THE WOMEN'S HEALTH TECHNOLOGIES COORDINATED REGISTRY NETWORK (WHT-CRN)

Contents

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II. EXECUTIVE SUMMARY

There is a growing demand for evidence to evaluate the performance of many commonly used devices and technologies in women's health and to produce evidence that better reflects the patient experience and outcomes during routine care. Registries and other real-world data sources can help meet evidence requirements by collecting data on real-world patient care and the specific device exposures. However, registries can be expensive to maintain if they are not efficiently designed. Collecting long-term outcome data is also challenging and requires major investments. Hence, linking various real-world data sources can help create a viable ecosystem for technology life cycle evaluations. Furthermore, there are economies of scale to link registries of different medical conditions treated with device technologies. While each condition is unique, in most instances multiple registries collect the same demographic and comorbidity information but are not working together to gain efficiencies. With funding support from the U.S. Health and Human Services Office of Assistant Secretary of Planning and Evaluation via the Patient-Centered Outcomes Research Trust Fund (PCORTF), a coordinated registry network (CRN) for women's health technologies (WHT) was created to address infrastructure and methodological challenges related to evidence generation.

The first phase of the project involved establishing the WHT-CRN partnership structure and the roles and responsibilities of various WHT-CRN stakeholders. The project began in July 2017 by establishing a leadership committee, an overall informatics working group, and four additional clinical working groups for each of the clinical areas: sterilization/long acting reversible contraceptives (LARC), pelvic organ prolapse (POP), stress urinary incontinence (SUI), and uterine fibroids (UF). A conference titled the Women's Health Technologies CRNs Think-Tank was held on September 15, 2017, at the Food and Drug Administration (FDA) headquarters where stakeholders from the FDA, industry, nonprofit organizations, patient advocacy groups, payers, professional society leaders, academia, and clinical experts in each of the clinical conditions met to assess the current landscape of registries evaluating women's health devices and technologies, to discuss the perspectives of each major stakeholder, to coordinate project efforts, to identify opportunities and challenges, and to discuss approaches for each working group. Following the meeting, the WHT-CRN also recruited patient partners to join each of the clinical working groups as representatives of the larger patient community.

From the outset, clinical experts representing various stakeholders assessed the landscape of existing evidence and data repositories for each clinical condition. Initially, literature reviews were conducted to identify the existing evidence and evidence gaps for each of the clinical conditions. Then, thorough assessments of claims data for analysis was conducted. Subsequently, various algorithms were created based on procedure codes used for each clinical condition and operation and these algorithms were used to conduct claims-based analyses. Finally, existing registries for each clinical condition were identified and partnerships were established with the registry leads.

To develop the CRNs in women's health, experts from academia, FDA, and professional societies were engaged to define an initial set of subject specific and common data elements for each clinical condition based on stakeholder feedback, a review of the literature, regulatory requirements, and existing research efforts focusing on standardizing demographic variables. These datasets included a list of all of the validated Patient-Reported Outcome Measures (PROMs) for each clinical

condition. Simultaneously, the Office of the National Coordinator (ONC), for Health Information Technology conducted an environmental assessment and pilot testing feasibility analysis to examine the current data infrastructure for women's health devices and the related standards and technologies. Unstructured interviews and working group discussions were held with key researchers, leaders, subject matter experts, and PCOR stakeholders to develop a detailed understanding of the current state of CRNs and their corresponding technology for ONC.

The second phase of the project focused on building the overall data infrastructure for the WHT-CRN led by four clinical working groups. First, each clinical working group used the initial set of data elements to launch a six-month Delphi consensus process to reach agreement on a core minimum dataset for each condition. Following the identification of a minimum core dataset for each clinical condition, the WHT-CRN partners identified common data elements among all four clinical areas and to begin the harmonization and standardization process. The initial analytic processes helped to identify the most common comparable concepts across the groups and was followed by collaboration between the National Library of Medicine (NLM) experts and informatics experts to define terminologies and standards. Continuous engagement of clinical working groups for feedback and further refinements ensured applicability and efficiency. After several iterations, the WHT-CRN partners finalized the recommendation for an initial harmonized set of data elements across the different women's registries, and NLM delivered the initial set to the WHT-CRN Implementation Guide (IG) work group, for inclusion with the Health Level Seven (HL7)[1] Fast Healthcare Interoperability Resources (FHIR®)[2] IG submission.

Simultaneously with the common data elements harmonization process, the WHT-CRN team leveraged the HL7 FHIR® standard to develop an IG that outlines the technical requirements to promote interoperability for data collection and exchange. Specifically, the team leveraged the US-Core IG, Structured Data Capture FHIR® IG and the Patient-Reported Outcomes FHIR® IG. The team launched the WHT-CRN IG Development Workgroup to address the needs of the IG. The HL7 standards development process included creating the IG content, submitting the notice of intent to ballot, balloting the IG, reconciling the ballot comments, completing the IG updates, submitting the publication request and publishing the IG. Subsequently, the team identified registries to pilot test the WHT-CRN FHIR® IG, its underlying standards, and data sets as defined by the CRN project, in a test or production environment (e.g., clinical or provider setting).

The pilot testing and demonstration projects conducted as part of the project included:

1. Funding and developing SUI and POP registries within the American Urogynecologic Society (AUGS) Quality Registry (AQUIRE). Particular focus was on SUI module data quality for all types of SUI surgeries, including slings, burch procedures and periurethral bulking agents.

[1] Founded in 1987, Health Level Seven International (HL7) is a not-for-profit, ANSI-accredited standards developing organization dedicated to providing a comprehensive framework and related standards for the exchange, integration, sharing, and retrieval of electronic health information that supports clinical practice and the management, delivery and evaluation of health services.

[2] FHIR® is a next generation standards framework created by HL7. FHIR® was developed by HL7 in response to the growing use of electronic health records (EHRs) and aims to simplify implementation without sacrificing information integrity. FHIR® leverages existing logical and theoretical models to provide a consistent, easy to implement, and rigorous mechanism for exchanging data between healthcare applications.

2. Using existing registries as pilot sites to test and support the implementation and refinement of specifications in the WHT-CRN FHIR® IG in a test or production environment (e.g., clinical or provider setting). The two registries selected were AUGS (POP module) and New York Presbyterian Hospital system registry hosted within FDA High-Performance Integrated Virtual Environment (both POP and SUI modules). The latter effort plans to expand the newly created registry under the leadership of AUGS and the Society of Urodynamics, Female Pelvic Medicine & Urogenital Reconstruction (SUFU).
3. Conducting a pilot project to integrate the uterine fibroids core minimum data set into the Uterine Leiomyoma Treatment with Radiofrequency Ablation (ULTRA) registry at the University of California in San Francisco. The project included creating standardized reports based on data extracted from the electronic health record (EHR). The data included core minimum data that can be used for research as well as for quality improvement and regulatory and educational purposes.
4. Using natural language processing (NLP) to develop an annotation model and applying natural language processing to device adverse event reports such as reoperations following hysteroscopic sterilization in the Manufacturer and User Facility Device Experience (MAUDE) database.
5. Claims database studies to assess the value of administrative databases as part of building CRNs, which included the following targeted investigations:
    a. Short-term risk of reoperations and erosions following SUI sling procedures
    b. Continuous surveillance with determination of predictors of reoperations and erosions following SUI sling procedures to aid the FDA with decisions regarding mesh use for SUI
    c. Large consecutive cohort study of patients undergoing sacral neuromodulation procedure to study reintervention rate and device malfunction rates at one, three, and five years after surgery
    d. Examine the association between sling implantation for SUI and autoimmune disease and carcinogenesis among large cohort of patients who underwent sling surgery for SUI
    e. Short- and long-term studies of outcomes after mesh-based POP surgery including the longest follow-up study worldwide to determine erosions and reoperations after surgery to aid the FDA with decision regarding mesh use for POP repair
    f. Evaluation of the impact of the 2011 FDA safety communication on the use of mesh in urology and assessment of use patterns following the communication
    g. Conducting several claims-based research studies to evaluate outcomes of devices used for sterilization procedures. The studies informed FDA decision making related to conduct of additional post-market surveillance studies. The final follow-up surveillance study was completed after device was removed from the market to assess the seven-year outcomes after hysteroscopic and laparoscopic sterilizations and inform patients and physician making.

The final phase of the project has focused on enhancing the value of the WHT-CRN and assessing how the WHT-CRN infrastructure can be used for future research. This process includes recommendations on sustainability through grant funding, professional society engagement, federal agency engagement, industry engagement, and future pilot studies that can ensure the long-

term value and sustainability of the CRN. As part of this process CRN clinical working groups identified approaches to address priority research questions that utilize relevant core minimum datasets. The WHT-CRN coordinating center at Weill Cornell Medicine provided a roadmap for stakeholders to use WHT-CRN and address research questions of interest in the future. Overall, the WHT-CRN illustrates the strength of partnership and real world evidence (RWE) to address specific research questions and advance the registry model. Use of tools such as structured data capture and HL7 FHIR® helps to efficiently extract, standardize and exchange data across multiple data sources for generating RWE.

III. SIGNIFICANCE, OBJECTIVES AND PROJECT SPECIFIC BACKGROUND

A. Significance

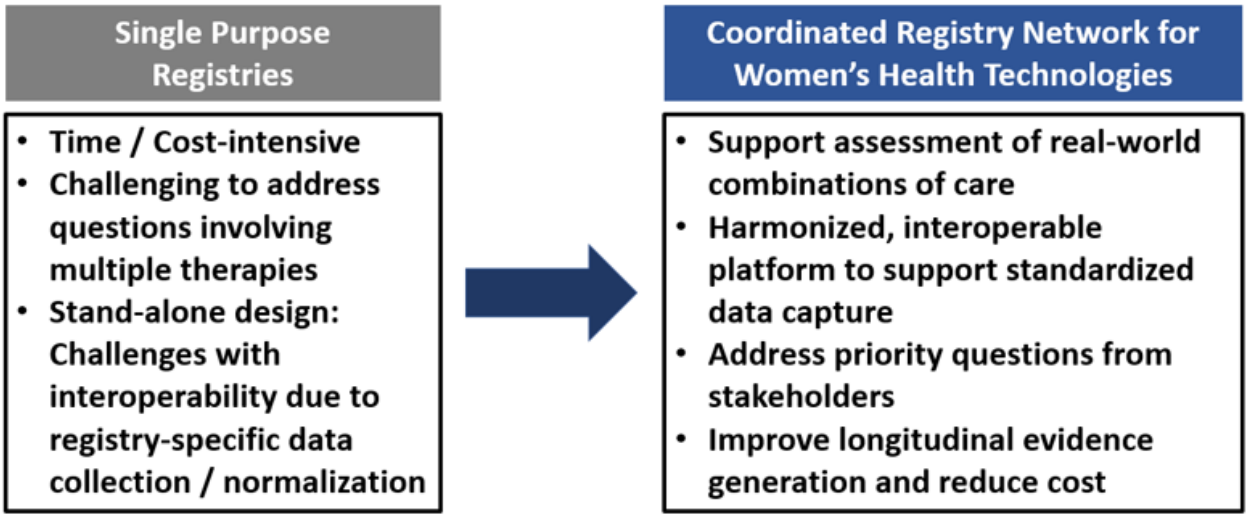
Effectiveness and safety of medical devices and technologies affect the lives of millions of women worldwide. There are clinical conditions that uniquely affect women, which includes pelvic floor disorders, uterine fibroids (UF), and conditions requiring female sterilization that can be treated with medical devices. Over the last several decades, significant advancements have been made in the treatment of these conditions. However, signals have arisen for several medical devices and evidence is limited.[i,ii,iii] There are several factors that hinder evidence generation. For example, device use or implantation may be performed by one group of healthcare professionals such as surgeons, while long-term care and monitoring may be conducted by others such as primary care physicians. This care fragmentation makes it difficult to track the device over the course of its total product lifecycle. Changes in women's conditions and their device use over the human lifespan (from the pediatric through adult phases, and through pregnancy & labor, post-pregnancy, menopause, and post menopause) can introduce additional complexity with respect to long-term device effects. Finally, device benefits and risks may differ substantially among subgroups of women due to certain conditions that may affect women differently, such as auto-immune and inflammatory conditions, as well as sensitivity to device materials that leads to complications (e.g., bleeding/clotting, etc.).

