivotal Study was limited to patients who met the following inclusion criteria:

   - Age ≥18 years.

- Any of the following conditions in the descending thoracic aorta:
  - Aneurysm ≥ 5.0 cm in diameter;
  - Aneurysm ≥ 4.0 cm in diameter with an increase of ≥0.5 cm within the last 6 months or ≥1.0 cm over the last 12 months;
  - Aneurysm with maximum diameter exceeding two times the diameter of the non-aneurysmal, adjacent aorta;
  - Saccular aneurysm;
  - PAU with a depth of 10 mm or more.
- Proximal and distal aortic neck with diameter between 20 mm and 42 mm.
- Proximal landing zone distal to the left common carotid and a distal landing zone proximal to the origin of the celiac artery; the lengths of which are dependent on the diameter and type of the device.
- Proximal and distal landing zones containing a straight segment (non-tapered, non-reverse-tapered, defined by <10% diameter change) with lengths equal to or greater than the required landing length for the intended device.
- Adequate iliac or femoral artery access for introduction of the Relay Delivery System. Alternative methods to gain proper access may be utilized (e.g., iliac conduit).
- Willingness to comply with the follow-up evaluation schedule.
- Informed Consent Form prior to treatment.

Patients were <u>not</u> permitted to enroll in the RelayPro Pivotal Study if they met any of the following exclusion criteria:

- Acute or chronic aortic dissection within the ascending aorta, arch or descending thoracic aorta.
- Diffuse intramural hematoma (current or previous).
- Traumatic aortic injury or transection.
- Aortic false aneurysm.
- Ruptured aneurysm.
- Significant stenosis (>50%), calcification, thrombus, or tortuosity of intended fixation sites that would compromise fixation or seal of the device.
- Anatomic variants which may compromise circulation to the carotid, vertebral, or innominate arteries after device placement, and are not amenable to subclavian revascularization.
- Prior endovascular or surgical repair in the descending thoracic aorta.
- The device could not be placed within any prior endovascular or surgical graft.
- Concomitant aneurysm/disease of the ascending aorta, aortic arch, or abdominal aorta requiring repair.
- Prior abdominal aortic aneurysm repair (endovascular or surgical) that was performed less than 6 months prior to the planned stent implant procedure.
- Major surgical or medical procedure within 45 days prior to the planned procedure, or is scheduled for a major surgical or medical procedure within

45 days post implantation. This excluded any planned procedures for the prospective stent-graft placement.

- Untreatable allergy or sensitivity to contrast media or device components.
- Known or suspected connective tissue disorder.
- Blood coagulation disorder or bleeding diathesis for which the treatment cannot be suspended for one week pre- and/or post-repair.
- Coronary artery disease with unstable angina.
- Severe congestive heart failure (New York Heart Association functional class IV).
- Stroke and/or MI within 3 months of the planned treatment date.
- Pulmonary disease requiring the routine (daily or nightly) need for oxygen therapy outside the hospital setting.
- Acute renal failure or renal insufficiency with a creatinine $\geq$ 2.5 mg/dL, unless stable on dialysis.
- Active systemic infection and/or mycotic aneurysms.
- Morbid obesity or other condition that may compromise or prevent the necessary imaging requirements.
- Less than two-year life expectancy.
- Current or planned participation in an investigational drug or device study that has not completed primary endpoint evaluation.
- Currently pregnant or planning to become pregnant during the course of the study.
- Medical, social, or psychological issues that Investigator believed could interfere with treatment or follow-up.

2. Follow-up Schedule

All patients were scheduled to return for follow-up examinations at 30 days (± 4 weeks), 6 months (± 8 weeks), 12 months (± 12 weeks) and annually (± 12 weeks) through 5 years postoperatively.

Preoperatively – Each patient was required to have the following: review of medical history, verification of meeting study selection criteria, pregnancy testing for female patients of childbearing potential, physical exam and neurological assessment, CT scan with contrast and patient-reported outcomes/Quality of Life assessment.

Treatment and Discharge – During the implant procedure, each patient was to have an intraoperative angiogram. Device assessment by the investigator was collected including: device delivery, deployment, patency, and integrity. At the time of the procedure and prior to hospital discharge, clinical utility data was documented, consisting of: type of anesthesia, duration of procedure, amount of contrast administered, total fluoroscopy time, estimated blood loss, vascular access site, duration of hospitalization, duration of ICU stay. Prior to hospital discharge, each patient was to have an examination of the incision site.

Postoperative Follow-up Visits – Assessments during the study included CT scans with and without contrast, chest x-ray, and patient reported outcomes/Quality of Life. Adverse events and complications were recorded at all visits.

Additional assessments that were collected at each follow-up visit included:

- Device-related adverse events
- Aneurysm sac rupture
- Stent-graft migration, assessed by an Independent Core Lab
- Endoleak, assessed by an Independent Core Lab
- Aneurysm enlargement
- Stent-graft integrity, assessed by an Independent Core Lab
- Loss of stent-graft patency
- Conversion to open surgery
- Secondary interventions
- Aneurysm-related mortality

Schedule of Assessments are shown in **Table 5. Schedule of Assessment** below.

Table 5. Schedule of Assessment

Assessment	Screening/ Baseline	Treatment	Discharge	1m ± 4 weeks	6m ± 8 weeks	12m ± 12 weeks	2, 3, 4, 5y ± 12 weeks	Unscheduled Visits
Informed Consent	X							
Medical History	X							
Verify Inclusion/Exclusion Criteria	X							
Pregnancy testing for female patients of childbearing potential	X							
Physical Exam, including Neurological Assessment	X							
CT Scan with Contrast	X							X
Examination of incision site and assessment of healing			X					
CT Scan w/ & w/o Contrast[a]				X[a]	X[a]	X[a]	X[a]	
Angiogram		X						
Chest X-Ray				X[b]	X[b]	X[b]	X[b]	
Adverse Event Assessment		X	X	X	X	X	X	X
Device-Related Events		X	X	X	X	X	X	
Patient-Reported Outcomes	X			X	X	X	X	
Clinical Utility Measures		X	X					

[a]*MRI, combined with unenhanced CT, could be performed at follow-up visits for patients unable to receive contrast*

[b]*Chest X-Ray: To assess for stent strut integrity (wireform fractures) and modular graft component overlap, which may be indicative of graft migration. All imaging submitted is used to assess device integrity and evaluated by the core lab to determine the protocol requirement for adequate imaging, at a minimum x-ray imaging to assess anterior-posterior, oblique and lateral aspects of the device are necessary.*

The key timepoints are shown below in the tables summarizing safety and effectiveness.

3. Clinical Endpoints

With regard to safety, the primary safety endpoint was the incidence of major adverse events (MAEs) through 30 days post-procedure. A major adverse event was defined as any one of the following:

- Death
- Myocardial infarction
- Stroke, excluding transient ischemic attack (TIA)
- Renal failure
- Respiratory failure
- Paralysis, excluding paraparesis
- Bowel ischemia
- Procedural blood loss >1,000 cc

The primary safety endpoint was compared to a Performance Goal (PG) of 20%.

With regards to effectiveness, the primary effectiveness endpoint was successful aneurysm treatment, which was a composite of the following:

- Technical success through 24 hours post-procedure, defined as:
  - Successful delivery of the device through the vasculature
  - Successful deployment of the device at the intended location
  - Absence of Type I or III endoleak
  - Patent stent-graft without significant stenosis (>50%)
- Stent-graft patency through 12 months;
- Absence of aneurysm rupture through 12 months;
- Absence of Type I or III endoleak at 12 months;
- Absence of stent fractures in the attachment zone through 12 months;
- Absence of open or endovascular secondary interventions related to the device or treated pathology through 12-months;
- Absence of aneurysm expansion (>5 mm diameter increase) through 12 months, compared to the first post-procedural computed tomographic (CT) imaging study; and
- Absence of stent-graft migration (> 10 mm) through 12 months, compared to the first post-procedural CT.

The primary effectiveness endpoint was compared to a PG of 80%.

With regard to success/failure criteria, the RelayPro Pivotal Study will be considered successful if both the primary safety and effectiveness goals are met.

The following secondary analyses were completed using descriptive statistics:

- Intervention-Free Technical Success defined as:
  - Successful delivery of the device through the vasculature (i.e., ability to deliver the implant to the intended location without the need for unanticipated corrective intervention related to delivery);
  - Successful and accurate deployment of the device defined as:

        - deployment of the endovascular stent-graft in the planned location;
        - patency of the endovascular stent-graft, absence of device deformations (e.g., kinks, stent eversion, mal-deployment, misaligned deployment) requiring unplanned placement of an additional device within the endovascular stent-graft, and;
      - Successful withdrawal (i.e., successful withdrawal of the delivery system, without the need for unanticipated corrective intervention related to withdrawal)
- All-cause mortality and lesion-related mortality through 1-month, 6-months, 12-months and annual through 5 years;
- Loss of stent-graft patency through 1-month, 6-months, 12-months and annual through 5 years;
- Decreased stent-graft lumen diameter through 1-month, 6-months, 12-months and annual through 5 years;
- Aneurysm rupture through 1-month, 6-months, 12-months and annual through 5 years;
- All Endoleaks, evaluated individually, at 1 month, 6 months, 12 months and annual through 5 years;
- Stent fractures through 1-month, 6-months, 12-months and annual through 5 years;
- Incidence of open or endovascular secondary interventions related to the device or treated pathology to treat a condition involving the study device and/or the aneurysm treated with the study device through 1 month, 6 months, 12-months and annual through 5 years;
- Aneurysm expansion (> 5 mm diameter increase) at 6-months, 12-months and annual through 5 years compared to the first post-procedural CT;
- Stent migration (> 10 mm) at 6-months, 12-months and annual through 5 years compared to the first post-procedural CT;
- Thromboembolic events attributed to the stent-graft through 1-month, 6-months, 12months and annual through 5 years;
- Individual outcomes of the composite safety endpoints through 6 months, 12 months and annual through 5 years;
- All adverse events through 6-months, 12-months and annual through 5 years;
- Device-related adverse events through 5 years;
- Vascular access complications at the index procedure;
- Clinical utility measures, including duration of procedure, transfusions required, length of hospital stay, and time in ICU.

B. <u>Accountability of PMA Cohort</u>

At the time of database lock, of 110 patients enrolled in the PMA study, all 110 patients were implanted with the RelayPro . All but one patient (109/110, 99.1%) completed the 30-day visit (minimum of 96.4% with imaging adequate to assess endovascular graft parameters). Ninety-six patients (of 108 eligible patients) completed the 6-month visit with at least 83.3% of imaging adequate to assess endovascular graft parameters.

At 12-months, 93 of the 105 eligible patients (88.6%, 93/105) returned for the follow-up visit with at least 81% of imaging adequate to assess aneurysm diameter, endoleak, migration and fracture. At 2-years, 48 of the 91 eligible patients returned for the follow-up visit with 38 patients (41.87%, 38/91) still within the follow-up window. At 3-years, 4 patients of the 19 eligible patients have completed the follow-up visit. Compliance and imaging follow-up are provided in **Table 6** below.

Table 6. Summary of Compliance and Core Lab Imaging Follow-Up

	Patient Follow-up				Imaging Performed[d]		Imaging Adequate to Assess the Parameter†				Events Occurring Within Window‡				
Analysis Window	Eligible[a]	Follow-up done[c]	Pending*	Still in Window	CT Scan	X-Ray	Diameter	Endoleak	Migration	Fracture	Death	Lost to follow-up	Early Withdrawal	Other [b]	Not yet due
Procedure	110	NA	NA	N/A	NA	NA	NA	NA	NA	NA	0	NA	NA	NA	0
30 Days	110	99.1% (109)	0.9% (1)	0.0% (0)	99.1% (109)	97.3% (107)	98.2% (108)	96.4% (106)	99.1% (109)	97.3% (107)	2	0	0	0	0
6 Months	108	88.9% (96§)	11.1% (12)	0.0% (0)	89.8% (97)	85.2% (92)	89.8% (97)	83.3% (90)	89.8% (97)	89.8% (97)	2	1	0	0	0
12 Months	105	88.6% (93)	12.4% (13)	0.0% (0)	87.6% (92)	88.6% (93)	87.6% (92)	81.0% (85)	87.6% (92)	88.6% (93)	1	2	5	3	3
2 Years	91	52.7% (48)	47.3% (43)	41.8% (38)	50.5% (46)	46.2% (42)	50.5% (46)	45.1% (41)	50.5% (46)	50.5% (46)	3	1	3	0	65
3 Years	19	21.1% (4)	78.9% (15)	78.9% (15)	21.1% (4)	21.1% (4)	21.1% (4)	21.1% (4)	21.1% (4)	21.1% (4)	0	0	0	0	17

	Patient Follow-up				Imaging Performed[d]		Imaging Adequate to Assess the Parameter†				Events Occurring Within Window‡				
Analysis Window	Eligible[a]	Follow-up done[c]	Pending*	Still in Window	CT Scan	X-Ray	Diameter	Endoleak	Migration	Fracture	Death	Lost to follow-up	Early Withdrawal	Other [b]	Not yet due

NA – Not Applicable

[a] Eligible patients are all patients who are enrolled by snapshot date and either have a follow-up visit form or are past due for their follow-up (beyond upper limit of window on study and did not exit the study before the upper limit of the window).

[b] Patients choose to not reconsent to the study follow up extension.

[c] Patients with follow-up data according to the investigational site.

[d] Patients with CT scan data as determined by the Core Lab.

*Patients who did not have a visit within the window or patients who did not have a visit but have not yet reached the end of the analysis window. The number of patients eligible for the visit is used as the denominator when calculating the percentage of visits performed.

† Sac Diameter and Migration assessments use 1 month as baseline. Eligible patients require valid value at 1 month and at the specified time point.

‡ These columns reflect patients who had visits within the specified window but were not eligible at the start of the next window due to death, surgical conversion or early withdrawal.

§ One patient had no site follow-up data but has CT data available; therefore, there are 96 patients with follow-up completed, and 97 patients with CT imaging available.

C. Study Population Demographics and Baseline Parameters

Demographics

The demographics of the study population are typical for a thoracic endovascular graft study performed in the US and are summarized in **Table 7. Summary of Patient Demographics**. In the study, 62.7% of patients were males (69/110) with 54.5% of the cohort being 75+ (60/110). Additionally, 39.1% (43/110) of the pivotal cohort was Asian and 49.1% (54/110) were white.

Regarding the Japan and US cohorts of the RelayPro Pivotal Study, the Japan cohort was older (mean 78.5 vs. 72.6) and consisted of a higher percentage of male patients (78.6%, 33/42 vs. 52.9%, 36/68) as compared to the US cohort. The US cohort was predominantly white (79.4%, 54/68).

Table 7. Summary of Patient Demographics

Characteristic	Statistics	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
Sex				
Female	% (n)	47.1% (32)	21.4% (9)	37.3% (41)
Male	% (n)	52.9% (36)	78.6% (33)	62.7% (69)
Age (years) at Treatment	Mean ± SD	72.6 ± 8.5	78.5 ± 6.6	74.9 ± 8.3
	Median (IQR)	73 (67 - 78.5)	81 (73 - 83)	76 (70 - 81)
	Min - Max	45 - 92	65 - 94	45 - 94
Age Group				
18-64	% (n)	14.7% (10)	0% (0)	9.1% (10)
65-74	% (n)	41.2% (28)	28.6% (12)	36.4% (40)
75+	% (n)	44.1% (30)	71.4% (30)	54.5% (60)
Ethnic Group				
Hispanic/Latino	% (n)	4.4% (3)	0% (0)	2.7% (3)
Not Hispanic/Latino	% (n)	85.3% (58)	100.0% (42)	90.9% (100)
Not Reported	% (n)	10.3% (7)	0% (0)	6.4% (7)
Race				
Asian	% (n)	1.5% (1)	100.0% (42)	39.1% (43)
Black	% (n)	19.1% (13)	0% (0)	11.8% (13)
White	% (n)	79.4% (54)	0% (0)	49.1% (54)

Baseline Medical History

Baseline patient comorbidities are presented in the **Table 8**. The most common comorbidities observed include hypertension and/or treatment for hypertension (86.4%, 95/110), hypercholesterolemia (64.5%, 71/110), history of smoking (81.8%, 90/110), history of peripheral vascular disease (18.2%, 20/110), documented COPD (29.1%, 32/110), history of neurologic disease (20%, 22/110), diabetes mellitus (19.1%, 21/110), and renal insufficiency (19.1%, 21/110).

Regarding the US and Japan cohorts of the RelayPro Pivotal Study, a larger proportion of patients in the US cohort had history of peripheral vascular disease (26.5% vs. 4.8%), documented myocardial infarction (16.2% vs. 9.5%), documented COPD (33.8% vs. 21.4%), hypercholesterolemia (69.1% vs. 57.1%), and history of GI complications (35.3% vs. 21.4%). A larger proportion of patients in the Japan cohort had diabetes mellitus (26.2% vs. 14.7%) and renal insufficiency (21.4% vs. 17.6%).

Table 8. Summary of Patient Comorbidities

Comorbidity	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
History of Peripheral Vascular Disease	26.5% (18)	4.8% (2)	18.2% (20)
Coronary Artery Disease			
Stable Angina	7.4% (5)	9.5% (4)	8.2% (9)
Unstable Angina	1.5% (1)	0% (0)	0.9% (1)
Myocardial Infarction	16.2% (11)	9.5% (4)	13.6% (15)
Arrhythmias	13.2% (9)	0% (0)	8.2% (9)
Congestive Heart Failure	5.9% (4)	2.4% (1)	4.5% (5)
Other	25.0% (17)	2.4% (1)	16.4% (18)
Chronic Obstructive Pulmonary Disease	33.8% (23)	21.4% (9)	29.1% (32)
Routine (daily/nightly) home oxygen use	0% (0/23)	11.1% (1/9)	3.1% (1/32)
History of Neurologic Disease	20.6% (14)	19.0% (8)	20.0% (22)
Diabetes Mellitus	14.7% (10)	26.2% (11)	19.1% (21)
Hypertension (HTN) and/or Treatment of HTN	88.2% (60)	83.3% (35)	86.4% (95)
Hypercholesterolemia	69.1% (47)	57.1% (24)	64.5% (71)
History of Smoking	83.8% (57)	78.6% (33)	81.8% (90)
Former Smoker	56.1% (32/57)	97.0% (32/33)	71.1% (64/90)
Current Smoker	43.9% (25/57)	3.0% (1/33)	28.9% (26/90)
Renal Insufficiency	17.6% (12)	21.4% (9)	19.1% (21)
Current Antiplatelet/ Anticoagulant Medication	66.2% (45)	40.5% (17)	56.4% (62)

Comorbidity	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
History of Limb Ischemia	7.4% (5)	7.1% (3)	7.3% (8)
History of Vascular Intervention	23.5% (16)	28.6% (12)	25.5% (28)
History of Gastrointestinal Complications	35.3% (24)	21.4% (9)	30.0% (33)
Cholecystitis	4.4% (3)	0% (0)	2.7% (3)
Ischemic Colitis	1.5% (1)	0% (0)	0.9% (1)
GI Bleed	2.9% (2)	2.4% (1)	2.7% (3)
Small Bowel Ischemia	0% (0)	0% (0)	0% (0)
History of Impotence (males only)	16.7% (6/36)	3.0% (1/33)	10.1% (7/69)
All values expressed as % (n). Site reported data.			

Baseline Vessel Measurements

Baseline aneurysm and anatomical measurements, as well as access vessel characteristics of the study population, were reported by both the Core Lab and the site. The clinical sites and Core Lab evaluated 100% (110/110) of the baseline contrast CT scans. Baseline aneurysm characteristics are summarized in **Table 9.**

All patients enrolled in this study met the inclusion criteria based on site-reported CT measurements. Patient eligibility was confirmed by the Core Lab prior to enrollment. There were minor differences observed between the Core Lab and the site measurements. See the IFU for a detailed discussion.

There were no substantial differences between the US cohort and the Japan cohort related to the baseline aneurysm and anatomical measurements. See the IFU for a detailed discussion.

Of the 110 patients enrolled in the study with aneurysms, 76 were fusiform aneurysms (45 US and 31 Japanese patients) and 34 were saccular aneurysms or PAUs per the site reported assessment.

Table 9. Core Laboratory – Reported Baseline CT Measurements

Characteristic	Statistics	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
Slice Thickness	Mean ± SD	1.5 ± 0.7	1.7 ± 0.8	1.6 ± 0.8
	Median (IQR)	1.3 (1.0 - 2.0)	1.5 (1.0 - 2.0)	1.3 (1.0 - 2.0)
	Min - Max	0.5 - 3.0	0.5 - 3.0	0.5 - 3.0
Aortic Diameter at LCC (mm)	Mean ± SD	31.8 ± 4.1	34.9 ± 4.7	33.0 ± 4.6
	Median (IQR)	31.5 (29.4 - 33.9)	34.4 (32.0 - 37.1)	32.5 (30.2 - 35.1)
	Min - Max	24.1 - 46.9	27.5 - 49.9	24.1 - 49.9

Characteristic	Statistics	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
Aortic Diameter at LSA (mm)	Mean ± SD	30.5 ± 3.7	33.6 ± 4.8	31.7 ± 4.4
	Median (IQR)	30.4 (27.4 - 32.6)	33.6 (30.3 - 36.3)	31.3 (28.7 - 34.6)
	Min - Max	20.6 - 39.8	25.5 - 47.2	20.6 - 47.2
Aortic Diameter at Distal End of Proximal Neck (mm)	Mean ± SD	33.8 ± 4.6	35.3 ± 5.0	34.4 ± 4.8
	Median (IQR)	34.4 (29.9 - 36.8)	36.5 (31.7 - 39.0)	34.7 (30.9 - 37.7)
	Min - Max	23.2 - 44.3	24.7 - 43.8	23.2 - 44.3
Aortic Diameter at Proximal End of Distal Neck (mm)	Mean ± SD	32.2 ± 4.5	31.9 ± 4.4	32.1 ± 4.4
	Median (IQR)	32.2 (28.5 - 34.9)	31.0 (28.2 - 34.8)	31.9 (28.3 - 34.8)
	Min - Max	22.4 - 42.1	25.1 - 44.3	22.4 - 44.3
Length from LCC to Proximal End of Proximal Neck (mm)	Mean ± SD	19.4 ± 17.3	37.0 ± 42.0	26.1 ± 30.3
	Median (IQR)	19.3 (0.0 - 28.4)	17.9 (14.4 - 50.2)	18.4 (11.0 - 32.0)
	Min - Max	0.0 - 82.8	0.0 - 156.0	0.0 - 156.0
Proximal Neck Length – Centerline (mm)	Mean ± SD	64.9 ± 36.3	75.0 ± 36.8	68.8 ± 36.7
Centerline distance from the proximal edge of the landing zone to the proximal edge of the aneurysm/lesion	Median (IQR)	54.4 (35.7 - 83.0)	70.3 (42.3 - 106.0)	57.8 (38.6 - 94.0)
	Min - Max	22.6 - 186.0	25.8 - 150.0	22.6 - 186.0
Proximal Neck Length – Inner Curve (mm)	Mean ± SD	47.8 ± 31.4	56.3 ± 30.6	51.0 ± 31.2
Inner curve distance from the proximal edge of the landing zone to the proximal edge of the aneurysm/lesion	Median (IQR)	37.9 (23.3 - 62.4)	46.7 (29.3 - 81.0)	40.9 (25.3 - 74.0)
	Min - Max	13.9 - 158.0	20.0 - 125.0	13.9 - 158.0
Distal Neck Length – Centerline (mm)	Mean ± SD	77.4 ± 47.2	80.7 ± 54.9	78.7 ± 50.1
Centerline distance from the distal edge of the aneurysm/lesion to the proximal edge of the celiac trunk	Median (IQR)	63.0 (40.2 - 95.4)	60.3 (36.3 - 108.0)	63.0 (38.3 - 100.0)
	Min - Max	25.1 - 219.0	25.8 - 204.0	25.1 - 219.0

Characteristic	Statistics	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
Distal Neck Length –Inner Curve (mm)	Mean ± SD	71.7 ± 45.3	74.7 ± 51.3	72.8 ± 47.5
Inner curve distance from the distal edge of the aneurysm/lesion to the proximal edge of the celiac trunk	Median (IQR)	57.2 (37.0 - 92.0)	56.8 (34.0 - 107.0)	57.2 (35.4 - 93.3)
	Min - Max	20.0 - 219.0	21.4 - 194.0	20.0 - 219.0
Aneurysm Length (mm)	Mean ± SD	104.4 ± 59.0	85.0 ± 40.3	97.0 ± 53.3
	Median (IQR)	92.0 (54.7 - 142.5)	84.0 (53.1 - 107.0)	89.4 (53.6 - 127.0)
	Min - Max	19.6 - 236.0	18.8 - 172.0	18.8 - 236.0
Right Iliac Tortuosity Index	Mean ± SD	1.3 ± 0.2	1.4 ± 0.2	1.4 ± 0.2
	Median (IQR)	1.3 (1.2 - 1.5)	1.3 (1.2 - 1.5)	1.3 (1.2 - 1.5)
	Min - Max	1.1 - 1.8	1.1 - 2.2	1.1 - 2.2
Left Iliac Tortuosity Index	Mean ± SD	1.3 ± 0.2	1.4 ± 0.2	1.3 ± 0.2
	Median (IQR)	1.3 (1.2 - 1.4)	1.3 (1.2 - 1.5)	1.3 (1.2 - 1.5)
	Min - Max	1.1 - 1.8	1.1 - 2.0	1.1 - 2.0
Proximal Neck Thrombus Max Thickness (mm)	Mean ± SD	0.9 ± 1.6	1.0 ± 2.0	0.9 ± 1.8
	Median (IQR)	0.0 (0.0 - 0.9)	0.0 (0.0 - 0.0)	0.0 (0.0 - 0.0)
	Min - Max	0.0 - 5.4	0.0 - 8.3	0.0 - 8.3
Proximal Neck Thrombus Degrees >2mm in Thickness (mm)	Mean ± SD	20.1 ± 47.4	19.2 ± 41.7	19.7 ± 45.1
	Median (IQR)	0.0 (0.0 - 0.0)	0.0 (0.0 - 0.0)	0.0 (0.0 - 0.0)
	Min - Max	0.0 - 200.0	0.0 - 151.0	0.0 - 200.0
Proximal Neck Calcium Max Thickness (mm)	Mean ± SD	1.2 ± 1.3	2.1 ± 1.7	1.5 ± 1.5
	Median (IQR)	0.0 (0.0 - 2.2)	2.3 (0.0 - 2.9)	1.8 (0.0 - 2.6)
	Min - Max	0.0 - 4.5	0.0 - 6.0	0.0 - 6.0
Proximal Neck Calcium Degrees	Mean ± SD	24.2 ± 38.3	34.6 ± 38.6	28.2 ± 38.6
	Median (IQR)	0.0 (0.0 - 35.0)	25.0 (0.0 - 45.0)	13.5 (0.0 - 41.0)
	Min - Max	0.0 - 169.0	0.0 - 152.0	0.0 - 169.0
Distal Neck Thrombus Max Thickness (mm)	Mean ± SD	1.5 ± 2.8	1.3 ± 2.1	1.5 ± 2.5
	Median (IQR)	0.0 (0.0 - 2.9)	0.0 (0.0 - 2.9)	0.0 (0.0 - 2.9)