The United States (U.S.) Food and Drug Administration (FDA) recognizes that overcoming these complexities is crucial to understanding the effects of medical devices for regulatory decision-making.[iv] For these reasons, the FDA established the Office of Women's Health (OWH) in 1994 and embarked on several research projects to advance our understanding of women's health issues.[v] The FDA has subsequently produced guidance on the evaluation of medical devices in women.[vi] In 2016, the FDA also formalized a Center for Devices and Radiological Health (CDRH) Health of Women Program, which prioritizes investigation of unique health issues for medical device use in women across their lifetime.[vii] Previously the FDA has utilized the Manufacturer and User Facility Device Experience (MAUDE) Database to identify adverse events associated with medical devices.[viii] Using MAUDE, the FDA was able to identify thousands of adverse events associated with women's health technologies which helped to draw attention to important safety issues and subsequent regulatory changes.[ix,x] The reported adverse events catalyzed the clinical communities to initiate a revision of guidelines and helped the FDA initiate the process for removal of certain devices from the market.[xi,xii,xiii]

However, MAUDE and other passive reporting systems are not adequate to address the complexities related to real world use of devices and possible adverse events. To enhance research and surveillance capacity, scientific questions within the women's health technology field have been evaluated in stand-alone prospective or retrospective studies. In some instances, targeted registries were funded that were aligned with the vison of National Medical Device Post-market Surveillance System by the FDA CDRH.[xiv] However, the registries, if not linked to other data sources, will miss the opportunity to create advanced infrastructure to advance women's health as a whole and in the continuum of routine clinical practice. Federally-funded claims databases such as the database provided by the Centers for Medicare and Medicaid Services (CMS) can be utilized

to assess certain long-term device safety and effectiveness events particularly for women above the age of 65. Linkages between data sources can increase post-market surveillance capabilities, further increase possible evidence generation, support adverse event analyses, advance follow-up achievements, and complement existing surveillance tools such as Medical Device Reporting (MDR). These efforts are the focus of Coordinated Registry Networks (CRN) (see Figure 1).

Figure 1: Purpose of Coordinated Registry Networks Compared to Single Purpose Registries



B. Objectives

The primary objective of the Women's Health Technologies Coordinated Registry Network (WHT-CRN) is to establish a CRN for women's health technologies and address infrastructure, methods and evidentiary requirements to study devices throughout their life cycle. The CRN is focused on developing innovative approaches to facilitate data collection within existing and new registries by leveraging efficient clinical data capture mechanisms, taking advantage of relevant claims and EHR data sources and creating patient facing applications for capturing patient-reported outcomes.

The secondary objective is to demonstrate that data in the CRN can be used to do the following:

- Evaluate the effectiveness and safety of various device-based treatment options for sterilization/ long acting reversible contraceptives (LARC), pelvic organ prolapse (POP) and stress urinary incontinence (SUI) using real world evidence (RWE);
- Provide a framework for the conduct of clinical studies within the CRN, including industry-sponsored studies required to fulfill the FDA's request for pre-market and post-market regulatory activities;
- Enable more effective assessment of surgeon and patient outcomes related to devices and technologies used as part of quality improvement activities; and
- Create collaborative opportunities for new and existing registries related to women's health technologies to work with each other and link to other major data sources and networks.

The tertiary objective is to develop and test information technology solutions in order to more effectively support future advancement of the WHT-CRN:

- Share and exchange data at the point of care in a standardized format (HL7 FHIR®), using standard terminologies and definitions; and
- Engage communities such as patients, providers, and researchers in demonstrating the capture/exchange of data to inform development of HL7 FHIR® profiles related to women's health technology issues.

The newly created WHT-CRN will serve as the national infrastructure for the evaluation of medical devices in clinical areas unique to women and enable more timely identification of unanticipated issues and promote the innovation of safe and effective medical technology. The individual registries plan to operate under the auspices of healthcare professional societies (e.g., American College of Obstetricians and Gynecologists (ACOG), American Urogynecologic Society (AUGS), American Society of Plastic Surgeons (ASPS), etc.), and are expected to share a common platform and analytical and support infrastructure, while maintaining the flexibility necessary to address specific questions unique to the clinical conditions covered by the respective registries. The infrastructure has the capability to incorporate premarket evaluations and post-market mandated studies to help limit startup costs and implementation time of clinical trials as well as review time for FDA to evaluate premarket applications or post-market submissions.

C. Project Specific Background

The CRN concept was originally developed by the National Medical Device Registry Task Force and defined as, "strategically partnered electronic health information systems that support 1) the implementation of structured device identifiers, core minimum data elements and definitions, and 2) the ability to share complementary data across information systems." The WHT-CRN was conceived as a major project to illustrate the strength of big data to address specific questions and also to advance the registry and RWE models using tools to efficiently extract, standardize and exchange data across multiple real-world data sources. The WHT-CRN aims to demonstrate the application of the CRN vision in the clinical context of specific devices used in clinical areas unique to women.

The project began in 2017 with funding support from the Patient-Centered Outcomes Research Trust Fund (PCORTF), which is administered by the Office of the Secretary, Office of Assistant Secretary of Planning and Evaluation (ASPE), by establishing four multi-stakeholder working groups for each of the clinical areas: Sterilization/LARC, POP, SUI, and UF. The working groups began meeting on a weekly or biweekly basis to discuss, identify and refine clinical elements for their individual registry. A separate informatics working group for the overall project was established to address cross-specialty information technology needs and identified roles and responsibilities for creating the informatics infrastructure to support the efforts of the CRN. Weill Cornell Medicine (WCM), Medical Device Epidemiology Network (MDEpiNet) Coordinating Center initiated a project management plan with FDA including participation from NLM, ONC and their contractors.

An inaugural conference was held on September 15, 2017, at the headquarters of the FDA in Silver Spring, Maryland. Stakeholders from the FDA, industry, nonprofit organizations, patient advocacy

groups, payers, professional society leaders, academia, and clinical experts in each of the clinical conditions met to assess the current landscape of registries evaluating women's health devices and technologies, to discuss the perspectives of each major stakeholder, to coordinate project efforts, to identify opportunities and challenges, and to discuss approaches for each working group. Breakout sessions were held for stakeholders of each clinical condition to propose data elements that should be collected for each condition.

Following the meeting, clinical working groups were created to develop the initial set of data elements based on stakeholder feedback, a review of the literature, regulatory requirements, and existing research efforts. The groups planned to use these data elements to launch a consensus process that would be used to reach agreement on core minimum datasets for each condition. The informatics working group was envisioned to refine their project management plan and create a responsibility assignment matrix to define how the clinical working groups and the informatics working group would share, review, standardize and refine core data elements, their definitions, value sets, and other characteristics for the CRN. To support this phase in the project, the informatics working group established a repository on Max.Gov to help coordinate informatics and clinical work for the entire CRN.

Key Messages:

- There is growing demand for evidence to evaluate the performance of women's health devices related to SUI, POP, UF, and Sterilization/LARC.
- The WHT-CRN addresses this critical need by creating innovative approaches to facilitate data collection through leveraging efficient clinical data capture mechanisms, linkages between registries, relevant claims and EHR data sources, and creating patient facing applications for patient reported outcomes (PROs).
- Coordination and linkages between data sources can increase post-market surveillance capabilities, further increase possible evidence generation, support adverse event analyses, increase follow-up time, and complement existing surveillance tools such as MDR.

IV. APPROACH TO VARIOUS DATA SOURCES

A. Registry Data

The WHT-CRN has focused on building a unique infrastructure that tracks devices and device-based procedure outcomes in stress urinary incontinence, pelvic organ prolapse, uterine fibroids, sterilization, and long-acting reversible contraception. The WHT-CRN consists of a registry-based core of the existing professional society based registries augmented by administrative claims data, electronic health records, and patient-generated data. Clinical data registries serve as quality systems to advance clinical care and include relevant data repositories that capture information about a patient's health, the health care that they receive, and the devices and technologies that are used to improve patients' health (see panel). A clinical data registry system can focus on a disease, condition, or procedure and capturing a holistic picture of a patients' clinical data enables researchers and clinicians to evaluate patient outcomes and improve the quality of care. This infrastructure provides a basis for post-market surveillance of medical devices and for the development of evidence to support medical device innovation.

Panel: Definition of registry within device regulation with eight desirable characteristics

"Organised system that continuously and consistently collects relevant data in conjunction with routine clinical care, evaluates meaningful outcomes and comprehensively covers the population defined by exposure to particular device(s) at a reasonably generalisable scale (eg, international, national, regional, and health system) with a primary aim to improve the quality of patient care"—International Medical Device Regulatory Forum.

1 Device data: the registry contains sufficient information to uniquely identify the device. Ideally, the unique device identifier would be included, but when unavailable, the registry would include a combination of identifiers (catalogue number, manufacturer, description).
2 Quality improvement system: is part of a health-care delivery quality improvement system or evolving into one as device technologies are diffused into practice and need continuing evaluation (including outlier identification).
3 Beneficial change: has established mechanisms to bring about beneficial change in health-care delivery through stakeholder participation, ownership, and integration into the relevant health-care systems.
4 Efficiency: the registry is embedded in the health-care delivery system so that data collection occurs as part of care delivery (ie, not overly burdensome, not highly complicated, not overly costly) and integrated with workflow of clinical teams.
5 Actionable data: the registry provides actionable information in a relevant and timely manner to decision makers.
6 Tranparency: the governance structure, data access, and analytical processes of the registry are transparent.
7 Linkability: information in the registry can be linked with other data sources for enhancement, including adequate follow-up achievement.
8 Total device lifecycle: the registry can serve as infrastructure for seamless integration of evidence throughout the device lifecycle.

B. Claims Data

The WHT-CRN has been designed to have a capacity to be linked to several administrative claims databases provided through the CMS, as well as various state administrative databases (e.g., the New York State discharge database). The Medicare database contains all services reimbursed by CMS and rendered to individuals covered by fee-for-service Medicare insurance. Another example administrative data such as The New York State discharge database is an all-payer data reporting system and contains data for all hospitalizations, emergency room admissions, and outpatient surgeries within New York State. These databases collect comprehensive patient-level characteristics, diagnoses, treatments, hospitalization courses, and charges and/or costs for inpatient and outpatient services. This allows researchers to evaluate all reported events or diagnoses that are related and unrelated to medical devices.

Thus, claims provide information on certain adverse events such as erosions and reoperations. Furthermore, these claims capture hospitalization experiences over a longer period of time and are not limited to follow-ups reported by the facilities that provided the initial care. The availability of longer, comprehensive follow-up allows for continuous and rigorous evaluation of long-term outcomes over the course of the product life cycle. In some instances, the claims can be further leveraged to provide information regarding the physician real-world use of the device that is more complete than registry data that is dependent upon voluntary reporting of information. Results from claims data can be used to calculate population estimates and are generalizable to a large population.

The Medicare database that is currently part of the CRN data infrastructure includes approximately 560,000 elderly women who underwent POP and SUI sling procedures between 2008 and 2016. These data are comprised of both facility and physician billings. The New York State discharge database includes approximately 50,000 women who underwent sterilization between 2005 and 2016, approximately 85,000 women who underwent POP procedures and SUI sling procedures between 2008 and 2016, and approximately 220,000 women who underwent UF treatment between 2007 and 2016. The mean follow-up of these patients is 6 years.