Characteristic	Statistics	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
	Min - Max	0.0 - 15.5	0.0 - 7.2	0.0 - 15.5
Distal Neck Thrombus Degrees >2mm in Thickness (mm)	Mean ± SD	27.8 ± 48.5	28.6 ± 51.4	28.1 ± 49.4
	Median (IQR)	0.0 (0.0 - 54.0)	0.0 (0.0 - 50.0)	0.0 (0.0 - 51.0)
	Min - Max	0.0 - 211.0	0.0 - 200.0	0.0 - 211.0
Distal Neck Calcium Max Thickness (mm)	Mean ± SD	0.9 ± 1.2	1.4 ± 1.3	1.1 ± 1.3
	Median (IQR)	0.0 (0.0 - 1.9)	1.6 (0.0 - 2.5)	0.0 (0.0 - 2.0)
	Min - Max	0.0 - 4.1	0.0 - 4.5	0.0 - 4.5
Distal Neck Calcium Degrees	Mean ± SD	14.4 ± 29.5	16.0 ± 23.7	15.0 ± 27.3
	Median (IQR)	0.0 (0.0 - 15.5)	11.0 (0.0 - 23.0)	0.0 (0.0 - 19.7)
	Min - Max	0.0 - 173.0	0.0 - 122.0	0.0 - 173.0
Max TAA Diameter (mm)	Mean ± SD	54.6 ± 10.6	58.6 ± 8.0	56.1 ± 9.9
	Median (IQR)	55.2 (48.2 - 61.6)	57.7 (55.6 - 61.0)	56.9 (50.7 - 61.1)
	Min - Max	33.0 - 80.8	34.7 - 81.3	33.0 - 81.3
PAU: Depth (mm)	Mean ± SD (N)	11.0 ± 1.3 (9)	19.7 ± NA (1)	11.8 ± 3.0 (10)
	Median (IQR)	10.2 (10.0 - 11.8)	19.7 (19.7 - 19.7)	10.4 (10.0 - 13.0)
	Min - Max	10.0 - 13.2	19.7 - 19.7	10.0 - 19.7
PAU: Diameter (mm)	Mean ± SD (N)	27.6 ± 7.7 (9)	27.8 ± NA (1)	27.6 ± 7.2 (10)
	Median (IQR)	26.0 (24.0 - 35.6)	27.8 (27.8 - 27.8)	26.9 (24.0 - 35.6)
	Min - Max	14.5 - 36.3	27.8 - 27.8	14.5 - 36.3
Total Treatment Length - Outer Curve (mm)	Mean ± SD (N)	289.6 ± 59.5 (67)	277.1 ± 71.7 (42)	284.8 ± 64.5 (109)
Outer curve distance from the proximal end of the proximal neck to the distal end of the distal neck.	Median (IQR)	293.0 (262.0 - 327.0)	293.5 (242.0 - 320.0)	293.0 (258.0 - 326.0)
	Min - Max	40.6 - 408.0	60.5 - 378.0	40.6 - 408.0
Tortuosity Index	Mean ± SD (N)	1.5 ± 0.2 (64)	1.6 ± 0.2 (42)	1.5 ± 0.2 (106)
	Median (IQR)	1.5 (1.4 - 1.6)	1.6 (1.5 - 1.6)	1.5 (1.4 - 1.6)
	Min - Max	1.2 - 2.0	1.2 - 2.4	1.2 - 2.4
Minimum Right Common Iliac Diameter (mm)	Mean ± SD (N)	9.5 ± 2.5 (66)	9.3 ± 2.7 (42)	9.4 ± 2.5 (108)
	Median (IQR)	9.5 (7.7 - 11.1)	9.0 (7.9 - 10.5)	9.3 (7.8 - 11.0)

Characteristic	Statistics	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
	Min - Max	4.6 - 15.9	4.1 - 18.3	4.1 - 18.3
Minimum Right External Iliac Diameter (mm)	Mean ± SD (N)	6.9 ± 1.8 (66)	7.4 ± 1.3 (42)	7.1 ± 1.6 (108)
	Median (IQR)	6.9 (5.5 - 8.2)	7.4 (6.6 - 8.3)	7.2 (5.9 - 8.2)
	Min - Max	3.7 - 11.3	4.5 - 10.9	3.7 - 11.3
Minimum Right Common Femoral Diameter (mm)	Mean ± SD (N)	7.5 ± 1.8 (66)	8.3 ± 1.3 (42)	7.8 ± 1.7 (108)
	Median (IQR)	7.3 (6.2 - 9.0)	8.2 (7.2 - 9.2)	7.6 (6.8 - 9.1)
	Min - Max	4.1 - 12.3	6.0 - 11.3	4.1 - 12.3
Minimum Left Common Iliac Diameter (mm)	Mean ± SD (N)	9.4 ± 2.8 (67)	9.2 ± 2.6 (42)	9.3 ± 2.7 (109)
	Median (IQR)	9.2 (7.0 - 10.8)	8.9 (7.7 - 10.2)	9.2 (7.4 - 10.8)
	Min - Max	3.4 - 18.6	4.7 - 17.5	3.4 - 18.6
Minimum Left External Iliac Diameter (mm)	Mean ± SD (N)	6.7 ± 1.8 (67)	7.4 ± 1.2 (42)	7.0 ± 1.7 (109)
	Median (IQR)	6.8 (5.5 - 8.1)	7.3 (6.6 - 8.0)	6.9 (5.9 - 8.0)
	Min - Max	2.6 - 10.5	5.2 - 10.6	2.6 - 10.6
Minimum Left Common Femoral Diameter (mm)	Mean ± SD (N)	7.5 ± 1.7 (66)	8.0 ± 1.3 (42)	7.7 ± 1.6 (108)
	Median (IQR)	7.4 (6.2 - 8.6)	7.8 (7.2 - 8.7)	7.7 (6.5 - 8.7)
	Min - Max	3.8 - 11.6	5.3 - 11.7	3.8 - 11.7
Arch Type				
Type I	% (n)	8.8% (6)	14.3% (6)	10.9% (12)
Type II	% (n)	42.6% (29)	19.0% (8)	33.6% (37)
Type III	% (n)	48.5% (33)	66.7% (28)	55.5% (61)
Arch Type (Normal/Bovine)				
Bovine	% (n)	25.0% (17)	0% (0)	15.5% (17)
Normal	% (n)	75.0% (51)	100.0% (42)	84.5% (93)
Indication				
Aneurysm	% (n)	86.8% (59)	97.6% (41)	90.9% (100)
PAU	% (n)	13.2% (9)	2.4% (1)	9.1% (10)

RelayPro Devices Implanted

A total of 168 device components were implanted in the Pivotal Study. The number of devices implanted in the initial procedure are shown in **Table 10**. One RelayPro device was implanted in 51.8% (57/110) of the cohort (43 NBS and 14 Proximal Bare Stent), and

two RelayPro devices were implanted in 43.6% (48/110) of the cohort (33 NBS only, 5 Proximal Bare Stent only and 10 received both). Three RelayPro devices were implanted in 5 patients (4.5%, 5/110) of the cohort (1 NBS only and 4 received both).

Table 10. Number of RelayPro Devices Implanted During the Initial Procedure

Number of Devices Implanted	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
1	57.4% (39)	42.9% (18)	51.8% (57)
2	36.8% (25)	54.8% (23)	43.6% (48)
3	5.9% (4)	2.4% (1)	4.5% (5)
*Denominator includes all patients who received the test device. Site reported data			

Table 11. Number of Devices Implanted During the Initial Procedure – Bare Stent

Number of Devices Implanted	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
1	11.8% (8)	14.3% (6)	12.7% (14)
2	13.2% (9)	14.3% (6)	13.6% (15)
3	5.9% (4)	0% (0)	3.6% (4)
*Denominator includes all patients who received the test device. Site reported data			

Table 12. Number of Devices Implanted During the Initial Procedure - NBS

Number of Devices Implanted	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
1	45.6% (31)	28.6% (12)	39.1% (43)
2	30.9% (21)	52.4% (22)	39.1% (43)
3	5.9% (4)	2.4% (1)	4.5% (5)
*Denominator includes all patients who received the RelayPro device. Site reported data.			

The diameters of the devices implanted in the Pivotal Study are shown in

Table 13. The most commonly implanted NBS devices were the 34 mm (19.1%, 21/110), 36 mm (21.8%, 24/110), 38 mm (28.2%, 31/110), and 40 mm (13.6%, 15/110) proximal diameters. The most commonly implanted proximal bare stent configurations were the 36 mm (7.3%, 8/110), 38 mm (10.9%, 12/110), and 40 mm (6.4%, 7/110) proximal diameters.

Table 13. Diameters of RelayPro Devices Implanted During the Initial Procedure

Diameters (mm)	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
Proximal (NBS)			

Diameters (mm)	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
26	0% (0)	4.8% (2)	1.8% (2)
28	1.5% (1)	0% (0)	0.9% (1)
30	4.4% (3)	11.9% (5)	7.3% (8)
32	11.8% (8)	7.1% (3)	10.0% (11)
34	19.1% (13)	19.0% (8)	19.1% (21)
36	22.1% (15)	21.4% (9)	21.8% (24)
38	30.9% (21)	21.4% (9)	27.3% (30)
40	11.8% (8)	16.7% (7)	13.6% (15)
42	5.9% (4)	16.7% (7)	10.0% (11)
44	1.5% (1)	9.5% (4)	4.5% (5)
46	4.4% (3)	0% (0)	2.7% (3)
Proximal (bare stent)			
26	0% (0)	0% (0)	0% (0)
28	0% (0)	0% (0)	0% (0)
30	5.9% (4)	4.8% (2)	5.5% (6)
32	4.4% (3)	2.4% (1)	3.6% (4)
34	5.9% (4)	4.8% (2)	5.5% (6)
36	8.8% (6)	4.8% (2)	7.3% (8)
38	13.2% (9)	7.1% (3)	10.9% (12)
40	5.9% (4)	7.1% (3)	6.4% (7)
42	2.9% (2)	2.4% (1)	2.7% (3)
44	1.5% (1)	2.4% (1)	1.8% (2)
46	2.9% (2)	0% (0)	1.8% (2)
Distal			
26	1.5% (1)	4.8% (2)	2.7% (3)
28	5.9% (4)	2.4% (1)	4.5% (5)
30	5.9% (4)	19.0% (8)	10.9% (12)
32	17.6% (12)	14.3% (6)	16.4% (18)
34	36.8% (25)	31.0% (13)	34.5% (38)
36	25.0% (17)	26.2% (11)	25.5% (28)
38	23.5% (16)	11.9% (5)	19.1% (21)
40	11.8% (8)	19.0% (8)	14.5% (16)
42	5.9% (4)	16.7% (7)	10.0% (11)
44	1.5% (1)	2.4% (1)	1.8% (2)
46	2.9% (2)	0% (0)	1.8% (2)
*Denominator includes all patients who received the test device. Site reported data.			

Procedural Data

Detailed information and observations regarding the index procedure were documented by the physician on case report forms. **Table 14** summarizes the information from the index procedure, including clinical utility endpoints. The majority of patients had general anesthesia (93.6%, 103/110). Right femoral access (73.6%, 81/110) was the predominant access location. Mean duration of the procedure was 113.6 ± 79.6 min and the mean implantation duration was 20 ± 16 min.

Vascular access method was different between the US and Japan cohorts, with the Japan cohort using 100% surgical cutdown (42/42) compared to 73.5% of patients (50/68) in the US cohort having the percutaneous access. In the US cohort, the duration of ICU time was lengthier compared to the Japanese cohort (61.4±57.9 hours vs. 21.6±19.4 hours), while the duration of hospital stay was lengthier in the Japananese cohort (9.9±6.8 days vs. 4.8±3.8 days).