During the project performance period the MDEpiNet Coordinating Center team at WCM and other collaborators of the WHT-CRN led a number of studies using claims data to address important effectiveness and safety endpoints related to medical devices. These studies served at least two purposes: (a) test novel methodological tools and data sources; and (2) complement existing evidence to help inform decision making by a variety of stakeholders including FDA. To that end, the claims data have been the important source of evidence that was used to evaluate long-term outcomes of devices in women undergoing care for POP, SUI, and sterilization purposes. Other claims databases, including Truven MarketScan linked with electronic medical records, have also been leveraged to study various endpoints.

C. Electronic Health Records

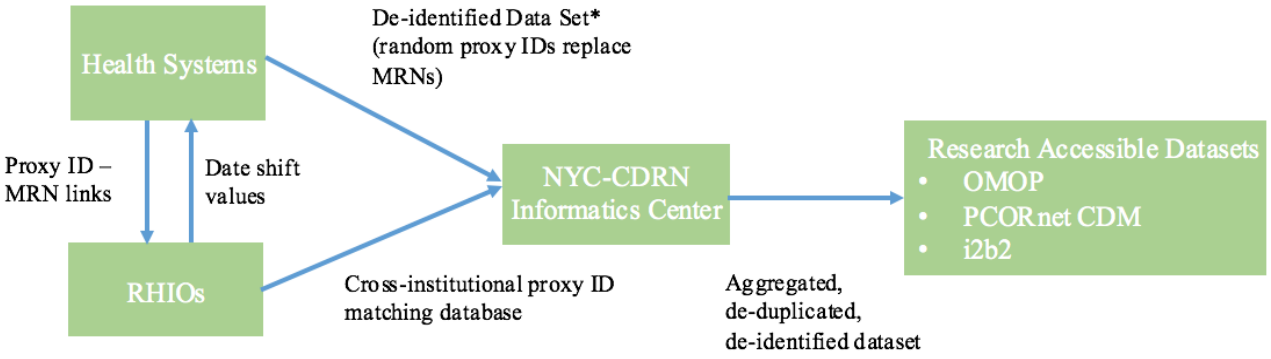
EHR data is evolving as an important data source within the WHT-CRN as it can be linked with the registry core when appropriate. The WHT-CRN is developing the tools necessary to efficiently extract and standardize clinical data from EHRs using HL7 FHIR® profiles and Structured Data Capture (SDC). The new HL7 FHIR® resources and profiles, as well as conceptual lessons learned from the WHT-CRN project, have already begun sharing information with other CRNs and PCORTF projects that require effective and sustainable data collection methods. Efforts for SDC have been successful in creating standards and protocols that will enable efficient EHR data capture for clinical studies and can be utilized to investigate how SDC protocols can leverage advancements in Application Programming Interface (API) infrastructure and growing market support for Substitutable Medical Applications, Reusable Technologies (SMART) on FHIR® for the development of other CRNs beyond women's health.

Furthermore, Clinical Data Research Networks (CDRNs) within PCORNet can be valuable resources for linkage between EHRs and the registry core, specifically the New York City Clinical Data Research Network (NYC-CDRN), which is organized by Weill Cornell Medicine (WCM) - one of the leading agencies for the WHT-CRN project. The NYC-CDRN is a collection of 22 organizations across seven systems that were already pursuing data sharing and patient-centered

clinical research. The NYC-CDRN combines the strengths of participating organizations by enabling sharing capabilities and facilitating coordinated and patient-centered clinical research. The NYC-CDRN offers researchers and users access to large high-quality patient data and is already supporting numerous funded research studies on various devices. The process for using CDRNs in women's health studies is underway.

There are current efforts underway to expand the de-identified central research databases to integrate new sources and types of data, such as Medicaid data and social determinants of health. Thus, the NYC-CDRN will provide a rich supply of clinical, patient-reported, patient-generated, bio-specimen, claims, registry, and study-specific longitudinal data for at least 2.5 million and potentially up to 6 million patients. Figure 2 describes the NYC-CDRN system for linking data from across multiple data sources for creating a central de-identified data repository.

Figure 2: NYC-CDRN System for Data Linkage



Note. *RHIOs* indicate Regional Health Information Organizations; *OMOP*, Observational Medical Outcomes Partnership; *CDM*, Common Data Model; *i2b2*, Informatics for Integrating Biology & the Bedside Cohort Discovery system.

D. Patient-Generated Data

Patient-generated data is envisioned to become one of the major approaches to building WHT-CRN and will also be linked to the registry core. By providing information about patients' health, functional status and quality of life, patient reported outcomes (PROs) are one of the best ways to capture the experiences of patients associated with a specific procedure or treatment. By enabling the patient's experience to be factored into clinical decision-making, PROs can also be used to greatly improve the quality of patient care. As such, it is important that PROs are collected by CRNs in routine practice and for specific studies. Access to PRO data is especially critical since, for a variety of reasons, patients do not always return to their original surgeons for follow-up and may see another physician or healthcare provider instead. Tracking PROs will allow patients to share their concerns or complications with their surgeons and/or any other provider who could potentially access the patients' EHR.

There are three categories of Patient Reported Outcome Measures (PROMs): generic health status, preference-based, and condition- or population-specific-measures. Clinical reliability of the instrument is related to its importance and the degree to which it has been developed and has been matured. For example, PHQ-9 might be highly clinically reliable, but not condition-specific as a PRO. This makes a case for shared instruments that have received much careful thought and refinement. Condition-specific PROMs are likely to be highly targeted and specific and likely to have received the thought necessary to make them highly reliable. The WHT-CRN is working on several ways to collect patient-generated data, including the development of a patient-facing mobile app for evaluation of technologies used in SUI and POP.

Key Messages:

- Data from registries, claims, EHRs, and patient-generated data are all valuable sources of information to assist in the evaluation of medical devices and technologies used for clinical conditions that are unique to women**.**
- All RWE data sources were assessed for their contribution to the WHT-CRN. Data sources are complementary and can provide more robust evidence within CRN while maintaining the flexibility necessary to address specific questions unique to the clinical conditions covered by the respective registries and administrative data sources.

V. REGULATORY HISTORY AND DATABASE STUDIES

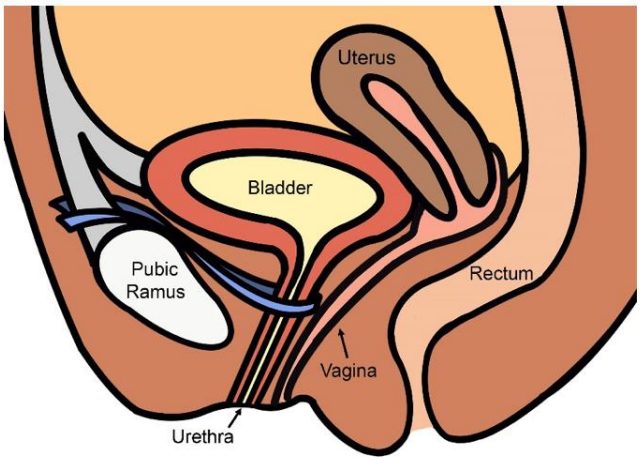
A. Stress Urinary Incontinence

Summary of Evidence from Regulatory Perspective

Female SUI is a highly prevalent condition of involuntary loss of urine due to faulty closure or poor support of the urethra and is typically associated with coughing, sneezing or physical activity. SUI has a debilitating social, psychologic and economic impact, substantially reducing a woman's quality of life. The cumulative risk for undergoing stress incontinence surgery is estimated at 13.6%.[xv] Treatment options for women with SUI encompass lifestyle/behavioral modification, physical therapy, biofeedback, vaginal insert devices, and surgery. Over 100 procedures have been described to treat SUI leading to broad regional, specialty and provider variability in the delivery of care.

Developed in the mid-1990's, midurethral slings (MUS) treat SUI in a minimally invasive, outpatient procedure. This technique utilizes a small mesh strip composed of monofilament polypropylene placed through the vagina under the mid-urethra, exiting from 2 small sites in either the suprapubic or groin areas (see Figure 3). The MUS has become the gold standard for treatment among urologists and gynecologists because of its superior effectiveness, its minimally invasive approach and associated short convalescence and relatively quick return to work and activities of daily living.[xvi]

Figure 3 – Treatment of Stress Urinary Incontinence



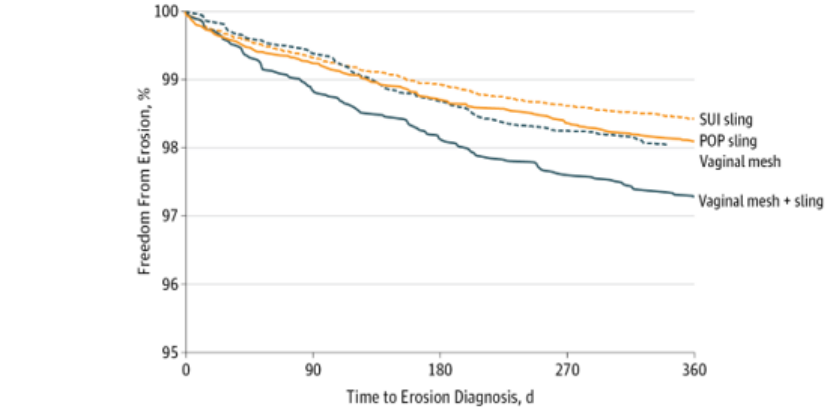
A 2011 FDA Obstetrics and Gynecology Devices Panel of the Medical Devices Advisory Committee found that the safety and effectiveness of multi-incision slings are well-established in clinical trials with up to one year of follow-up but not adequately demonstrated in mini-slings for female SUI.[xvii] From 2012-2013, the FDA ordered post-market surveillance studies from manufacturers of mini-slings.[xviii] To ensure women's health, the FDA continues to analyze Medical Device Reports and post-market information; conduct epidemiological research; and examine quality published literature that investigates potential adverse events associated with surgical mesh for SUI. Despite the absence of a product "recall," a significant portion of manufacturers ceased production and sale of their mesh kits for repair of transvaginal POP citing concerns for liability exposure with individual and class action litigation. However, alternative treatments such as peri-urethral bulking agent injections carry their own risks; approximately one-third of patients who receive peri-urethral bulking agent injections experience some type of complication.[xix] With the widespread use of sling implant in SUI treatment, evidence regarding its short- and long-term safety is warranted.

Summary of WHT-CRN Conducted Database Studies

Leaders of the WHT-CRN SUI working group have performed several claims-based research studies led by WCM to evaluate devices used for SUI. New York State administrative data has been the primary claims data source that was used to evaluate effectiveness and safety endpoints related to medical devices.

In the first study of the short-term risk of reoperation and erosion diagnosis following SUI sling procedures, 37,806 women who received the procedure in New York State between 2008 and 2012 were examined. This study found that the estimated risk of reoperation within one year following sling procedure alone was 2.5%. The estimated risk of erosion diagnosis within one year following sling procedure along was 1.6% (see Figure 4).[xx]

Figure 4: Kaplan-Meier Curves of the Time to Erosion Diagnosis After Index Procedures During 1-Year Follow-up



No. at risk

SUI sling	22252	22104	22014	21944	21901
POP sling	10484	10406	10349	10315	10284
Vaginal mesh	3798	3775	3748	3729	3721
Vaginal mesh + sling	5070	5013	4977	4947	4932

In another study, approximately 4,946 patients diagnosed and undergoing a sacral neuromodulation procedure were identified in the New York Statewide Planning and Research Cooperative System (SPARCS) data from 2008 to 2015. The reintervention rate associated with sacral neuromodulation treatment failure and device malfunction at one, three, and five years after surgery was assessed. Sacral neuromodulation was associated with a high rate of failure within 5 years of device placement. However, the details of the clinical events are not available in claims databases. Hence, the authors concluded that a device registry is urgently needed in this setting to advise stakeholders and assist future innovations.[xxi]

Series of WHT-CRN led studies evaluated the potential link between sling implantation for SUI and autoimmune disease and carcinogenesis between January 2008 and December 2009 was investigated using SPARCS data. Among 10,401 identified patients who underwent sling surgery for SUI, no association between the receipt of sling and the development of autoimmune disease and malignancy at a mean follow-up of 6 years was observed.[xxii]

Continuous surveillance is underway investigating predictors of reoperation and erosion following SUI sling procedures, 36,195 women undergoing sling procedure between 2008 and 2016 in New York State were included. Concomitant POP repair and previous hysterectomy were associated with higher risks of reoperation and erosion.