Table 14. Details of the Initial Procedure

Characteristic	Statistics	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
Type of Anesthesia				
General	% (n)	98.5% (67)	85.7% (36)	93.6% (103)
Local	% (n)	1.5% (1)	14.3% (6)	6.4% (7)
Vascular Access				
Left Femoral	% (n)	25.0% (17)	26.2% (11)	25.5% (28)
Right Femoral	% (n)	73.5% (50)	73.8% (31)	73.6% (81)
Right Iliac	% (n)	1.5% (1)	0% (0)	0.9% (1)
Vascular Access Method				
Conduit	% (n)	2.9% (2)	0% (0)	1.8% (2)
Percutaneous	% (n)	73.5% (50)	0% (0)	45.5% (50)
Surgical Cut Down	% (n)	23.5% (16)	100.0% (42)	52.7% (58)
Procedure time (min)	Mean ± SD	117.2 ± 96.6	107.9 ± 39.3	113.6 ± 79.6
	Median (IQR)	87.5 (53 - 142.5)	96 (85 - 128)	91 (64 - 131)
	Min - Max	27 - 563	53 - 230	27 - 563
Implantation time (min)	Mean ± SD	20 ± 18	20 ± 12	20 ± 16
	Median (IQR)	16 (9.5 - 25.5)	17 (12 - 25)	16 (10 - 25)
	Min - Max	2 - 120	5 - 54	2 - 120
Estimated Blood Loss (cc)	Mean ± SD (N)	195 ± 356 (67)	132 ± 334 (42)	170 ± 348 (109)
	Median (IQR)	100 (50 - 200)	31 (10 - 85)	52 (20 - 150)
	Min - Max	5 - 2500	0 - 1516	0 - 2500

Characteristic	Statistics	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
Transfusion Required	% (n)	2.9% (2)	2.4% (1)	2.7% (3)
ICU Stay (hours)	Mean ± SD	61.4 ± 57.9	21.6 ± 19.4)	46.2 ± 50.8
	Median (IQR)	50 (33 - 71.5)	22 (0 - 24)	36 (22 - 57)
	Min - Max	0 - 360	0 - 73	0 - 360
Hospital Stay (days)	Mean ± SD	4.8 ± 3.8	9.9 ± 6.8	6.7 ± 5.7
	Median (IQR)	3.8 (3 - 6)	8.5 (7 - 10)	5 (3 - 9)
	Min - Max	1 - 22	3 - 36	1 - 36

D. Safety and Effectiveness Results

1. Safety Results

1.1 Primary Safety Endpoint

The analysis of safety was based on the RelayPro Pivotal Study cohort of 110 patients available for the 30-day (1 month) evaluation. The key safety outcomes for this study are presented below in **Table 15**. Adverse effects are reported in **Table 16** - **Table 18**.

The primary safety endpoint was the MAE rate through 30 days post procedure compared to a performance goal of 20%. Patients who experienced at least 1 MAE through 30 days were included in the primary safety analysis even if the patient had not completed a 1-month follow-up visit. The composite MAE rate through 30 days was 6.4% (7/110, upper 95% CI 11.6%). A total of 7 MAEs were observed in 7 patients. MAEs reported through 30 days include 2 strokes, 2 cases of procedural blood loss >1,000 cc requiring tranfusion, 2 paralysis events (excluding paraparesis), and 1 renal failure event. The MAE rates observed through 30 days did not vary between geography; 5.9% (4/68) in the US and 7.1% (3/42) in Japan.

Since all 110 patients were available for the primary safety endpoint, there's no missing data and thus no need for sensitivity analysis.

An assessment of poolability was performed by comparing the primary safety endpoint across sites, both Japanese and U.S. sites individually, as well as pooled Japanese sites as compared to pooled U.S. sites. These analyses were based on Fisher's Exact test of binomial proportions. No significant differences between the groups were found.

Table 15. 30-Day Major Adverse Events: Pivotal Study

Characteristic	Statistics	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
MAE Rate at 30 Days	% (n)			6.4% (7)
	Upper 95% CI			-, 11.6%
	P-Value*			0.0002
Time to MAE Analysis				
Number with Events	n			7
Censored	n			1
At Risk	n			101
Freedom from MAE within 30 days	% (95% CI)	94.1% (85%, 97.7%)	92.9% (79.5%, 97.6%)	93.6% (87.1%, 96.9%)
MAE individual components				
Death	% (n)	0% (0)	0% (0)	0% (0)
Myocardial Infarction	% (n)	0% (0)	0% (0)	0% (0)
Stroke (excluding TIA)	% (n)	1.5% (1)	2.4% (1)	1.8% (2)
Renal Failure	% (n)	1.5% (1)	0% (0)	0.9% (1)
Respiratory Failure	% (n)	0% (0)	0% (0)	0% (0)
Paralysis (excluding paraparesis)	% (n)	0% (0)	4.8% (2)	1.8% (2)
Bowel Ischemia	% (n)	0% (0)	0% (0)	0% (0)
Procedural blood loss > 1,000 cc requiring transfusion	% (n)	2.9% (2)	0% (0)	1.8% (2)

*P-value corresponds to the null hypothesis test that the observed value is greater than the Primary Safety Endpoint Performance Goal of 20%.
MAE – Major Adverse Events, NA – not applicable.
All MAEs were adjudicated by the Clinical Events Committee (CEC).

1.2 Secondary Safety Endpoints

1.2.1. Major Adverse Events Through Follow-Up

The secondary safety endpoint includes the individual components of the Major Adverse Events (MAE) endpoint (**Figure 3**), namely death, myocardial infarction, stroke (excluding transient ischemic attack), renal failure, respiratory failure, paralysis (excluding paraparesis), bowel ischemia, and procedural blood loss > 1000 cc requiring transfusion. All MAEs were adjudicated by the Clinical Events Committee.

MAEs throughout follow-up are depicted in **Figure 3**. Kaplan-Meier analysis predicts a freedom from MAEs of 93.6% at 1-30 days, 89.0% at 31-180 days, 89% at 181-360 days, 87.4% at 361-540 days, 78.7% at 541-720 days and 74.1% at 721-900 days.

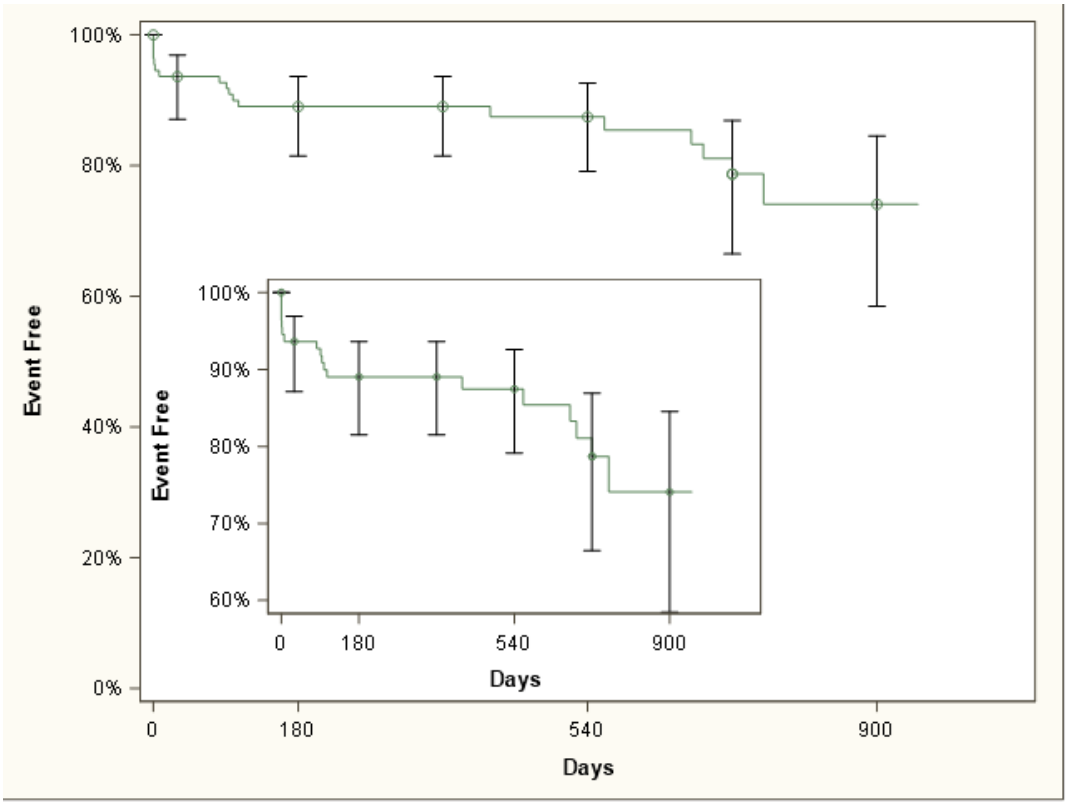

Figure 3. Kaplan-Meier Freedom from Major Adverse Event

From Day X - Day Y	# Entered	# Censored	# Events	Event-free [%]	Greenwood SE [%]	95% Confidence Interval
0	110	0	4	96.4%	1.8%	90.6%-98.6%
1-30	106	2	3	93.6%	2.3%	87.1%-96.9%
31-180	102	0	5	89.0%	3.0%	81.5%-93.6%
181-360	97	11	0	89.0%	3.0%	81.5%-93.6%
361-540	86	42	1	87.4%	3.3%	79.1%-92.6%
541-720	43	7	4	78.7%	5.1%	66.5%-86.9%
721-900	32	29	1	74.1%	6.6%	58.5%-84.6%
901-1080	2	2	0			

The total number of patients who were eligible for follow-up with MAE(s) was reported as 7.3% (8/110) at 30 days, 3.7% (4/108) at 6 months, 1.9% (2/105) at 12 months, and 5.5% (5/91) at 2-years. Six (6) patients experienced either a stroke (4 - occuring at 1 day, 7 days, 94 days and 419 days post implant) or paraplegia (2) event during the study. The two patients in the Japan cohort reporting paraplegia (immobility of the lower limbs) had symptom onset on the day of the procedure. Both were managed with spinal drain placement and the paraplegia improved on the same day; both events were adjucidated by the CEC as procedure relatated, one as also adjudicated as device related.

Table 16. Summary of MAEs Reported at Follow-Up

MAE	30 Days	6 Months	12 Months	2 Year
Number Eligible for Follow-Up	110	108	105	91
Patients with ≥1 MAE (Total)	7.3% (8/110)	3.7% (4/108)	1.9% (2/105)	5.5% (5/91)
MAEs (Total)	9	5	2	5
Death				
New	2	2	1	3
To Date	1.8% (2/110)	3.6% (4/110)	4.6% (5/109)	8.3% (8/96)
Myocardial Infarction				
New	0	1	0	0
To Date	0% (0/110)	0.9% (1/108)	1.0% (1/105)	1.1% (1/91)
Paralysis				
New	2	0	0	0
To Date	1.8% (2/110)	1.9% (2/108)	1.9% (2/105)	2.2% (2/92)
Stroke				
New	2	1	1	0
To Date	1.8% (2/110)	2.8% (3/109)	3.7% (4/107)	4.3% (4/93)
Renal Failure				
New	1	1	0	1
To Date	0.9% (1/110)	1.9% (2/108)	1.9% (2/105)	3.2% (3/93)
Procedural blood loss > 1000 cc requiring transfusion				
New	2	0	0	0
To Date	1.8% (2/110)	1.9% (2/108)	1.9% (2/105)	2.2% (2/91)
Bowel ischemia				
New	0	0	0	1
To Date	0.0% (0/110)	0.0% (0/108)	0.0% (0/105)	1.1% (1/91)

1.2.2 All-Cause Mortality

There have been 8 reports of death in the Pivotal Study. The Kaplan-Meier analysis estimate for freedom from All-Cause Mortaility is shown in **Figure 4**. Kaplan Meier analysis predicts a freedom from All-Cause Mortality to be 100% at 30 days, 97.2% at 31-180 days, 96.3% at 181-360 days, 94.3% at 361-540 days, 92.2% at 541-720 days and 80.3% at 721-900 days.

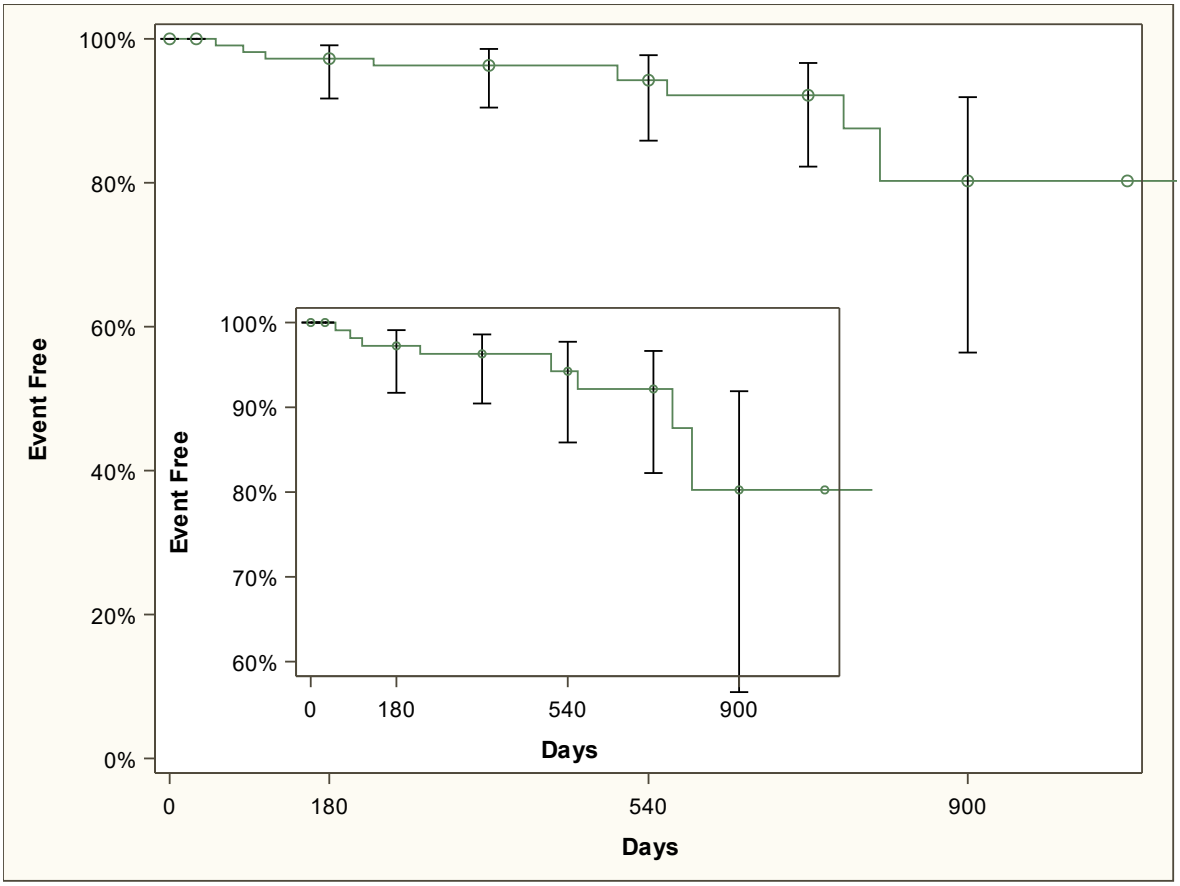

Figure 4. Kaplan-Meier Freedom from All-Cause Mortality

From Day X - Day Y	# Entered	# Censored	# Events	Event-free [%]	Greenwood SE [%]	95% Confidence Interval
0	110	0	0	100.0%	0%	
1-30	110	1	0	100.0%	0%	
31-180	109	0	3	97.2%	1.6%	91.7%-99.1%
181-360	106	12	1	96.3%	1.8%	90.4%-98.6%
361-540	93	47	1	94.3%	2.7%	85.9%-97.7%
541-720	45	8	1	92.2%	3.4%	82.2-96.6%
721-900	36	30	2	80.3%	8.6%	56.4%-91.9%
901-1080	4	3	0	80.3%	8.6%	56.4%-91.9%

1.2.3 Lesion-Related Mortality

The RelayPro Aneurysm Study (Pro-A) Lesion-Related Mortality is defined as patient death as the result of a serious and device- or procedure-related adverse effect. Two patients expired on day 52 and 83 post implant, respectively, and met the criteria for lesion-related mortality. Kaplan-Meier analysis predicts a freedom from Lesion-Related Mortality at 30 days of 100% and 98.2% through 3 years.