The methodology of these studies is transparent and relevant International Classification of Diseases (ICD) procedure codes, current procedure terminology (CPT) codes, and Healthcare

Common Procedure Coding System (HCPCS) codes for SUI are listed in the Appendix of this report.

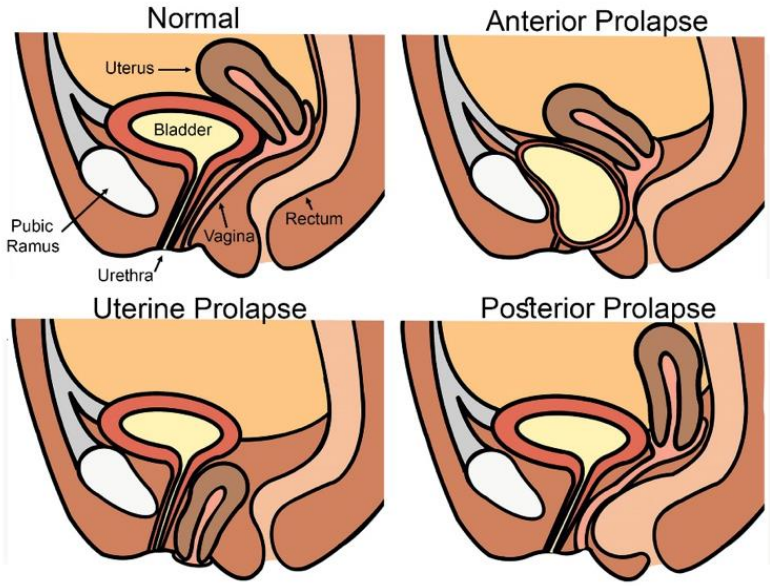
Key Messages:

- The short- and long-term safety of sling and alternative treatments for SUI in the real world settings is not well established.
- Claims databases can be leveraged to assess short- and long-term outcomes related to some SUI treatments.
- The WHT-CRN SUI working group has performed claims-based studies to assess the association of SUI treatments with important outcomes including reoperation, erosion, and sacral neuromodulation.
- Results from the claim-based studies emphasize the need for a device registry for stress urinary incontinence treatments to advise stakeholders and assist in future device innovations.

B. Pelvic Organ Prolapse

Summary of Evidence from Regulatory Perspective

Figure 5 – Anatomy of Pelvic Organ Prolapse



POP occurs when the uterus or vaginal walls weaken and descend, causing a variety of symptoms including pressure, pain, bleeding, and incontinence (See Figure 5). The lifetime risk of receiving surgical intervention for POP is reported to be around 11% by the age of 80 years in the US.[xxiii] It was estimated that over 200,000 procedures for POP are conducted each year in the U.S.[xxiv] The first transvaginal mesh used specifically in the treatment of POP was cleared in 2002, initially classified as a Class II device, and reviewed under the 510(k) Premarket Notification Program.[xxv] Mesh use in POP repair was expected to reduce rates of prolapse recurrence and provide better anatomical results than procedures not using mesh.[xxvi,xxvii] Since the clearance of transvaginal mesh implant for POP, there has been a significant increase in the use of mesh or graft for surgical repair of POP among female patients.[xxviii,xxix] Randomized trials and population-based studies of prolapse repair surgery comparing the use of mesh with native tissue repair reported conflicting results and were limited by small size and patient selection.[xxx,xxxi,xxxii,xxxiii] After receiving complaints regarding adverse events related to transvaginal mesh, the FDA released a public health

notification in 2008 to inform clinicians and patients of reported adverse events related to the use of transvaginal mesh. In 2011, the FDA followed-up with a safety communication providing an update on serious complications associated with transvaginal mesh for POP. Furthermore, a White Paper titled: "Urogynecologic Transvaginal Mesh: Update on the Safety and Effectiveness of Transvaginal Placement for Pelvic Organ Prolapse" was published.[xxxiv] The Obstetrics and Gynecology Devices Panel of the Medical Device Advisory Committee convened to discuss the safety and effectiveness of transvaginal mesh to treat POP. The panel recommended that transvaginal mesh be reclassified from a Class II to a Class III device and that further post-market surveillance studies be performed to address effectiveness and safety concerns. In response to the panel's recommendations as well as FDA's examination of published literature and adverse event reports, the FDA ordered post-market surveillance studies by manufacturers to address safety and effectiveness concerns related to surgical mesh used for transvaginal repair of POP in 2012.[xxxv] In April 2014, the FDA then issued two proposed orders: one to reclassify surgical mesh for transvaginal POP repair from class II to III devices and a second to require pre-market approval (PMA) applications. In 2016, the FDA reclassified transvaginal meshes as Class III devices and thereby required manufacturers to submit PMA studies. All PMA studies were due and reviewed in 2018. In July 2018, the last manufacturer of surgical mesh for transvaginal POP repair in the posterior compartment (rectocele) withdrew their products from the market per FDA orders. Then on April 16, 2019, the FDA ordered manufacturers of transvaginal mesh intended for POP repair in the anterior/apical compartment (cystocele) to stop selling and distributing their products due to insufficient evidence of probable benefits that outweigh probable risks.[xxxvi]

Despite the removal of transvaginal mesh from the market, other mesh implants, including transabdominal mesh remain. Large population-level studies and longer-term follow-up are needed to continuously assess the short- and long-term adverse events following mesh-based POP repair.

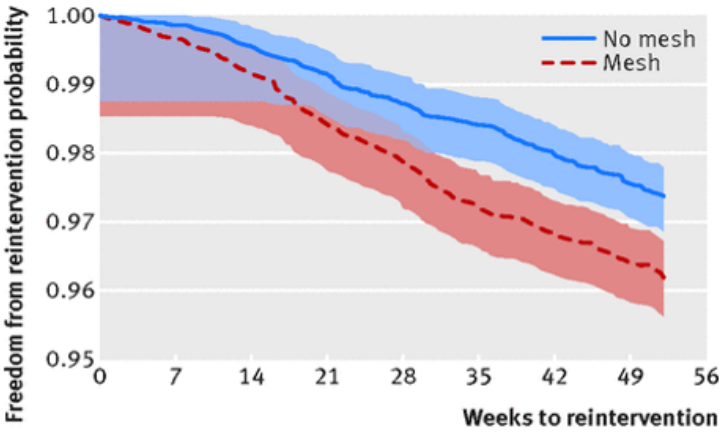
Summary of WHT-CRN Conducted Database Studies

Members of the WHT-CRN Pelvic Organ Prolapse working group have performed several claims-based research studies led by WCM to evaluate devices used for POP.

The first study using the claims New York State SPARCS Administrative database, SPARCS, examined the use of mesh in POP between 2008 and 2013 and related outcomes. The study found that mesh was associated with an increased risk of reoperation following the initial POP repair (see Figure 6).[xxxvii] A follow up study was conducted to determine outcomes and short-term complications of mesh-based POP surgery with and without concurrent hysterectomy in patients under the age of 44 between 2009 and 2014. A total of 1,601 women were identified, including 921 women who underwent concurrent hysterectomy. No difference in reintervention rates were observed in the three-year follow-up period.[xxxviii] These studies complemented the adverse event reports received through passive surveillance, providing population level evidence and estimates to quantify the risks associated with mesh use in pelvic organ prolapse repair. A third and most

recent study with extended follow up time of median 5 years assessed the long-term reoperation rates following initial POP repair. This study found that POP with mesh was consistently associated with increased risks of reoperation when compared with native tissue repair over the long term.[xxxix]

Figure 6: Time to reintervention within one year following pelvic organ prolapse surgery*



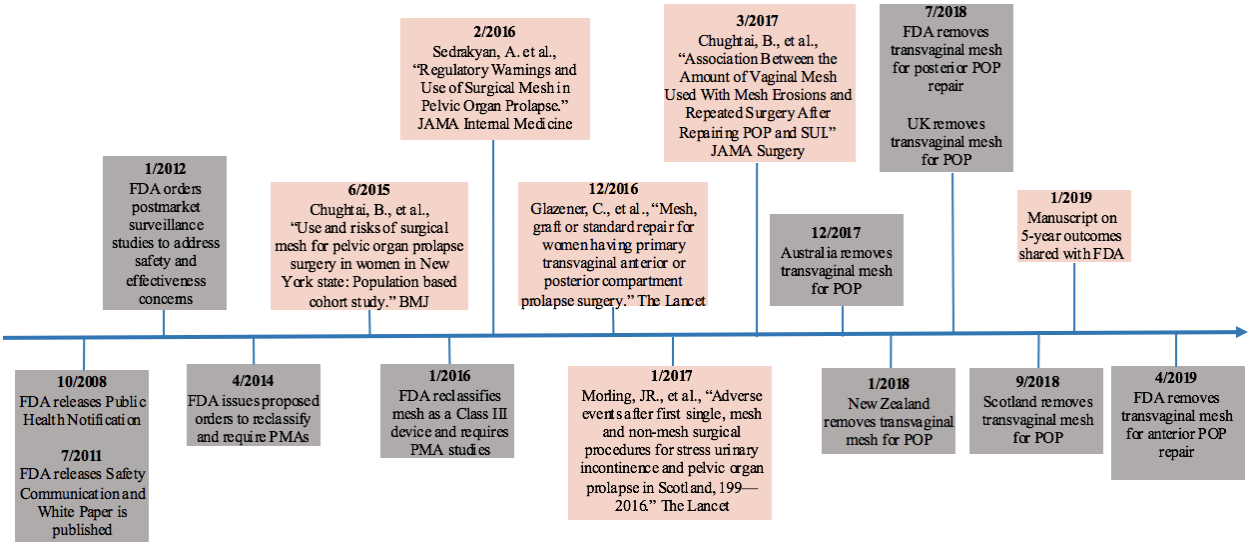
Mesh	7295	6921	6465	5959	5507	5080
No mesh	7295	6915	6520	6084	5642	5141

*with or without mesh placed between 2008 and 2011 in New York state, after propensity score matching

In addition, Leaders of the WHT-CRN POP working group evaluated long-term systemic effect of mesh to determine the potential link between synthetic polypropylene mesh implantation for POP and autoimmune disease and carcinogenesis. Among 2,229 patients who underwent mesh surgery for POP, no association between implantation of mesh and the development of malignancy at a mean follow-up of 6 years was found. Similarly, results showed that mesh-based vaginal surgery was also not associated with the development of autoimmune diseases.[xl,xli]

These studies provided information for regulatory decision making by the FDA. Figure 7 below illustrates the timeline of our claims-based research studies and FDA regulatory actions for transvaginal mesh used for POP.

Figure 7: Timeline of Claims-based Research Studies and FDA Regulatory Actions



Finally, WCM led a study using New York State data that investigated the impact of the 2011 FDA safety communication on the use of mesh. Examining 88 hospitals that used mesh in POP repair before 2011, 46% hospitals decreased mesh use by at least 50% in 2013.[xlii] A recently conducted study further found that Hispanic patients were less likely to have decreased use of mesh when compared with white women.

The relevant ICD procedure codes, CPT codes, and HCPCS codes for POP are listed in the Appendix of this report.