Pro-A Aneurysm-Related Mortality is defined as either death due to a rupture, death within 30 days or prior to hospital discharge from primary procedure, or death within 30 days or prior to hospital discharge for a secondary procedure to treat the index pathology. There was no aneurysm-related mortality reported.

Please note that there were two definitions for relatedness to mortality for this Pro-A study and were prospectively defined as presented above. The standard aneurysm-related mortality definition used for other thoracic endovascular graft studies includes a combination of both the Pro-A definitions for Lesion-Related and Aneurysm-Related Mortality. As there were no deaths meeting the Pro-A Aneurysm-Related definition, the Pro-A Lesion Related deaths represents the standard aneurysm-related morality definition.

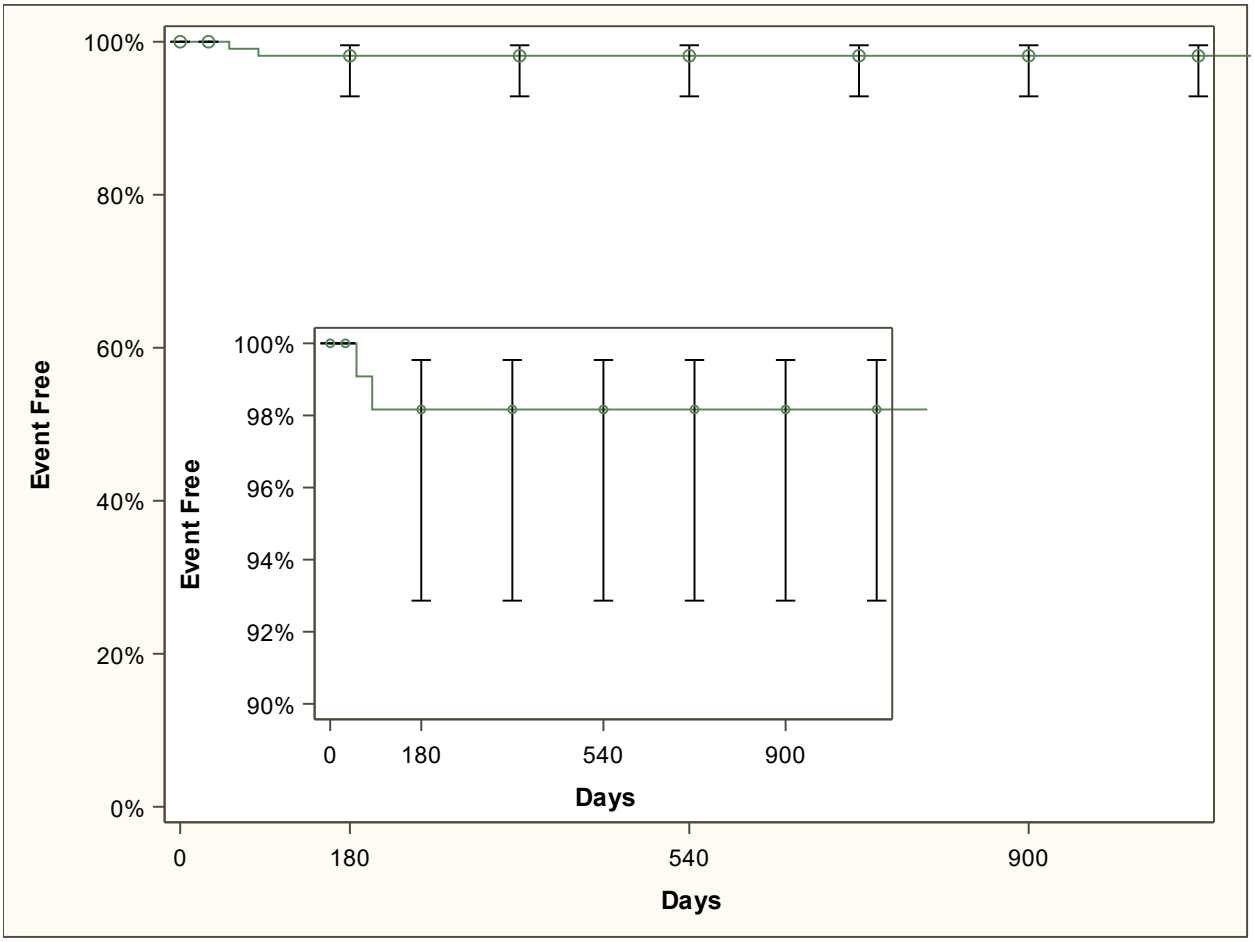

Figure 5. Kaplan-Meier Freedom from Standard Aneurysm-Related Mortality (Pro-A Lesion-Related Mortality): Pivotal Study

From Day X - Day Y	# Entered	# Censored	# Events	Event-free [%]	Greenwood SE [%]	95% Confidence Interval
0	110	0	0	100.0%	0.0%	
1-30	110	1	0	100.0%	0.0%	
31-180	109	1	2	98.2%	1.3%	92.9%-99.5%
181-360	106	13	0	98.2%	1.3%	92.9%-99.5%
361-540	93	48	0	98.2%	1.3%	92.9%-99.5%
541-720	45	9	0	98.2%	1.3%	92.9%-99.5%
721-900	36	32	0	98.2%	1.3%	92.9%-99.5%
901-1080	4	3	0	98.2%	1.3%	92.9%-99.5%

1.2.4 Device-Related Adverse Events

Adverse events adjudicated by the CEC as being device-related are summarized in **Table 17** and 11.8% (13/110) of patients experienced one or more device-related adverse events with the most frequently reported being stent-graft endoleaks (11 patients; 10.0%).

Table 17. Summary of CEC Adjudicated Device-Related Adverse Events

MedDRA System-Organ Class/Preferred Term Adverse Event	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
Patients with One or More Device-Related Adverse Events	8 (11.8%)	5 (11.9%)	13 (11.8%)
Gastrointestinal disorders	1 (1.5%)	0 (0%)	1 (0.9%)
Gastrointestinal hemorrhage	1 (1.5%)	0 (0%)	1 (0.9%)
General disorders and administration site conditions	6 (8.8%)	4 (9.5%)	10 (9.1%)
Stent-graft endoleak*	7 (10.3%)	4 (9.5%)	11 (10.0%)
Nervous system disorders	0 (0%)	1 (2.4%)	1 (0.9%)
Paraplegia	0 (0%)	1 (2.4%)	1 (0.9%)
Product issues	1 (1.5%)	1 (2.4%)	2 (1.8%)
Device dislocation	1 (1.5%)**	1 (2.4%)***	2 (1.8%)

MedDRA System-Organ Class/Preferred Term Adverse Event	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)

Data is presented as n (%). Includes serious and non-serious adverse events.
Percentages are based on the number of patients in the Safety Evaluable Population. Event verbatim terms are reported by sites. The events listed in this table are coded using MedDRA version 21.0 and then stratified by System-Organ Class (SOC) and Preferred Term. Patients may be counted in this table more than once by Preferred Term but are only counted once in the SOC summary line.
*Stent-graft endoleak: 3 Patients with Type Ib endoleaks; 1 Patient with a Type II endoleak; 2 Patients with a Type Ia endoleak; 2 Patients with a site-reported Type Ia endoleak (Core Lab reported Type II); 2 Patients with site reported Type IIIb endoleak (Core Lab reported Type II); 1 Patient with site-reported Type Ia endoleak (Core Lab reported Type II).
**Site- reported proximal migration at the 6-month visit resulting in a secondary intervention where an additional RelayPro was implanted proximally. Secondary intervention was adequate to address the migration as observed during the 12-month and 2-year visits.
***Site-reported Type Ia endoleak and migration at the 2-year follow-up (Core Lab reported Type Ia endoleak with thoracic aorta lengthening, no migration). The secondary intervention was performed to implant competitive devices to successfully exclude the lesion.

1.2.5 Procedure-Related Adverse Events

Adverse events adjudicated by the CEC as being procedure-related are summarized in **Table 18** where 13.6% (15/110) of patients experienced one or more procedure-related adverse events. The incidences of paraplegia, cereberal infarction and cerebrovascular accident were 1.8% (2/110), 1.8% (2/110) and 0.9 % (1/110), respectively

Table 18. Summary of CEC Adjudicated Procedure-Related Adverse Events

MedDRA System-Organ Class/Preferred Term Adverse Event	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
Patients with One or More Procedure-Related Adverse Events	10 (14.7%)	5 (11.9%)	15 (13.6%)
Blood and lymphatic system disorders	1 (1.5%)	0 (0%)	1 (0.9%)
Blood loss anemia	1 (1.5%)	0 (0%)	1 (0.9%)
Cardiac disorders	1 (1.5%)	0 (0%)	1 (0.9%)
Chest pain	1 (1.5%)	0 (0%)	1 (0.9%)
General disorders and administration site conditions	2 (2.9%)	1 (2.4%)	3 (2.7%)
Stent-graft endoleak	2 (2.9%)	1 (2.4%)	3 (2.7%)
Injury, poisoning and procedural complications	1 (1.5%)	1 (2.4%)	2 (1.8%)
Arterial injury	1 (1.5%)	0 (0%)	1 (0.9%)
Spinal subdural hematoma	0 (0%)	1 (2.4%)	1 (0.9%)
Investigations	1 (1.5%)	0 (0%)	1 (0.9%)
Blood creatinine increased	1 (1.5%)	0 (0%)	1 (0.9%)
Nervous system disorders	2 (2.9%)	4 (9.5%)	6 (5.5%)

MedDRA System-Organ Class/Preferred Term Adverse Event	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
Cerebral infarction	0 (0%)	2 (4.8%)	2 (1.8%)
Cerebrovascular accident	1 (1.5%)	0 (0%)	1 (0.9%)
Intraventricular hemorrhage	1 (1.5%)	0 (0%)	1 (0.9%)
Myelomalacia	1 (1.5%)	0 (0%)	1 (0.9%)
Paraplegia	0 (0%)	2 (4.8%)	2 (1.8%)
Respiratory, thoracic and mediastinal disorders	2 (2.9%)	0 (0%)	2 (1.8%)
Acute respiratory failure	1 (1.5%)	0 (0%)	1 (0.9%)
Pulmonary embolism	1 (1.5%)	0 (0%)	1 (0.9%)
Vascular disorders	2 (2.9%)	0 (0%)	2 (1.8%)
Femoral artery dissection	1 (1.5%)	0 (0%)	1 (0.9%)
Hemorrhage	1 (1.5%)	0 (0%)	1 (0.9%)
Iliac artery rupture	1 (1.5%)	0 (0%)	1 (0.9%)

Data is presented as n (%). Includes serious and non-serious adverse events.

Percentages are based on the number of patients in the Safety Evaluable Population. Event verbatim terms are reported by sites. The events listed in this table are coded using MedDRA version 21.0 and then stratified by System-Organ Class (SOC) and Preferred Term. Patients may be counted in this table more than once by Preferred Term but are only counted once in the SOC summary line.

2. Effectiveness Results

2.1 Primary Effectiveness

The analysis of effectiveness was based on the 83 patients evaluable for all components of the composite endpoint at the 12-month timepoint. Key effectiveness outcomes are presented in **Table 19** and **Table 20**.

The primary effectiveness endpoint of treatment success at 12-months was achieved in 89.2% of Pivotal Study patients (74/83, lower 95% CI 81.8%). The lower bound of the 95% confidence interval of 81.8% is above the 80% performance goal indicating that the primary effectiveness endpoint was met (P=0.0185).