Key Messages:

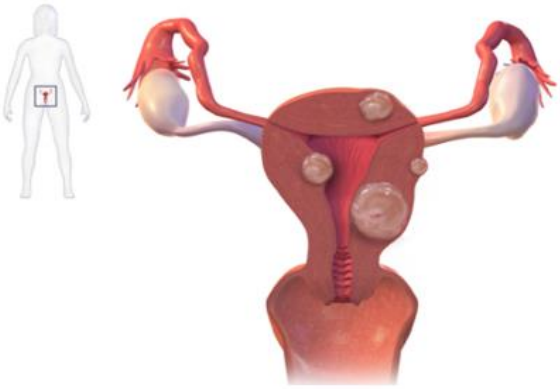
- Claims databases can be leveraged to address some of the key short- and long-term outcomes related to POP.
- The WHT-CRN POP working group has performed claims-based studies to assess the risk of reintervention in women receiving transvaginal mesh versus native tissue repair without mesh.
- Claims-based studies have demonstrated no association between mesh and autoimmune disease or carcinogenesis.
- The studies performed by the WHT-CRN POP working group had a major impact on clinical choices and also helped inform FDA decision making.
- Despite the removal of transvaginal mesh from the market, further studies and more comprehensive data sources are needed to comprehensively understand and assess the scope and long-term effects of transvaginal mesh as well as newly emerging POP treatments.

C. Uterine Fibroids

Summary of Evidence from Regulatory Perspective

Uterine fibroids (also known as leiomyomas) are growths that develop in the uterus, are almost always benign, and can vary in size, number, and symptomatology (see Figure 8). According to the Department of Health and Human Services between 20-80% of women develop fibroids by age 50.[xliii] There are multiple treatment options for fibroids, including hysterectomy, myomectomy, endometrial ablation, radiofrequency ablation, uterine artery embolization, and magnetic resonance guided focused ultrasound. Treatment decisions may depend on factors such as symptoms, size, and location of the fibroids, as well as the patient's age and desire for future childbearing. Despite the large burden of disease, evidence on the relative safety and effectiveness of available treatment options remains sparse.[xliv]

Figure 8: Anatomy of Uterine Fibroids



The evidence gaps were highlighted in 2014, when safety issues regarding uterine fibroid surgery garnered national attention. The FDA issued a safety communication warning against the use of

laparoscopic power morcellation during myomectomy or hysterectomy for treatment of fibroids, due to the risk of spreading cancerous tissue in women who have unsuspected uterine sarcoma.[xlv]

In 2017, the FDA published an update to this safety communication, which noted potential concerns of increased uterine sarcomas and decreased long-term survival in cancer patients associated with laparoscopic power morcellation.[xlvi] Laparoscopic power morcellators are Class II medical devices used during laparoscopic (minimally invasive) surgeries to cut tissue into smaller pieces so the tissue can be removed through a small incision site. Although fibroids are usually benign, in some cases there may be cancerous cells within the fibroid, and power morcellation can disseminate these cells throughout the peritoneal cavity. It is hard to distinguish between uterine fibroid and uterine sarcoma before surgery with currently available testing. The exact incidence of cancer diagnoses after fibroid surgery was unknown, due to the paucity of available high-quality published data; however, it was suspected to be higher than previously thought, leading to increased risks for patients. A study conducted by MDEpiNet Coordinating Center has shown that morcellation in patients aged 50 years or less is associated with 1 in 769 risk of sarcoma and with the risk of dissemination. But evidence needs to be weighed against benefits of possible mortality reduction.[xlvii] Thus, this example illustrates that there is a clear need for systematic collection of post-market real-world data for women undergoing treatments using medical devices, with careful consideration of which patient characteristics, procedural data, and health outcomes are most important to capture from a clinical perspective.

These issues are not limited to devices. Several drugs are currently in development for the treatment of fibroids. Safety issues identified in post-marketing surveillance in the European Union have delayed approval of one medication in the US.[xlviii] Given the relatively small numbers of patients in premarket studies for both devices and drugs compared to the large number of women affected by fibroids, systematic post-marketing collection of data to identify rare but serious complications, such as undiagnosed leiomyosarcoma or liver failure, are needed for all types of treatment. In addition, given the interest of many fibroid patients in future pregnancies, identifying the safety and impact of devices and drugs on reproductive outcomes, which also requires large numbers of subjects, is an additional reason to develop systematic methods for capturing data.

Summary of WHT-CRN Conducted Database Studies

Members of the WHT-CRN UF working group have performed several claims-based research studies to evaluate devices used for UF. The primary procedures evaluated among women with UF within claims thus far are endometrial ablation, myomectomy, hysterectomy, and uterine artery embolization.

WHT-CRN scientists from Duke compared the durability of uterine preserving procedures, measured in terms of time to and incidence of subsequent procedures, for symptomatic fibroids.[xlix] The authors utilized linked electronic health records (EHRs) and administrative claims data from Truven MarketScan to identify 2,648 patients between 2005 and 2011. Among these patients, 1,274 had endometrial ablation, 1,076 myomectomy, and 298 artery embolization. Myomectomy and uterine artery embolization were associated with a lower risk of requiring a subsequent procedure when compared to patients who underwent endometrial ablation. The authors concluded that EMRs and claims are valuable data sources that can provide additional evidence regarding important endpoints that may aid in provider and patient treatment decision making.

The relevant ICD procedure codes, CPT codes, and HCPCS codes for UF are listed in the Appendix of this report.

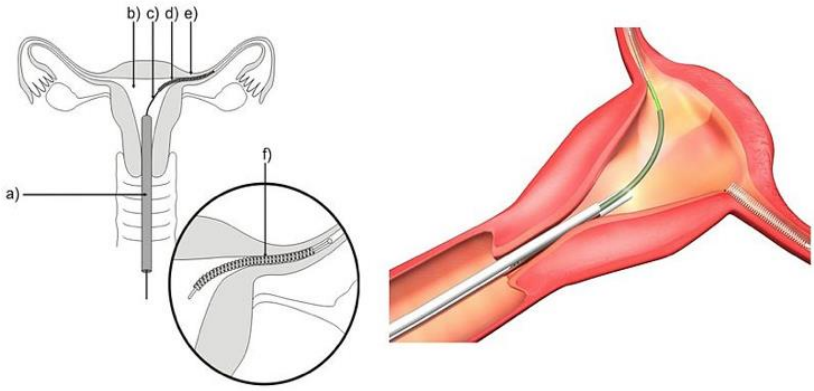
Key Messages:

- Despite the high disease burden of uterine fibroids, there is limited evidence on the safety and effectiveness for treatment options and a sparse number of premarket studies for both devices and drugs.
- Studies conducted by the MDEpiNet Coordinating Center and UF working group have underscored the critical need for systematic collection of post-market real-world data pertaining to the treatment of uterine fibroids that assesses patient characteristics, procedural data, and health outcomes of clinical importance.
- By leveraging and expanding current data capture in existing data sources the WHT-CRN offers a more robust mechanism to assess the safety and effectiveness of uterine fibroid treatment options.

D. Sterilization/LARC

Summary of Evidence from Regulatory Perspective

Figure 9 – Sterilization Device in Fallopian Tube



Female sterilization is one of the most commonly used methods of contraception worldwide and is adopted by over 10 million women of reproductive age in the United States.[I] Bilateral tubal ligation via laparoscopic approach or mini laparotomy has been the primary technique for sterilization for decades. Hysteroscopic sterilization with implant was introduced as a less invasive alternative to laparoscopic sterilization in the 2000s (see Figure 9). The "Essure" device received approval in Europe (Conformité Européenne (CE) mark) in 2001 and was approved by the FDA in 2002. The hysteroscopic procedure with the Essure device was purported to not require general anesthesia and was demonstrated to have high effectiveness and low peri-procedural complications in early clinical studies.[Ii,Iii] As a part of the approval process, the manufacturer was required to perform two post-approval studies. The first post-approval study collected five-year follow up information on the participants in the premarket clinical trial patient cohorts. The second post-approval study evaluated the bilateral placement rate for newly trained physicians. However, these studies were small and conducted in highly controlled settings without a comparison group. Since its approval, PMA supplements for Essure, most of which were submitted by manufacturers voluntarily or in adherence to regulations, have resulted in labeling

changes. After wide commercialization, safety concerns related to hysteroscopic sterilization were raised. Reported complications related to device included pelvic pain, hemorrhage, and device migration or incompatibility that can lead to reoperation.[liii]

Manufacturers were required to update physician and patient labeling to include the following: a nickel sensitivity warning in 2011, inclusion of Phase II device efficacy study results and reported pregnancies in 2012, risk of chronic pain and device migration in 2013, and a boxed warning with a Patient Decision Checklist in 2016. In February 2016, the FDA also required the manufacturer to conduct an additional post-market surveillance study due to an increasing concern regarding the benefits and risks of Essure. Furthermore, in 2018 a restriction on the sale and distribution of Essure was imposed. The sale and distribution were limited to physicians that review the FDA-approved Patient-Doctor Discussion Checklist with their patients and obtain the patients' signatures before device implantation. The manufacturer announced in July 2018 that it would halt all sales of Essure within the United States by the end of 2018.

Meanwhile, the use of intrauterine device for contraception has increased over time. LARC methods, like intrauterine devices and subdermal implants, have also had a history of controversy. In the early 1970s, the Dalkon Shield, the first popular IUD, entered the market and was sold to about 2.5 million women during a four-year period.[liv] Soon after entering the market, there was an influx of severe adverse event reports related to the device, including pelvic infections, miscarriages, sepsis, infertility and hysterectomies. Eventually, these complications led to many lawsuits, with approximately 200,000 claimants worldwide, and the device was removed from the market by 1975.[lv] It was eventually discovered that, compared to other IUDs, the Dalkon shield had a unique tail made of multifilament string that made it easier for pathogenic bacteria from the vagina to enter the uterine cavity.[lvi] Although these side effects were largely unique to the Dalkon Shield, this controversy left many women fearful of IUDs and has led to low adoption rates of all LARC methods in the U.S.

Summary of WHT-CRN Conducted Database Studies

Members of the WHT-CRN Sterilization/LARC working group have performed several claims-based research studies to evaluate devices used for sterilization procedures and have also primarily used SPARCS data.

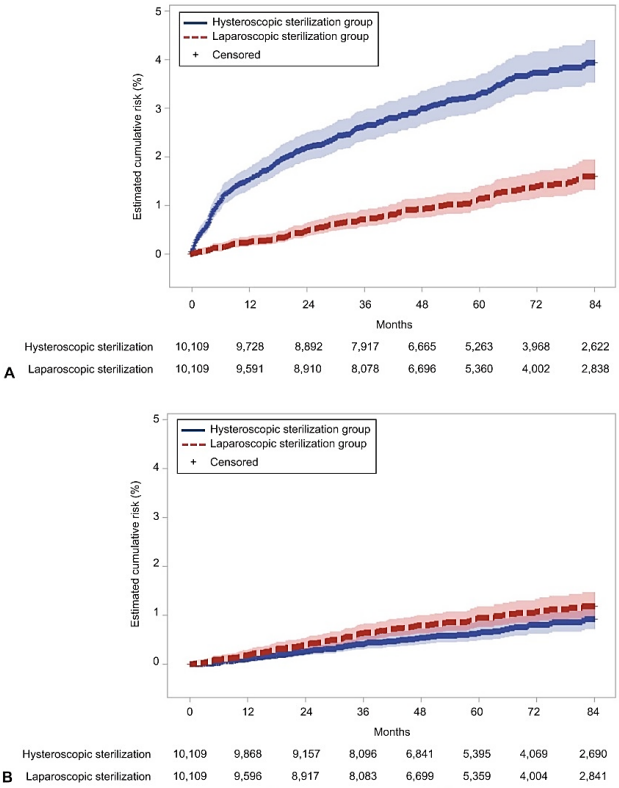
In 2015, the first study using New York State data compared the safety and outcomes following hysteroscopic and laparoscopic sterilizations. In this study of 52,326 women, it was found that hysteroscopic sterilization was associated with an increased risk of reoperation within one year, when compared with traditional laparoscopic sterilization.[lvii] This study was published at the time when many adverse event reports were received, and the FDA convened the 2015 Advisory Committee meeting. Immediately following this study in February 2016, the FDA also required the manufacturer to conduct an additional post-market surveillance study due to an increasing concern regarding the benefits and risks of Essure.[lviii]

Following the FDA panel discussion and labeling change, concerns and questions still remained regarding longer-term safety following hysteroscopic sterilization. A follow-up study was performed later to assess the seven-year outcomes after hysteroscopic and laparoscopic

sterilizations were evaluated in 10,143 women who underwent interval hysteroscopic and 53,206 women who underwent laparoscopic sterilization in New York State from 2005 to 2016.

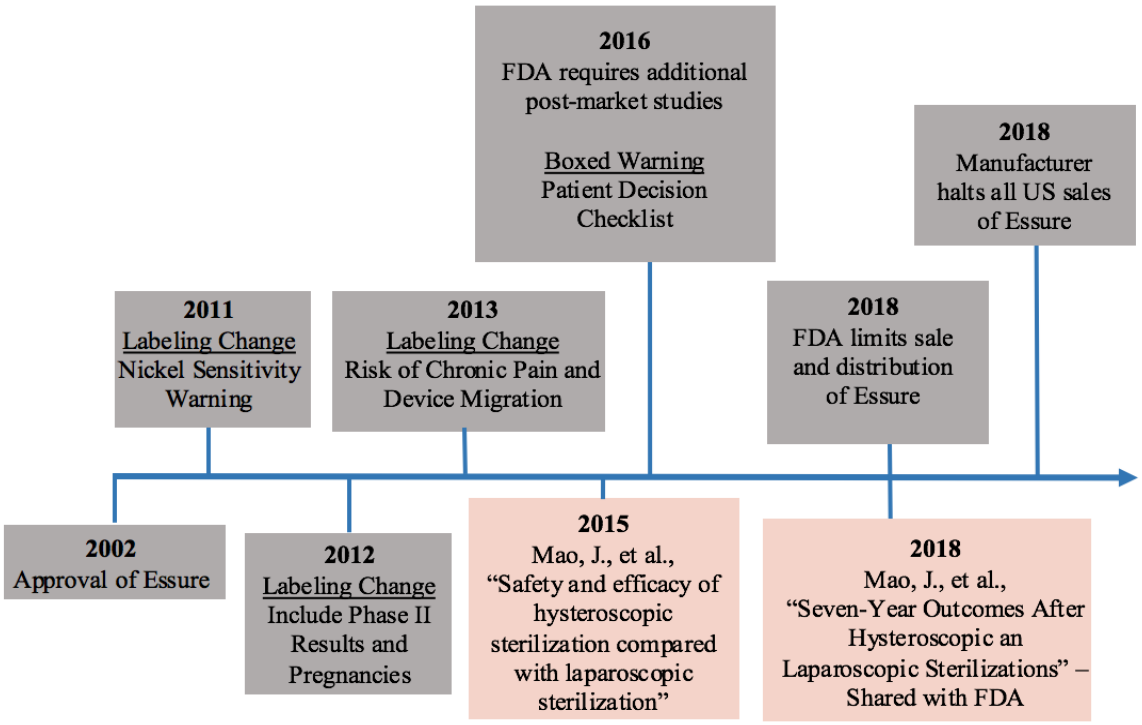
The authors found that women who underwent hysteroscopic sterilization had a higher risk of receiving an additional tubal resection or ligation than those undergoing laparoscopic sterilization. No difference in subsequent hysterectomy between the two groups was observed (see Figure 10).[lix] These study results were shared with the FDA prior to publication in 2018 and provided findings which support FDA's later restriction on the sale and distribution of Essure, limiting it to physicians that review the FDA-approved Patient-Doctor Discussion Checklist with their patients and obtain the patient's signatures before device implantation.[59] These studies offered valuable evidence in favor of the regulatory decisions made by the FDA over the last several years (see Figure 11).

Figure 10: Time to additional tubal ligation or resection and hysterectomy



Note. Time to additional tubal ligation or resection (A) and hysterectomy (B) after hysteroscopic and laparoscopic sterilization, including the number of patients at risk and 95% CIs.

Figure 11: Timeline of Claims-Based Research Studies and FDA Regulatory Decisions for Essure



The relevant ICD procedure codes, CPT codes, and HCPCS codes for Sterilization/LARC procedures are listed in the Appendix of this report.

Key Messages:

- Despite the prominence of sterilization among women for contraception and the increasing use of LARC, no existing registry captured the safety and effectiveness of these devices.
- The WHT-CRN Sterilization/LARC working group have conducted multiple claims-based research to evaluate devices used for sterilization procedures and made key contributions to the literature such as the complications related to Essure, which has since been taken off the market.
- Claims data can be helpful for research and surveillance (e.g. specific devices used for sterilization if these products are unique in the market)
- Claims data are limited in collecting granular clinical information and device identifiers.

VI. ASSESSMENT OF REGISTRIES AND ENHANCING THE INFRASTRUCTURE

A. Summary of Existing Registries from Information Technology Perspective

Purpose

The purpose of the environmental assessment for the WHT-CRN was to (1) examine the current state of women's health registries, their use of health standards and other relevant tools; (2) perform a pilot feasibility analysis to identify feasibility issues within each selected registry; and (3) provide detailed metadata and descriptive statistics describing: population demographics, disease presentation, device exposure, follow-up duration, and relevant clinical outcomes captured.

Approach

The first step of the environmental assessment was to conduct outreach to stakeholders from women's health registry organizations. To identify the stakeholders, the team conducted key informant interviews with leaders and patient-centered outcomes researchers in women's health technology services. These stakeholders included the following (see Table 1):

Table 1: Example Stakeholders of the WHT-CRN

Organization/Work Group	Organization Website
The American College of Obstetricians and Gynecologists (ACOG)	https://www.acog.org/
The American Urogynecologic Society (AUGS)	https://www.augs.org/
Comparing Options for Management Patient-Centered Results for Uterine Fibroids (COMPARE-UF)	http://compare-uf.org/
Pelvic Floor Disorders Registry (PFDR)	https://www.augs.org/clinical-practice/pfd-research-registry/
Society of Urodynamics, Female Pelvic Medicine & Urogenital Reconstruction (SUFU)	https://sufuorg.com/about.aspx

The discussions lasted approximately one hour each and were unstructured, with no formal surveys provided to the participants. To inform the environmental assessment, many participants volunteered resource materials such as publications, web links, data dictionaries, and other points of contact.

Assessment of Key Findings

1. **Variation in Registry Operational Capabilities**
   The range of maturity and capability across the registries offered different perspectives of the opportunities and challenges each registry experienced. Registries that were currently operational were collecting data and designing studies. Others were in the early stages of establishment without comparable capabilities. There was variation among the technologies and systems used by the registries, which included electronic portals,

standalone mobile applications (apps), open-source web-based software, Microsoft Excel or Access, and third-party vendors that store data in the cloud. Integration with an EHR varied regardless of how old the registry was. Overall most registries lacked the necessary infrastructure to support interoperability and link to other registries.

2. **Lack of Core Data Elements**
   Each registry collected different data elements based on their specific use case. The number of data elements captured ranged from 200 to more than 700 data elements. Some of the newer registries were still identifying data elements. At the time the interviews took place a core set of data elements that are common across the registries did not exist. Additionally, each registry had data definitions and data dictionaries in different formats and with varying levels of semantic compatibility. These variations highlighted the need for harmonization of data elements to enable interoperability.
3. **Variation in Data Collection Techniques and Processes**
   In addition to the differences in definitions and the number of elements, the instruments data collection instruments used also varied. The interviews revealed that most of the registries used research coordinators in varying capacities to discuss data collection and obtain informed consent for enrollment from patients. They also facilitated data collection during the surgery or intervention and post-surgery, following up with patients at regular intervals. There were also significant variations in data collection methods. For example, some registries used custom-developed portals while some used stand-alone apps to collect data. Some used systems such as Research Electronic Data Capture (REDCap) and Dorsata while others manually extracted clinical data from EHR systems to populate registry systems. There were also reported instances where telephone and in-person interviews were conducted to collect the data for subsequent entry into registry systems. The data collection techniques and processes were originally designed to meet the unique needs of each registry, therefore there was minimal need for standardization of data and data collection approaches. These variations made the infrastructure across registries less interoperable, adding complexity to the project task of creating a registry network.
4. **Low Adoption of Technical Standards**
   The interviews highlighted that healthcare data standards were not widely used to define data elements, collect structured (i.e., machine-readable) data, and store data. While many registries were aware of relevant regulations from federal agencies such as FDA and ONC, data collection processes generally did not include the use of standards for either structure or semantics. Interviewees expressed several reasons for low adoption of standards, including:
   - Lack of awareness of existing standards
   - Complexity of the standards
   - Changes to data elements or terminology already in use are time-consuming
   - Lack of a single standard to address all of a registry's needs
5. **Few Data Linkages and Need for Common Technical Infrastructure Across Registries**
   The interviews revealed that there was minimal linkage of data across registries. While some organizations administering multiple registries had tried developing a common infrastructure for re-using data across the registries, experience was insufficient to determine its effectiveness. A coordinated network of registries would require a common technical infrastructure to enable these linkages.

6. **Need for Standardized Data Access APIs**
   The interviews also revealed that data access APIs were not well-defined across the registries. While there were strict privacy protections or necessary security controls limiting data access, there were no consistent data access and sharing approaches across registries. In some cases, the entire database was shadowed and accessed, while in others, data was exported and pushed to federal agencies or accessed only by personnel within the organization directly from the database.

Challenges and Areas for Consideration

1. **Patient Engagement and Enrollment**
   Registries identified reaching the right patients at the right time and educating them about the importance of data collection and usage for research as increasingly difficult. Registries use patient outreach, marketing, seminars, education sessions, referrals, and other techniques to enroll patients. There may be relevant lessons learned from effective approaches used in other research initiatives to recruit and enroll participants. For example, the NIH *All of Us* Research Program is employing a platform to enroll one million or more people living in the United States to accelerate research and improve health.[lx] A similar, common infrastructure for patient enrollment could be created to include appropriate materials through a coordinated registry network that individual registries could use.
2. **Common Core Data Elements for Women's Health**
   Every registry interviewed identified the need for data definition to begin any registry activity. Even established registries have to perform this activity repeatedly as they add new use cases. Data collected cannot be interoperable across registries without standardization and normalization since their activities are independent. Data definitions can improve the interoperability of data collected across registries tremendously producing the base for a linked coordinated registry network. Further aligning these data elements with other existing relevant federal regulations from FDA, CMS, and ONC improves the likelihood of data being available in a structured form. Defining a common set of core data elements applicable to women's health that all registries could implement was identified as a way to make an immediate impact.
3. **Standardized and Interoperable Data Collection Tools**
   As identified previously, data collection techniques and processes vary across the registries. A common set of tools that could be used by the registries as a starting point to build a technical infrastructure for data collection would help better align the disparate efforts. For example, a tool that can create and administer instruments and collect responses in a standardized manner would be a core part of the technology required for each registry. Data collection tools built using health data standards such as FHIR can enable interoperable exchange of data.
4. **Data Collection Burden on Patients, Providers, and Research Coordinators**
   Reusing data from other sources may reduce some of the data collection burden by integrating with other systems that are part of care delivery and already have some of the data needed for a given registry. For example, patient demographics, medical history, procedures, and other related data collected as part of routine care should not have to be collected a second time using a registry data collection instrument. Instead, the instrument should be pre-populated with data previously collected during the course of clinical care

so that only additional data need to be obtained. Questionnaire forms developed using standards such as FHIR and SMART on FHIR provide a common architecture that reduces the data entry burden as they can leverage interoperable networks to automatically populate routinely collected data. In addition, it improves the registries' sustainability, efficiency, interoperability, and creates a base capability for a linked coordinated registry network.