Table 19: Successful Aneurysm Treatment at 12 Months

Primary Effectiveness Endpoint	Statistics	Pivotal (N=110)
Successful Aneurysm Treatment at 12 Months	% (n/N)	89.2% (74/83)
	Lower 95% CI	81.8%, -
	P-Value	0.0185

A total of 9 patients did not meet the definition of treatment success (7 patients in the US and 2 in Japan cohorts). The technical success rate (through 24 hours post-procedure) was 100% (107/107). There was successful delivery of the device through the vasculature, successful deployment of the device at the intended location, absence of Type I or III endoleak and patent stent-graft without significant stenosis.

All patients had stent-graft patency, absence of aneurysm rupture, absence of stent fractures in the attachment zone and absence of stent-graft migration (> 10 mm) reported through 12 months. Absence of Type I or III endoleak through 12 months was reported in 95.3% (82/86) patients (92.2%, 47/51 in the US and 100.0%, 35/35 in Japan cohorts). Absence of open or endovascular secondary interventions related to the device or treated pathology through 12 months occurred in 94.1% (95/101) of patients, and 98.9% (91/92) of patients had an absence of aneurysm expansion (>5 mm diameter increase) through 12 months, compared to the first post-procedural computed tomographic (CT) imaging study.

Two of the 9 patients experienced two endpoint events. One of these patients experienced a Type Ib endoleak at the 1-month follow-up visit, on post-index procedure day 472 a secondary intervention was performed implanting an additional RelayPro Stent-Graft, successfully excluding the endoleak. The other patient had a Type Ib endoleak identified at the 1-month follow-up visit; a secondary intervention was performed on post-index procedure day 276 implanting an additional RelayPro stent-graft, successfully excluding the endoleak; at the 2-year follow-up visit a Type Ib endoleak was again identified, but additional intervention has not occurred to date.

The individual components of the Primary Effectiveness Endpoint are presented in **Table 20**.

While there is information missing from the primary effectiveness analysis, there is at least 81% imaging adequate to assess key endovascular graft parameters through 12-months. This compliance information shows that while there is patient information missing that precludes them from being included in the primary effectiveness analysis, there is adequate data available in the RelayPro pivotal study to evaluate important endovascular graft parameters.

A tipping point analysis was conducted imputing missing data over a range of possible scenarios for the treatment effect; for the primary effectiveness analysis, 27 patients (83/110) did not have a complete data set collected for the analysis. The sensitivity analysis identified the scenario or 'tipping point' where the treatment effect in patients with missing data overturned the significant treatment effect obtained in the study population as 6 patients considered failures; at that point, the success rate was 86.4% (95/110, 95% lower CI 79.8%). In other words, when 6 or more patients out of the 27 missing were failures, the study would have failed the primary effectiveness endpoint. However, of the 27 missing patients, 16 patients

had almost complete data at 1-year. Of the remaining 11 patients, 2 had follow-up data later than one year, leaving 9 patients with no follow-up data. The success rate of patients with no follow-up data would have to be much lower (33.3%) than the calculated success rate (86.4%) of the available patient data in order to fail the primary effectiveness endpoint. It should be noted that for effectiveness a sample size of 83 patients provides greater than 90% power for the primary effectiveness endpoint.

A poolability analysis was completed on the primary effectiveness analysis using a Fisher's exact test of binomial proportions to compare the endpoint across sites, both Japanese and U.S. sites individually as well as pooled Japanese sites as compared to pooled U.S. sites. No significant difference between groups was found.

Table 20: Individual Components of the Composite Primary Effectiveness Endpoint at 12 Months

Endpoint	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
Composite of Technical Success at Procedure	100.0% (66/66)	100.0% (41/41)	100.0% (107/107)
Successful delivery of the device through the vasculature.	100.0% (68/68)	100.0% (42/42)	100.0% (110/110)
Successful deployment of the device at the intended location.	100.0% (68/68)	100.0% (42/42)	100.0% (110/110)
Absence of Type I or III endoleak[a]	100.0% (66/66)	100.0% (41/41)	100.0% (107/107)
Patent stent-graft without significant stenosis	100.0% (68/68)	100.0% (42/42)	100.0% (110/110)
Stent-graft patency through 12 months.*	100.0% (51/51)	100.0% (35/35)	100.0% (86/86)
Absence of aneurysm rupture through 12 months.	100.0% (61/61)	100.0% (40/40)	100.0% (101/101)
Absence of Type I or III endoleak through 12 months.*	92.2% (47/51)	100.0% (35/35)	95.3% (82/86)
Absence of stent fractures in the attachment zone through 12 months.*	100.0% (53/53)	100.0% (40/40)	100.0% (93/93)

Endpoint	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
Absence of open or endovascular secondary interventions related to the device or treated pathology through 12 months.	93.4% (57/61)	95.0% (38/40)	94.1% (95/101)
Absence of aneurysm expansion (>5 mm diameter increase) through 12 months, compared to the first post-procedural computed tomographic (CT) imaging study.*	98.1% (52/53)	100.0% (39/39)	98.9% (91/92)
Absence of stent-graft migration (> 10 mm) through 12 months, compared to the first post-procedural CT.*	100.0% (53/53)	100.0% (39/39)	100.0% (92/92)

*Denominators include patients that did not meet the endpoint definition or did not fail the endpoint and had evaluable core lab imaging data available through 1 year. [a]Presumed Type I or III endoleaks observed angiographically at the conclusion of the index procedure shall trigger the performance of a contrast-enhanced CT or contrast-enhanced magnetic resonance (MR) imaging study prior to discharge. The Primary Effectiveness endpoint will not be triggered without confirmation of the Type I or III endoleak on a pre-discharge contrast CT or contrast MR.

The secondary effectiveness outcomes are presented in **Table 21 to Table 25.**

2.2 Secondary Effectiveness Endpoints

A summary of the secondary effectiveness endpoints is presented in **Table 21.** The data presented are the number of patients with the event observed during each timepoint.

Intervention Free Technical Success, based on site-reported data, was achieved for all enrolled patients (100%).Although 8 subjects experienced Type II endoleak and 2 subjects experienced Type I endoleak at the end of the procedure, in all cases the treating physician did not perform interventions to treat these events during the procedure.

At 30-days, 1 Type Ia, 2 Type Ib endoleaks, and 15 Type II endoleaks were Core Lab reported. There were 2 lesion-related mortalities. Two secondary interventions related to the device or pathology were performed. There were no instances of rupture, or stent fracture. No conversions to open surgery were performed.

At 6-months, two Type Ib endoleaks (both persisting) and 13 Type II endoleaks were reported (11 persisting) by the Core Lab. Two patients had secondary

interventions performed to address the device or pathology. There were no instances of lesion-related mortality, rupture, or stent fracture. No conversions to open surgery were performed.

At 1 year, there was 1 new Type Ia endoleak, 1 persisting Type Ib endoleak, and 14 Type II endoleaks (9 persisting) reported by the Core Lab. The Core Lab reported one new aneurysm enlargement (no persisting). Three secondary interventions related to the device or pathology were performed. There were no instances of lesion-related mortality, rupture, or stent fracture. There were no conversions to open surgery performed.

At 2-years, the Core Lab reported 11 Type II endoleaks (6 persisting), 1 Type Ia (new) and 1 Type Ib (new)., There were 4 new aneurysm enlargements (none persisting) and 1 secondary intervention related to device/pathology. There were no instances of lesion-related mortality, rupture, stent fracture or conversion to open surgery performed.

At 3-years, there are 4 patients with data available. The Core Lab reported 1 new Type Ia endoleak, 1 Type II endoleak (persisting), and 1 new aneurysm enlargement (not persisting) that was addressed with a secondary intervention. There were no instances of lesion-related mortality, rupture, stent fracture or conversion to open surgery.

Table 21. Secondary effectiveness endpoints

Endpoints	30 Days	6 Months	1 Year	2 Years
Intervention-Free Technical Success	100.0% (110/110)	NA	NA	NA
All-cause mortality	1.8% (2/109)	2.0% (2/98)	1.1% (1/92)	7.3% (3/41)
Lesion-related mortality *(Pro-A)*	1.8% (2/109)	0% (0/96)	0% (0/92)	0% (0/38)
Rupture	0% (0/109)	0% (0/96)	0% (0/93)	0% (0/38)
Migration*	NA	0% (0/97)	0% (0/92)	0% (0/46)
All Endoleaks*	17.0% (18/106)	16.7% (15/90)	18.8% (16/85)	31.7% (13/41)
Type Ia	0.9% (1/106)	0% (0/90)	1.2% (1/85)	2.4% (1/41)
Type Ib	1.9% (2/106)	2.2% (2/90)	1.2% (1/85)	2.4% (1/41)
Type II	14.2% (15/106)	14.4% (13/90)	16.5% (14/85)	26.8% (11/41)
Type III	0% (0/106)	0% (0/90)	0% (0/85)	0% (0/41)
Type IV	0% (0/106)	0% (0/90)	0% (0/85)	0% (0/41)
Aneurysm Enlargement*	NA	0% (0/96)	1.1% (1/92)	8.7% (4/46)
Loss of Patency	0% (0/109)	0% (0/96)	0% (0/92)	0% (0/38)
Decreased stent-graft lumen diameter	0% (0/106)	0% (0/90)	0% (0/87)	0% (0/44)
Fractures*	0% (0/107)	0% (0/97)	0% (0/93)	0% (0/46)
Conversion to Open Repair	0% (0/110)	0% (0/96)	0% (0/92)	0% (0/38)

Endpoints	30 Days	6 Months	1 Year	2 Years
Related Secondary Intervention	1.8% (2/109)	2.1% (2/96)	3.3% (3/92)	2.6% (1/39)
Thromboembolic event attributed to stent-graft	0% (0/108)	0% (0/96)	0% (0/92)	0% (0/38)
Device-Related Adverse Events	11.0% (12/109)	4.2% (4/96)	1.1% (1/92)	15.0% (6/40)
Vascular access complications	5.5% (6/110)	NA	NA	NA

All values expressed as % (n/N) for endpoints reported within the specified window. Denominators are specified in **Table 8** (Summary of Compliance and Imaging Follow-Up: Pivotal Study). For imaging endpoints (fractures, migration, endoleak, enlargement), the denominator is the number of patients with imaging adequate to assess the parameter. For clinical endpoints (patency, conversion to open repair, secondary interventions), the denominator is the number of patients with visits within the window.
Windows for visits are as follows: 30 days (Day 0-90); 6 months (Day 91-270); 1 year (Day 271-540); 2 years (Day 541-900); 3 years (Day 901-1260).
*These data represent Core Laboratory assessed endpoints, including any reports of fracture, migration, endoleak, or aneurysm enlargement within each interval, including observations previously identified at earlier intervals that are considered ongoing or persistent and observations identified during an identified that later resolved within the interval.

2.2.1 Technical Success

Technical success is defined as a successful delivery of the device through the vasculature, successful deployment of the device at the intended location, absence of Type I or III endoleak and a patent stent-graft without significant stenosis through 24 hours post-procedure. Technical success, assessed by site Investigator, was achieved by all patients in the Pivotal Study.

2.2.2 Intervention Free Technical Success (Device Assessment at the Index Procedure)

Intervention-Free Technical Success is a composite of multiple enquiries of the implanting investigator subsequent to each RelayPro implant procedure regarding the device usability, functionality and expected response of the user. Intervention Free Technical Success is defined as a composite of the following:

- Successful delivery of the device through the vasculature (deliver the implant to the intended location without the need for unanticipated corrective intervention related to delivery);
- Successful and accurate deployment of the device defined as:
  - deployment of the endovascular stent-graft in the planned location;
  - patency of the endovascular stent-graft, absence of device deformations (e.g. kinks, stent eversion, mal-deployment, misaligned deployment) requiring unplanned placement of an additional device within the endovascular stent-graft, and;

- Successful withdrawal (i.e. successful withdrawal of the delivery system, without the need for unanticipated corrective intervention related to withdrawal)

All patients had an intervention free technically successful procedure. A summary of Investigator-assessed device performance at the index procedure are presented in **Table 22.**

Twenty-six (26) of 110 (23.6%) patients had additional procedures performed during the RelayPro Stent-Graft procedure. Of the 26 patients who underwent additional procedures, the majority of the patients (65.4%, 17/26) had an LSA Revascularization prior to the RelayPro index procedure, 34.6% (9/26) had a Balloon Dilation, 11.5% (3/26) Native Vessel PTA, 3.8% (1/26) had a Stent Placement (right iliac artery and right superficial femoral artery), and 23.1% (6/26) had 'Other'procedures.

Of the 110 patients treated with the RelayPro Stent-Graft System, 98.2% (108/110) had a positive Final Procedure Result; the lesion was excluded without a Type I, III or IV Endoleak; Conversion to Surgery; or Procedure Attempted, but Aborted. Two (2) patients had the Lesion Excluded with a site detected Type IV Endoleak reported as not resolved during the procedure. The Core Lab did not identify the Type IV Endoleaks. The site-reported Type IV Endoleak in one of these patients was not visualized on the Intra-Procedure Angiogram or any post implant imaging (1 and 6 month). In the second patient, the Core Lab classified the site-reported Type IV Endoleak as a Type II Endoleak Intra-Procedure and at 1-month post implant but it was not seen on 6 month post implant imaging.

One patient had an overall successful procedure with the Final Procedure Result as Lesion Excluded as reported by the site, with a Core Lab identified Type IV Endoleak that resolved prior to the 1-month follow-up imaging.