5. **Funding Challenges**
   Another challenge identified by the registries is the lack of funding to develop the necessary infrastructure for the registry. Costs may be reduced by providing reusable data definitions, tools, and standards education, as well as furnishing common core data elements to health IT developers and aligning those elements with national standards. Coordination across registries, standards development organizations (SDOs), and health IT developers is important to advancing the development and use of health IT standards. Lastly, governance policies and processes are needed for effective registry operationalization. Creating guidance for governance and providing templates for policies and processes may also help reduce the funding challenges faced by registries.

Standards Landscape

This section identifies some of the existing projects, initiatives, work groups and artifacts that were leveraged as part of the WHT-CRN's technical approach.

The emerging HL7 FHIR® standard along with SMART on FHIR® specifications provide an API-based approach for workflow integration with EHRs and basic standard infrastructure for building interoperable tools.

The data definitions that were created by the WHT-CRN were implemented using the HL7 FHIR® standard. HL7 workgroups (WGs) such as the Clinical Interoperability Council (CIC)[lxi] built common registry frameworks that were reusable. The FDA has completed the Clinical Information Interoperability Council (CIIC) project in collaboration with CIC as well as the HL7 Common Clinical Registry Framework (CCRF) to ensure that the WHT-CRN work is integrated with the overall infrastructure. The FDA has also updated the HL7 FHIR® Device resource to improve the capture and exchange of device specific information using Unique Device Identification (UDI) and data in Global Unique Device Identification Database (GUDID).[lxii,lxiii,lxiv]

There are other PCORTF sponsored projects that were completed and produced artifacts that were repurposed by the WHT-CRN. Some of them included the PRO project led by the ONC and the Agency for Healthcare Research and Quality (AHRQ), the Data Access Framework (DAF)[lxv] research project completed by ONC, and the SDC[lxvi] project completed by ONC.

WHT-CRN Workflow Model

Two models were developed to identify the specific actors and interactions that were in scope for collecting and accessing women's health technologies coordinated registry network data. These models were developed based on findings from the key informant interviews and built on artifacts shared by participating registries which included existing data dictionaries, use cases and workflow designs, expertise in application design, which reduced data entry burden, and long-term registry

plans. One model outlines the steps for collecting data as shown in Figure 2 and the second model outlines the steps for accessing data as shown in Figure 12.

Figure 12: The abstract model, actors and the data flow for WHT-CRN data collection

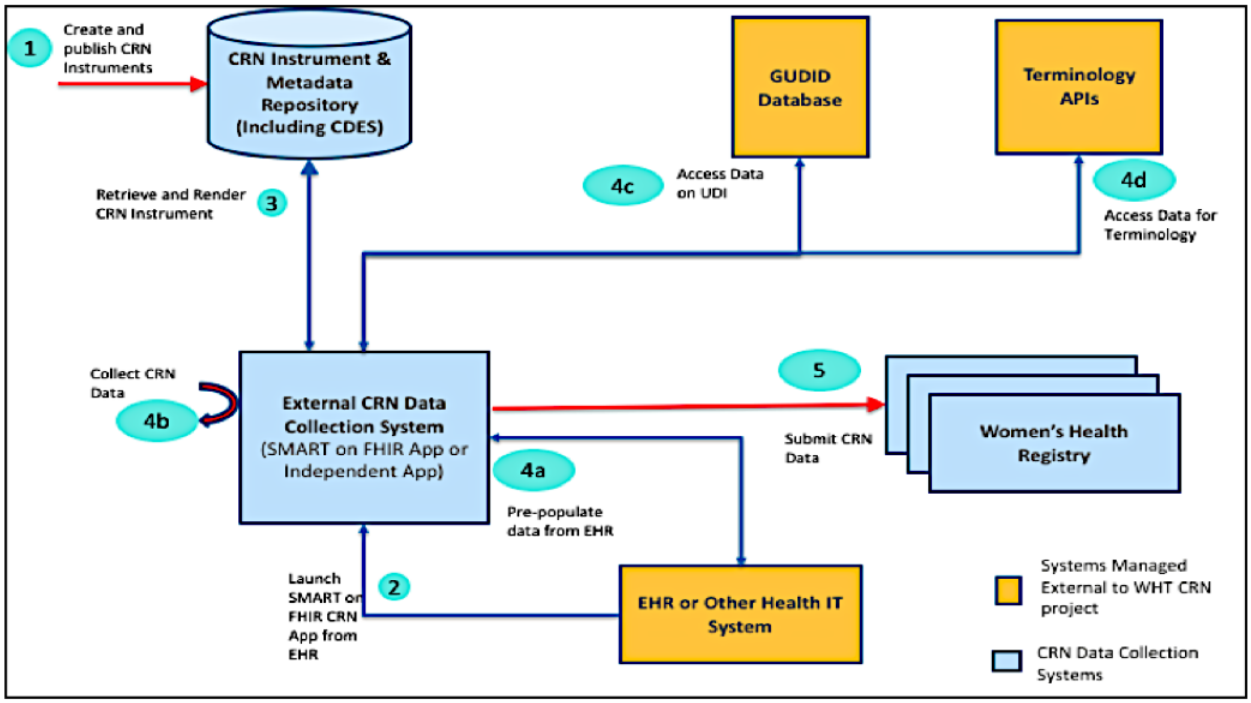
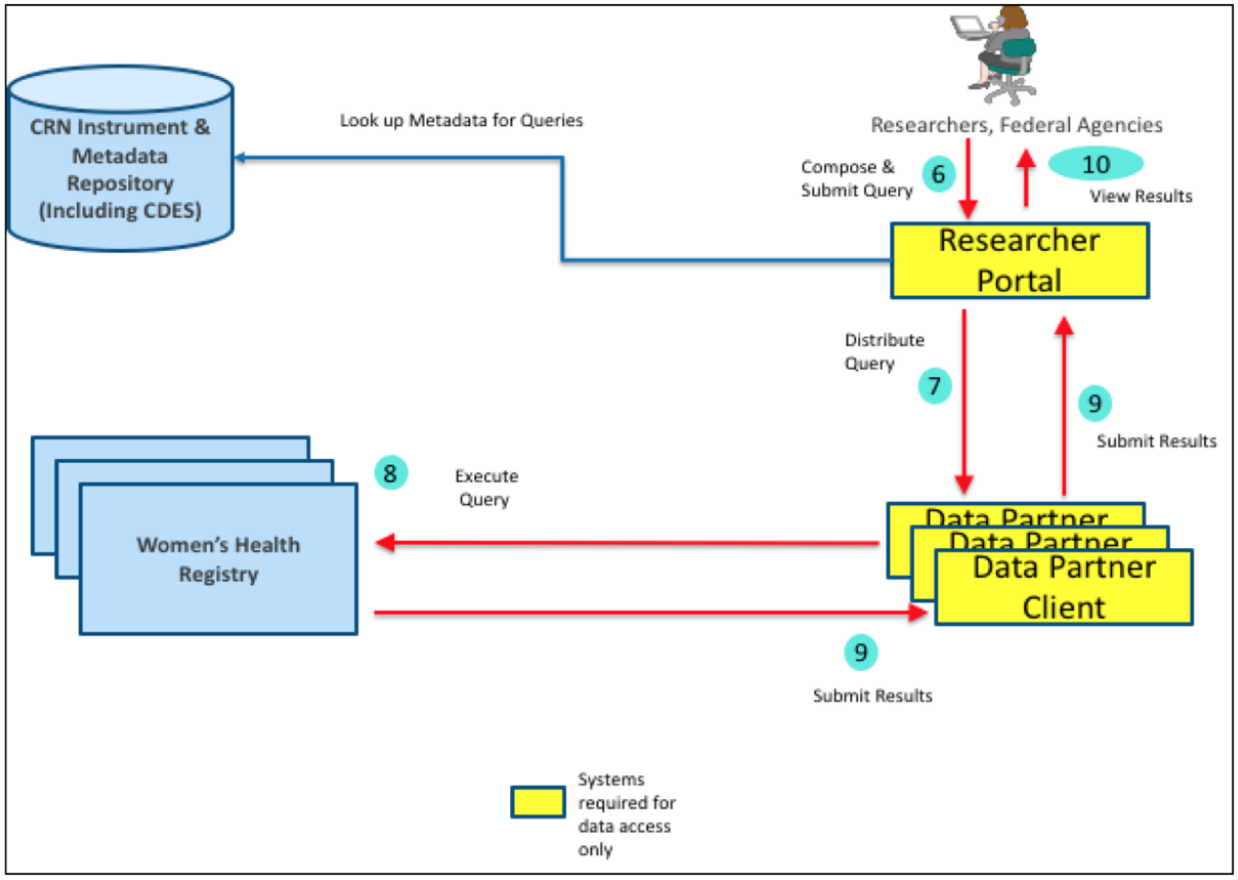


Figure 13: The abstract model, actors and the data flow to access collected data from registries



Key Messages:

- Conducting an environmental scan of existing registry infrastructures helps to better understand standards used by data owners, technology development needs and initiating pilots to improve existing processes.
- There were multiple challenges related to data standards. A mature plan has been developed to overcome many barriers by working with standards development organizations, clinical stakeholders and data owners.

B. Summary of Existing Registries from Clinical Perspective

Pelvic Floor Disorders

During the inception of the WHT-CRN, there were two existing registries related to pelvic floor disorders which are both operated by AUGS: the AUGS Quality Registry (AQUIRE) and the Pelvic Floor Disorders Registry (PFDR).

AQUIRE is a national urogynecology-focused registry and open to all physicians that is designed to measure and report healthcare quality and patient outcomes. AQUIRE is a Qualified Clinical Data Registry (QCDR). A QCDR is a CMS-approved entity that collects clinical data from MIPS

clinicians and submits it to CMS on their behalf for MIPS reporting. Because AQUIRE is a QCDR, users can report on FPMRS-focused measures not accessible outside of the registry. Individuals and groups may report via AQUIRE. Those using AQUIRE to report must report at least 60 percent of all the patients to which the measure(s) apply. In addition to the data warehousing and participation agreements, clinicians choosing to report MIPS through AQUIRE will be required to complete and return a data consent release form.

PFDR is a multi-centered prospective cohort of patients undergoing treatment for pelvic organ prolapse (POP) to evaluate the effectiveness, quality of life and safety associated with both surgical therapy (transvaginal/transabdominal native tissue repair, transvaginal mesh repair and sacrocolpopexy) and non-surgical management (pessary). The PFDR is a web-based platform designed to collect, store and analyze both provider and patient reported outcomes through broad participation from specialists and generalists performing surgery for prolapse. PFDR began as a necessity that was mandated at multiple institutional levels, including the FDA's orders for post-market surveillance studies to address safety and effectiveness concerns regarding the use of transvaginal mesh for POP repair.

Uterine Fibroids

During the inception of the WHT-CRN, there was one existing registry related to uterine fibroids: COMPARE-UF.

COMPARE-UF is a nationwide registry of women with UF that hopes to answer questions about the outcomes of different treatment options. The aim is to understand which treatment options are most effective and what factors influence treatment outcomes. We assessed the registry data and capacity to answer relevant questions and help women with UF make informed decisions about their treatment options.

The registry originally planned to enroll about 10,000 subjects undergoing both medical and procedural treatments., 18 to 54 years of age, in 9 clinical centers in the US. Patient recruitment started in November 2015 and continued recruitment for 24 months. However, many centers are recruiting patients continuously. Currently, 3144 patients are enrolled and are in the follow-up stage. The study enrolment was estimated to end in September 2019 and follow-up duration limiting to up to 3 years.