Table 22. Summary of Device Assessment by the Investigator

Device Assessment by Investigator*	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
Deployment at the Intended Location	100.0% (68)	100.0% (42)	100.0% (110)
Deployment Without Kinking or Twisting	100.0% (68)	100.0% (42)	100.0% (110)
Accuracy of Deployment Acceptable	100.0% (68)	100.0% (42)	100.0% (110)
Stent-Graft Patent	100.0% (68)	100.0% (42)	100.0% (110)
Stent-Graft Integrity (no wire fracture)	100.0% (68)	100.0% (42)	100.0% (110)
Procedure Performed Without Any Unplanned Vascular Access Difficulties	91.2% (62)	100.0% (42)	94.5% (104)
Additional procedures required:	30.9% (21)	11.9% (5)	23.6% (26)[b]
Balloon Dilation	28.6% (6/21)	60.0% (3/5)	34.6% (9/26)

Device Assessment by Investigator*	US Cohort (N=68)	Japan Cohort (N=42)	Pivotal (N=110)
Stent Placement	4.8% (1/21)	0% (0/5)	3.8% (1/26)[a]
Native Vessel PTA	9.5% (2/21)	20.0% (1/5)	11.5% (3/26)
Other[c]	28.6% (6/21)	0% (0/5)	23.1% (6/26)
LSA Revascularized	61.9% (13/21)	80.0% (4/5)	65.4% (17/26)
Pre-implant	100.0% (13/13)	100.0% (4/4)	100.0% (17/17)
Proximal end of the covered portion of the device:			
Distal to the Left Subclavian	73.5% (50)	85.7% (36)	78.2% (86)
Proximal to the Left Subclavian	26.5% (18)	14.3% (6)	21.8% (24)
Final Procedure Result			
Lesion Excluded	89.7% (61)	92.9% (39)	90.9% (100)
Type I, III or IV Endoleak**	0% (0)	4.8% (2)	1.8% (2)
Type II Endoleak	10.3% (7)	2.4% (1)	7.3% (8)

All values expressed as % (n). The denominator is included at the top of the respective column, unless otherwise indicated.

*The device assessment was performed at the time of the procedure.

**Only Type IV endoleaks were observed.

[a] Patient had stent placement at right iliac artery and right superficial femoral artery.

[b]Eight (8) patients had more than one additional procedure required: 3 patients had Balloon Dilation at Stent-Graft/LSA Revascularized; 2 patients had Stent Placement/Native Vessel PTA/LSA Revascularized; 2 patients had LSA Revascularized/Other and 1 patient had Balloon Dilation at Stent-Graft/Native Vessel PTA/Other.

[c]Six (6) subjects had additional procedures performed classified as 'Other'. These included 1 subject with a LCA/LSA bypass, 1 subject with a right femoral artery repair secondary to Perclose failure, 1 subject with a right femoral cutdown with pericardial patch, 1 subject with a serial dilatation, 1 subject with an LSA embolization and 1 subject with a left CFA patch angioplasty.

2.2.3 Aneurysm rupture

Aneurysm rupture is defined as rupture of the native aneurysm sac post-implantation of the stent-graft. There have been no reported aneurysm ruptures in this study.

2.2.4 Migration

The protocol defines device migration as a displacement of 10 mm or more relative to the 1-month location, as measured by the Core Lab. There have been no Core Lab reported instances of migration, proximal or distal, or stent-graft component seperation in any patient.

There has been one site reported proximal migration at the 6-month visit in a US patient, resulting in a secondary intervention where an additional RelayPro (proximal bare stent configuration) was implanted proximally. The secondary

intervention was adequate to address the migration (as observed on the 12-month visit and 2-year visit).

2.2.5 All Endoleaks (Core Lab Reported)

Table 23 presents the Core Lab reported endoleaks observed at each follow-up interval. Six (6) patients experienced a Type I endoleak during follow-up; 3 endoleaks were Type Ia and 3 Type Ib; all but one Type Ia endoleak were within the US cohort. One Type Ia endoleak was observed at both the 1 month follow-up visit and during an unscheduled follow-up visit (approximately 3 months post index procedure). However, the patient expired from non-aneurysm related pathology before any re-intervention could be performed. The second patient with a Type Ia endoleak had the endoleak observed on 12-month imaging with no aneurysm expansion. On post-index procedure day 538, a secondary intervention was performed to address an aortic ulceration of the arch implanting a TEVAR device in zone zero using the snorkel technique. The aortic ulcer was successfully excluded and subsequent CT imaging has confirmed resolution of the Type Ia endoleak. The third patient with a Type Ia endoleak was observed on 2-year imaging and no aneurysm expansion was observed. On day 791 post-index procedure, the patient had a TEVAR device implanted at the level of the left subclavian artery.

Two patients experienced a Type Ib endoleak as identified by the Core Lab at the 30-day follow-up visit and each underwent a secondary intervention where an additional RelayPro device was implanted to successfully resolve the Type Ib endoleak. Subsequent to the secondary intervention, the Core Lab identified a second Type Ib endoleak in one patient at the 2 year follow-up visit. In this same patient, the Core Lab noted a secondary procedure after the 6-month follow-up visit and that the Type Ib endoleak resolved. No further intervention has occurred as of the data lock.

Twenty-seven (27) patients have been identified with a Type II endoleak, 15 were identified by the Core Lab on the 30-day follow-up imaging, 13 on the 6-month follow up imaging (2 new and 11 persistent); 14 on the 12-month follow-up imaging (5 new and 9 persistant); 11 on the 2-year follow-up imaging (5 new and 6 persistant); and 1 persistant on the 3-year follow-up imaging. Two secondary interventions have been performed to address a Type II endoleak: 1) coil embolization procedure of the proximal left subclavian artery at 9 days post-index procedure and 2) extension of TEVAR into the abdominal aorta with parallel grafts into the SMA and renal arteries and coverage of the celiac artery at 1174 days post-index procedure. For both patients, the 1-month, 6-month and 12-month follow-up visits were completed. The Core Lab also confirmed continuation of the Type II endoleak proceeding the interventions.

No Type III endoleaks, Type IV endoleaks, or endoleaks of unknown type were reported.

Table 23. Summary of Core Laboratory-Reported Endoleaks

Endoleak	30 Days	6 Months	12 Months	2 Years	3 Years
Adequate Imaging*	106	90	85	41	4
Any Endoleaks (Total)	17.0% (18)	16.7% (15)	18.8% (16)	31.7% (13)	25.0% (1)
Type Ia					
New	1	0	1	1	0
Persistent	NA	0	0	0	0
New and Persistent	0.9% (1)	0% (0)	1.2% (1)	2.4% (1)	0% (0)
Type Ib					
New	2	0	0	1	0
Persistent	NA	2	1	0	0
New and Persistent	1.9% (2)	2.2% (2)	1.2% (1)	2.4% (1)	0% (0)
Type II					
New	15	2	5	5	0
Persistent	NA	11	9	6	1
New and Persistent	14.2% (15)	14.4% (13)	16.5% (14)	26.8% (11)	25.0% (1)
Type IIIa					
New	0	0	0	0	0
Persistent	NA	0	0	0	0
New and Persistent	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)
Type IIIb					
New	0	0	0	0	0
Persistent	NA	0	0	0	0
New and Persistent	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)
Type IV					
New	0	0	0	0	0
Persistent	NA	0	0	0	0
New and Persistent	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)
Unknown Type					
New	0	0	0	0	0

Endoleak	30 Days	6 Months	12 Months	2 Years	3 Years
Persistent	NA	0	0	0	0
New and Persistent	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)

*Adequate imaging was determined by the Core Laboratory. In general, images with contrast and non-contrast series were regarded as adequate for interpretation of endoleaks.

2.2.6 Aneurysm Enlargement

An increase in aneurysm sac size was defined as a change of 5 mm or more in diameter from the 1-month diameter measurement or the first post implant imaging. These assessments are based on Core Lab measurements. In the Pivotal Study, 97 patients have images at the 6-month follow-up which have been adequate to assess aneurysm diameter, 92 at the 12-month follow-up, and 46 at the 2-year follow-up and 4 at the 3-year follow-up. Six patients have been reported to have aneurysm enlargement, 1 newly identified on the 1 year follow-up imaging, 4 newly identified on the 2-year follow-up imaging, and 1 newly identified at 3-year follow-up imaging.

Three US patients have been reported to have aneurysm enlargement, 1 newly identified on the 1 year follow-up imaging, 1 newly identified on the 2-year follow-up imaging, and 1 newly identified at 3 year follow-up imaging. Two of the three patients with enlargement had baseline lesions that were fusiform aneurysms, and the third had been treated for a saccular aneurysm at the index procedure. Of these three patients, 1 enlargement was due to a Type II endoleak, 1 was attributed to worsening of proximal aortic disease requiring a full arch repair, and the third patient (with saccular aneurysm) experienced an enlargement due to unknown cause.

Three Japanese patients have been reported to have aneurysm enlargement, all three newly identified on the 2-year follow-up imaging. Of these three patients with enlargment, two had baseline lesions that were fusiform aneurysms and the third had been treated for a saccular aneurysm at the index procedure. Two enlargements were due to a Type II endoleak identified by the Core Lab while the site reported Type Ia endoleak and one was attributed to a site reported Type Ia endoleak.

The incidence of patients with decrease in aneurysm sac diameter was 16.7% (16/96), 33.7% (31/92), 34.8% (16/46) and 0% (0/4) at 6 months, 12 months, 2 years, and 3 years, respectively, when compared to the first post implant imaging.

Table 24. Summary of Core Laboratory Assessed Changes in Aneurysm Sac Diameter: Pivotal Study

Changes in Aneurysm Size	6 Months	12 months	2 Years
Imaging Adequate to Assess Diameter Change (N)	97	92	46
Increase > 5mm			

Changes in Aneurysm Size	6 Months	12 months	2 Years
New	0% (0)	1.1% (1)	8.7% (4)
Persistent	0% (0)	0% (0)	0% (0)
Total	0% (0)	1.1% (1)	8.7% (4)
Decrease	16.7% (16)	33.7% (31)	34.8% (16)
No Change	83.3% (80)	65.2% (60)	56.5% (26)

All values expressed as % (n), where n = Patients with evaluable images at 30 days (based on first procedure measurement made within 30 day follow up analytical window) and at time point (e.g. 6 or 12 months) and N = Patients evaluable at time point.

2.2.7 Loss of Patency

Loss of patency is defined within the study protocol as the unintentional obstruction of 100% of the stent-graft lumen. There have been no Core Lab or site-reported stent-graft occlusions reported in any patient at any timepoint.

2.2.8 Decreased Stent-Graft Lumen Diameter

Decreased stent-graft lumen diameter (stent-graft stenosis/thrombosis) is defined as greater than 50% decrease in the stent-graft lumen diameter. In the Pivotal Study, there have been no Core Lab or site-reported decreases in stent-graft lumen diameter (stent-graft stenosis/thrombosis). Additionally, no kinking of the stent-graft has been reported.

2.2.9 Stent Fractures

Stent fracture was defined as fracture or breakage of any portion of the stent. Fractures are assessed by the Core Lab with x-ray and CT imaging, or may be reported by the site. For the Pivotal Study cohort, 107 patients had adequate imaging to assess for fracture at 30-days, 97 patients at 6-months, 93 patients at 1 year, 46 patients at 2-years, and 4 patient at 3-years. No fractures (site reported or Core Lab reported) have been reported in any patient at any follow-up visit.

2.2.10 Open conversion related to device or pathology

There were no open surgical conversions in the study.

2.2.11 Secondary Intervention related to device or pathology

A summary of the reasons for secondary interventions are shown in **Table 25.** There have been a total of 11 secondary interventions performed in 9 patients. In summary, 3 interventions were performed to address site reported Type Ia endoleaks (Core Lab reported Type II), 2 to address site and Core Lab identified Type Ib endoleaks, 1 to address a site and Core Lab reported Type II endoleak, 1 to address site-reported migration, 1 to address a site and Core Lab reported Type I endoleak with site reported migration (Core Lab reported thoracic aorta lengthening, no migration) and 3 interventions within the same patient to address arch disease, Type Ib endoleak and a Type II endoleak.

Table 25. Summary of Reasons for Secondary Intervention

	30 Days	6 Months	1 Year	2 Years	3 Years
Patients at Risk (N)	109	96	92	38	2
Interventions (n)	2	2	3	1	3
Any Secondary Intervention	1.8% (2)	2.1% (2)	3.3% (3)	2.6% (1)	50% (1)
Type Ia Endoleak	0.9% (1)	1.0% (1)	1.1% (1)	2.6% (1)	0% (0)
Extension	1	1	1	1	0
Type Ib Endoleak	0% (0)	0% (0)	2.2% (2)	0% (0)	50% (1)
Extension	0	0	2	0	0
Type II Endoleak	0.9% (1)	0% (0)	0% (0)	0% (0)	0% (0)
Coil Embolization	1	0	0	0	0
Migration	0% (0)	1.0% (1)	0% (0)	2.6% (1)	0% (0)
Extension	0	1	0	0	0
Other*	0% (0)	0% (0)	0% (0)	0% (0)	50% (1)

Where % (n), % is the percentage of patients with an event, n is number of patients with an event and N is the number of patients with visits in the specified window.

Windows for visits are as follows: 30 days (Day 0-90); 6 months (Day 91-270); 1 year (Day 271-540); 2 years (Day 541-900); 3 years (Day 901-1260).

*Other includes occlusion, thrombus, ischemia and AV fistula.

2.2.12 Thromboembolic event attributed to stent-graft

Three patients (3/109, 2.8%) with possible thromboembolic events were identified to have occurred within 30 days of RelayPro implant.

The Medical Monitor and Clinical Events Committee (CEC) assessed all three events to be procedure-related but not device-related. There was no evidence of the possible thromboembolic event being related to the delivery system in any of these cases. In the case of the earliest event, only one device was used (therefore, only one delivery system), and the procedure was not considered prolonged, with no additional procedures.

2.2.13 Vascular access complications at the index procedure

Vascular access complications are injuries to vessels as a result of the endovascular procedure, including dissections, perforations, iliac thromboses, common femoral artery injuries not related to pre-existing disease, false or true aneurysms. Six of the 110 patients (5.5%) experienced vascular access complications at the index procedure as reported by the sites. These vascular access complications included 1 subject with a neck hematoma, 1 subject with a right femoral artery dissection secondary to Perclose failure that was repaired, 1 subject with a right femoral artery laceration secondary to Perclose failure that was addressed by right femoral cutdown and pericardial patch, 1 subject with right femoral and left common femoral artery injury that was addressed with serial dilatation, 1 subject with a left

CFA patch angioplasty, and 1 subject with a right iliac artery rupture and 1 dissection of the right SFA.

3. Subgroup Analyses

The following preoperative characteristics were evaluated for potential association with outcomes: gender, race, age, baseline lesion type (i.e., fusiform, non-fusiform aneurysm), and geography of enrollment (i.e., US, Japan). There were no statistically significant differences in the primary endpoints for any subgroup analyses.

In the pivotal study, 68 US patients and 42 Japanese patients were enrolled. The demographics, comorbidities, and baseline lesion characteristics, as well as outcomes reported in each cohort are presented in detail in each of the respective sections above. Regarding primary safety and effectiveness outcomes, the following were reported:

- A total of 6.4% (7/110) of patients experienced an MAE through 30 days; 5.9% (4/68) in the US and 7.1% (3/42) in Japan. A total of 7 MAEs were observed in these 7 patients. The MAEs reported include: 2 strokes, 1 renal failure, 2 paralysis, and 2 procedural blood loss > 1,000 cc requiring transfusion. The two paralysis events and one stroke event occurred in 3 patients within the Japan cohort. All other events occurred in the US cohort.
- The primary effectiveness endpoint of treatment success at 12-months was achieved in 89.2% of the Pivotal Study patients (74/83, lower 95% CI 81.8%) and varied slightly between geography (85.7%, 42/49 in US cohort, 94.1%, 32/34 in Japanese cohort).

In the pivotal study, 60 patients were 75 years old or older at time of enrollment and 50 patients were under 75 years old at the time of enrollment. Regarding primary safety and effectiveness outcomes, the following were reported:

- The MAE rate at 30 days was similar between the 2 groups where the 75 years old and greater group had a rate of 6.7% (4/60), and the under 75 years old group had a rate of 6.0% (3/50).
- Successful Aneurysm Treatment at 12 months was also similar when comparing the 2 age groups (≥ 75 years old: 86.7%, 39/45 and 92.1%, 35/38 for <75 years old).
- Regarding effectiveness-related measures, the following observations/events were reported through 12-months:
  - 4 Type I Endoleaks, 2 in each age group,
  - 4 Secondary interventions related to the device or treated pathology in the ≥ 75 year old group and 2 in the <75 year old group, and
  - 1 Aneurysm expansion in the ≥ 75 year old group.
- In all patients, there was 100% technical success, stent-graft patency, as well

as absence of aneurysm rupture, fracture, and absence of Core Lab reported migration through 12-months.

4. Pediatric Extrapolation
   In this premarket application, existing clinical data was not leveraged to support approval of a pediatric patient population.

E. Financial Disclosure

The Financial Disclosure by Clinical Investigators regulation (21 CFR 54) requires applicants who submit a marketing application to include certain information concerning the compensation to, and financial interests and arrangement of, any clinical investigator conducting clinical studies covered by the regulation. The pivotal clinical study included 36 investigators; 25 in the United States and 11 in Japan. None of the clinical investigators had disclosable financial interests/arrangements as defined in sections 54.2(a), (b), (c), and (f). The information provided does not raise any questions about the reliability of the data.

XI. PANEL MEETING RECOMMENDATION AND FDA'S POST-PANEL ACTION

In accordance with the provisions of section 515(c)(3) of the act as amended by the Safe Medical Devices Act of 1990, this PMA was not referred to the Circulatory Systems Devices Panel, an FDA advisory committee, for review and recommendation because the information in the PMA substantially duplicates information previously reviewed by this panel.

XII. CONCLUSIONS DRAWN FROM PRECLINICAL AND CLINICAL STUDIES

The RelayPro is the next generation Bolton Medical thoracic stent-graft system. The RelayPro is expected to perform similarly to the RelayPlus Thoracic Stent-Graft System (P110038) based on the design changes made and the similarities in outcomes in bench and clinical testing. The clinical study was designed with the standard 30-day primary safety endpoint defined as a composite MAE rate and a 1-year effectiveness endpoint defined as successful aneurysm treatment.

A. Effectiveness Conclusions

The primary effectiveness endpoint of treatment success at 12-months was achieved in 89.2% of the Pivotal Study patients (74/83 patients). The analysis of effectiveness was based on the 83 patients evaluable for all components of the composite endpoint at the 12-month timepoint. The lower bound of the 95% confidence interval of 81.8% is above the 80% performance goal indicating that the primary effectiveness endpoint was met (P=0.0185).

A total of 8.2% (9/110) of patients did not meet the definition of treatment success (10.3% (7/68) in the US and 4.8% (2/42) in Japan). Technical success through 24 hours

post-procedure was achieved in all patients (107/107), meaning there was successful delivery of the device through the vasculature, successful deployment of the device at the intended location, absence of Type I or III endoleak and patent stent-graft without significant stenosis.

A total of 11 events were observed in 9 patients. Events reported include 1 aneurysm expansion, 4 secondary interventions, 2 Type Ia endoleaks at 12 months, and 2 Type Ib endoleaks at 12 months with a secondary intervention. All patients reported stent-graft patency, absence of aneurysm rupture, absence of stent fractures in the attachment zone and absence of stent-graft migration (> 10 mm) through 12 months.

Two of the 9 patients experienced two endpoint events,Type Ib endoleaks at the 1-month follow-up visit, but both received an additional RelayPro Stent-Graft, successfully excluding the endoleak. .

In the longer term follow-up (after 12-months), the following events/observations have been reported: 3 deaths, 1 Type Ia endoleak, 1 Type Ib endoleak, 5 new aneurysm enlargements, and 2 secondary interventions related to device or pathology.

No losses of patency, decreased stent-graft lumen diameter, Core Lab reported Type III or IV endloeaks, fractures, Core Lab reported stent-graft migration, rupture, thromboembolic event attributed to the stent-graft were reported in the study. No conversions to open repair were performed.

Through longer term follow-up, 11 secondary interventions were performed in 9 patients. The majority of interventions were completed to address endoleaks.

Based on the effectiveness-related outcomes presented above, there is a reasonable assurance of effectiveness of the RelayPro for the proposed intended use.

B. Safety Conclusions

The risks of the device are based on data collected in non-clinical and animal studies, as well as data collected in a clinical study conducted to support PMA approval as described above.

The composite MAE rate was 6.4% (7/110, upper 95% CI 11.6%) through 30 days. The upper bound of the 95% confidence interval is below the 20% performance goal indicating that the primary safety endpoint was met (P=0.0002). Seven patients experienced 7 MAEs through 30 days, specifically 2 strokes, 1 renal failure, 2 paralysis events, and 2 events of procedural blood loss > 1,000 cc requiring transfusion.

The secondary endpoints of the study included MAEs and the individual components at 6 months and annually through 5 years. The following rates were reported for MAEs: 3.7% (4/108) at 6-months, 1.9% at 12-months, and 3.3% (2/61) at 2 years.

Device-related adverse events through 2 years, as reported by the sites was reported in 11.0% (12/109), 4.1% (4/97), 1.4% (1/71) and 8.3% (1/12) patients at 30 days, 6 months, 1 year and 2 years, respectively. Vascular access complications at the index procedure were reported in 6.4% (7/110) of patients.

The outcomes presented above are comparable to previous studies of this type and demonstrate a reasonable assurance of safety of the RelayPro for the proposed intended use.

C. Benefit-Risk Determination

The benefits and risks of the device are also based on data collected in a clinical study conducted to support PMA approval as described above. The RelayPro is a next generation endovascular graft of the currently marketed RelayPlus Thoracic Stent-Graft System (P110038). The RelayPro stent-graft is available in two proximal configurations and various diameters, lengths and tapers. The RelayPro also has a reduced delivery profile compared to the RelayPlus.

In the RelayPro Pivotal Study, there was 2 aneurysm-related deaths and no aneurysm ruptures or conversions to open surgical repair. In addition, the majority of patients had aneurysms that decreased or remained stable in diameter during follow-up. This demonstrates the benefit to patients of endovascular treatment of their aneurysms.

The probable risks of the device are also based on data collected in a clinical study conducted to support PMA approval as described above. The MAEs reported under this study are consistent with other studies of endovascular grafts intended for the repair of fusiform aneurysms and saccular/penetrating atherosclerotic ulcers in the descending thoracic aorta. Device-related risks include Type I endoleaks, aneurysm expansion, and the need for secondary intervention as described above.

In conclusion, given the available information above, the data support that for the endovascular treatment of patients with fusiform aneurysms and saccular aneurysms/penetrating atherosclerotic ulcers in the descending thoracic, the probable benefits outweigh the probable risks.

1. Patient Perspectives
   This submission did not include specific information on patient perspectives for this device.

D. Overall Conclusions

The data in this application support the reasonable assurance of safety and effectiveness of this device when used in accordance with the indications for use. The pre-clinical testing performed in accordance with applicable guidance documents and national and internal standards confirmed that the RelayPro met its performance and design specifications. The primary safety endpoint was met. The primary effectiveness endpoint was also met. Available longer-term clinical data supports continued

favorable safety and effectiveness-related outcomes. Patients are likely to benefit from the use of the RelayPro in the endovascular repair of fusiform aneurysms and saccular aneurysms/penetrating atherosclerotic ulcers in the descending thoracic aorta.

XIII. CDRH DECISION

CDRH issued an approval order on August 5, 2021. The final conditions of approval cited in the approval order are described below.

1. *Clinical Update*: The sponsor has agreed to provide a Clinical Update to physician users at least annually. At a minimum, this update will include, for the IDE and Post-Approval studies, respectively, a summary of the number of patients for whom data are available, with the rates of major adverse events, aneurysm-related mortality, aneurysm rupture, secondary endovascular procedures, conversions to surgical repair, endoleaks, aneurysm enlargement, prosthesis migration, occlusions, stenoses, losses of device integrity, and other procedure or device-related events. Reasons for secondary interventions and conversion to open surgery as well as causes of aneurysm-related death and rupture are to be described. Additional relevant information from commercial experience within and outside the United States is also to be included. A summary of any explant analysis findings is to be included. The clinical update for physician users and the information supporting the updates must be provided in the Annual Report.

2. *Post-Approval Study Reporting:* In addition to the Annual Report requirements, the sponsor must provide the following data in post-approval study (PAS) reports for each study listed below. Separate PAS Progress Reports must be submitted for each study every six (6) months during the first two (2) years of the study and annually thereafter, unless otherwise specified by FDA.

    a. *Continued Follow-up of the IDE Study Subjects*:
    This is a prospective, single-arm, multi-center study that consists of continued follow-up of all available subjects from the IDE Pivotal Study and the Continued Access Study. A total of 110 subjects were enrolled in the Pivotal Study and five (5) subjects were enrolled in the Continued Access Study. Remaining subjects will be followed for 5 years. Clinical outcomes will include all-cause mortality, lesion-related mortality, major adverse events, secondary interventions, conversion to open repair, occlusions, stenosis or kink, all types of endoleaks, stent graft migration (>10 mm), aneurysm expansion (> 5 mm), aortic rupture, loss of device integrity, and other device-related events. These endpoints will be analyzed descriptively and PAS reports submitted on a yearly basis.

    b. *RelayPro Post Approval Surveillance Study:* This is a prospective, multi-center, non-randomized, single arm, post approval observational regsitry as a part of the Terumo Aortic Global Aortic Global Endovascular Registry (TiGER). The objective of the registry is to collect real world, post-approval safety, performance, patient reported outcomes and health economic data on patients

treated with Terumo Aortic endovascular stent-grafts. The study will prospectively enroll a minimum of 177 aneurysm subjects treated with the RelayPro Thoracic Stent-Graft System at up to 80 global sites (with a minimum 88 U.S. Subjects at up to 40 U.S. sites) with at least 110 subjects evaluable at 5 years post-implantation. Follow-up will occur at 30 days, 1 year, and yearly thereafter through 5 years, with additional follow-up provided (if available) to 10 years or until lost to follow-up including subject death. The primary endpoint is aortic related mortality. Additional endpoints will be collected and reported at each follow-up point, including but not limited to the following: technical success, major adverse events, all-cause mortality, aneurysm rupture, clinical success as defined in the protocol, secondary interventions, conversion to open surgery, losses of device integrity, device occlusions, stenosis or kink, aneurysm enlargement (> 5 mm), stent graft migration (> 10 mm), all types of endoleaks, and other device-related events. Outcomes will be reported using descriptive statistics.

The applicant's manufacturing facilities have been inspected and found to be in compliance with the device Quality System (QS) regulation (21 CFR 820).

XIV. APPROVAL SPECIFICATIONS

Directions for use: See device labeling.

Hazards to Health from Use of the Device: See Indications, Contraindications, Warnings, Precautions, and Adverse Events in the device labeling.

Post-approval Requirements and Restrictions: See approval order.