The procedures that are captured in the COMPARE-UF registry are described below:

1. **Hysterectomy:** Surgical removal of the uterus.
2. **Abdominal myomectomy:** Surgical procedure to remove UF through an abdominal incision but does not remove uterus.
3. **Hysteroscopic myomectomy:** Surgical procedure to remove UF through the vagina but does not remove uterus.
4. **Laparoscopic or robotic myomectomy:** Surgical procedure to remove UF through several small abdominal incisions but does not remove uterus.
5. **Uterine artery embolization:** Usually done by an interventional radiologist who uses a slender, flexible tube (catheter) to inject small particles (embolic agents) into the uterine

arteries, which supply blood to your fibroids and uterus. The embolic agents are injected into these fibroid blood vessels. The goal is to block the fibroid vessels, starving the fibroids and causing them to shrink and die. Before the procedure, to see your uterus and blood vessels, the radiologist uses a fluoroscope. This device is a pulsed X-ray beam that produces moving images of internal structures and displays them on a computer monitor. In this procedure, x-ray equipment, a catheter and a variety of medications and synthetic materials, called embolic agents, are used.

i) Devices: Catheter, Fluoroscope
ii) Catheters and Guidewires:
    (1) InQwire® Diagnostic Guidewires (Bentson or "J" Wire) – 0.035"; 3 mm; 150 cm or 180 cm
    (2) Merit Laureate® Hydrophilic Guidewires – 0.035"; Angled; 150 cm or 180 cm
    (3) Tenor® Steerable Guidewires
    (4) True Form® Reshapable Guide Wire
    (5) UAC (Uterine Artery Catheter) – 4 Fr or 5 Fr
    (6) Impress® Diagnostic Peripheral Catheters – Berenstein; 4 Fr or 5 Fr
    (7) EmboCath® Plus Microcatheter – 135 cm
    (8) Merit Maestro® Microcatheter – 130 cm
    (9) SwiftNINJA® Steerable Microcatheter – 125 cm

6. **Endometrial ablation:** Surgical procedure that destroys uterine lining via a telescope placed inside the uterus.
    i) Devices: NovaSure, Her Option, HydroTherm
7. **Magnetic resonance:** Procedure that destroys fibroids while inside an MRI machine.
    i) Devices: MRgFUS, ExAblate; Sonalleve
8. **Radiofrequency ablation via laparoscopy:** Procedure that uses heat to destroy UF.
    i) Devices: Accessa

Sterilization/LARC

Prior to the launch of the WHT-CRN, there was no existing registry related to female sterilization nor long-acting and reversible contraceptives. However, the U.S. Collaborative Review of Sterilization (CREST) study was one major effort that was used to further knowledge on the safety and effectiveness of medical procedures and devices in this clinical area. CREST was a multicenter, prospective cohort study that enrolled over 11,000 women from 1978 to 1987, who were aged 18 to 44 years and underwent sterilization procedures.[lxvii] Although this study contains rich data with long-term sterilization outcomes for up to 14 years of follow-up, women's experiences with sterilization and clinical practice today are likely not fully captured[lxviii] further highlighting the critical need for a comprehensive registry.

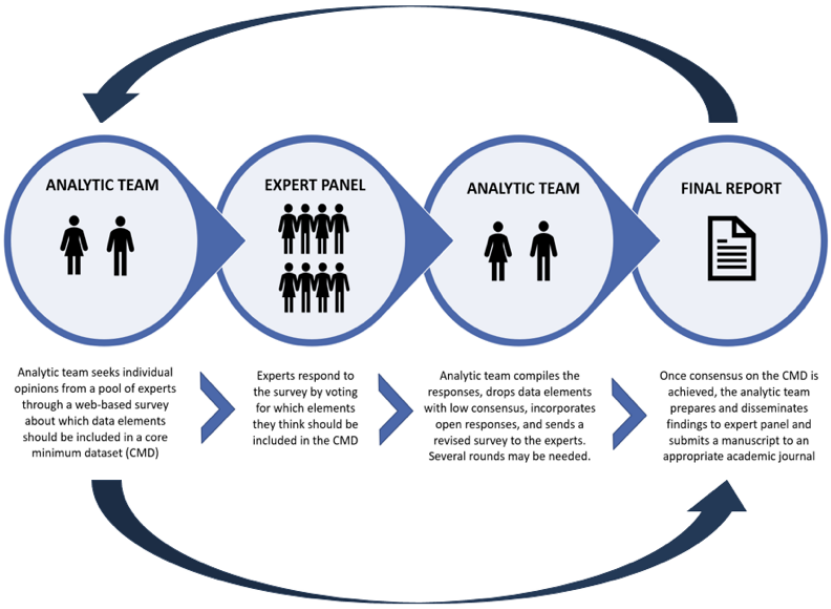
C. Summary of Developing Overall Data Infrastructure

Process used to identify core minimum datasets

Stakeholders from the FDA, industry, nonprofit organizations, patient advocacy groups, payers, professional society leaders, academia, and clinical experts discussed the current landscape of registries evaluating women's health devices and technologies and the perspectives of each

stakeholder. Data elements were identified that should be included in a consensus process to build core minimum datasets for each of the clinical conditions (SUI, POP, UF, Sterilization/LARC). Working groups employed a Delphi process to identify the core minimum data elements.

Figure 14: Delphi Method Overview



The Delphi Method is a group decision-making technique developed by Olaf Helmer and Norman Dalkey of the Rand Corporation as part of an Air Force study in the early 1950s.[lxix] The standard group decision-making technique, the consensus panel approach, brings experts together in a room and lets them discuss an issue until a consensus emerges. Challenges with this approach are that one person with a strong personality can have a large effect on the decision, and a lack of anonymity may introduce response bias. The Delphi Method was developed to retain the strength of a joint consensus, while removing potential bias from group dynamics and face-to-face responses. With the Delphi Method, group input is received through a series of anonymous surveys, which are sent to a pre-selected group of experts. The questionnaires are answered anonymously and individually by each member of the group. Each survey also provides an opportunity for group members to introduce suggestions. Results of each survey round are collected, collated and analyzed by a design team. This process is repeated until a group consensus is reached (see Figure 14).[lxix,lxx,lxxi]

In the months following the kick-off meeting the POP, UF and Sterilization/LARC working groups each created an initial set of data elements based on those identified at the September meeting, a review of the literature, regulatory requirements, and existing research efforts. The Delphi process for the working groups was initiated and completed over an eight-month time period from January 2018 to August 2018. Each of these working groups employed the following process:

- Two rounds of surveys were designed and administered by the analysis team at WCM and sent to the expert panelists through a secure anonymous online questionnaire (https://www.surveymonkey.com).
- The first-round Delphi survey results were analyzed by the analysis team and discussed in a series of conference calls with the working group co-chairs. Any variable with less than 50% consensus was removed from the list of data elements and any variable with greater than 50% consensus was retained for the second-round survey.
- These results and open response suggestions were presented and discussed with the full working group until consensus was achieved on how to proceed with open response

comments. The analysis team incorporated the results of this discussion into the design of the second-round survey and subsequently distributed the survey to the working group.

- The same process was repeated until the consensus was achieved on their final minimum core dataset in August 2018. The dataset was presented to the entire WHT-CRN community at the Second Annual WHT-CRN Meeting on September 7, 2018.
- A combined group of experts representing all three working groups met in late fall 2018 to identify and specify an initial harmonized common core data set ("common data elements") that would be captured across registries and reflected in the HL7 FHIR® Implementation Guide for the WHT-CRN. This work is described in greater detail in *Harmonization of Common Data Elements below.*

AUGS used a traditional consensus panel approach to develop a core minimum data set for SUI surgery. A core set of potential data elements related to SUI surgery were outlined in 2016 by a group of subject matter experts within AUGS (see Appendix A for the original outline). This initial outline was part of the concept proposal finalized in February of 2017 intended for inclusion in the WHT-CRN. As AUGS was a member of the Women's Health Registry Alliance, leaders of AUGS were present at the 2016 meeting where the FDA initially pitched the idea of a coordinated registry network similar to the existing orthopedic networks. Since the framework of data elements was already identified and the AQUIRE registry QCDR Module was already up and running, the SUI Surgery Module project was brought on board as part of the WHT-CRN to finalize data elements and build the module. In the fall of 2017, the minimum dataset was reviewed by AUGS clinical experts with input from the Society of Urodynamics, Female Pelvic Medicine and Urogenital Reconstruction (SUFU), Cornell, and the FDA in a series of conference calls. The workgroup was charged with developing a core minimum dataset that is relevant to a Quality/Registry mission, rather than a research mission. Patient characteristics and outcomes that were exploratory in nature, or focused on new research aims, were not included. The AQUIRE registry is set up under quality improvement rather than Research rules and regulations, and the core minimum dataset was selected to reflect that. All of the core minimum datasets are provided in Section I of the Appendix.

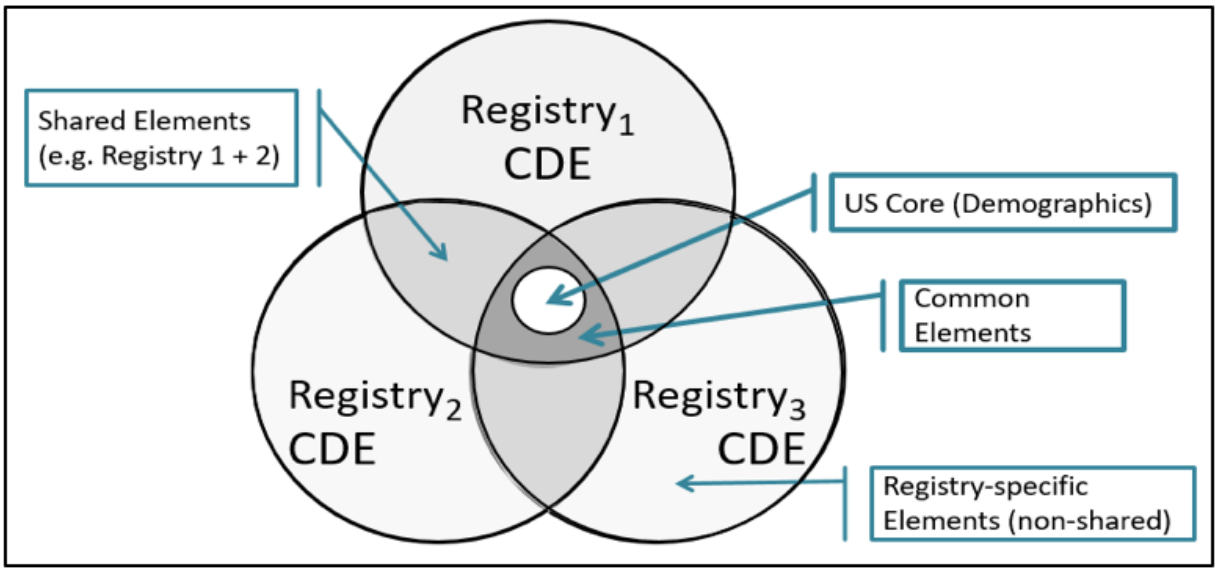
Key Messages:

- Existing registries for pelvic floor disorders and UF typically capture single conditions and are not linked to other data sources. These critical drawbacks limit the ability of previous registries to more comprehensively assess women's health technologies throughout the continuum of routine clinical practice.
- To establish a data infrastructure that is tailored to women's health issues, core minimum datasets were created based on input from multiple stakeholders through the Delphi method. The core minimum dataset identified clinical, demographic, and patient-centered variables that are crucial for the assessment of women's health technologies. This work was especially novel in the clinical area of sterilization/LARC, which did not previously have a registry. These data elements were then harmonized and standardized to ensure consistency in their use. The core data elements identified will streamline efforts to capture device use and associated safety and effectiveness outcomes among women within WHT-CRN.

Harmonization of Common Data Elements

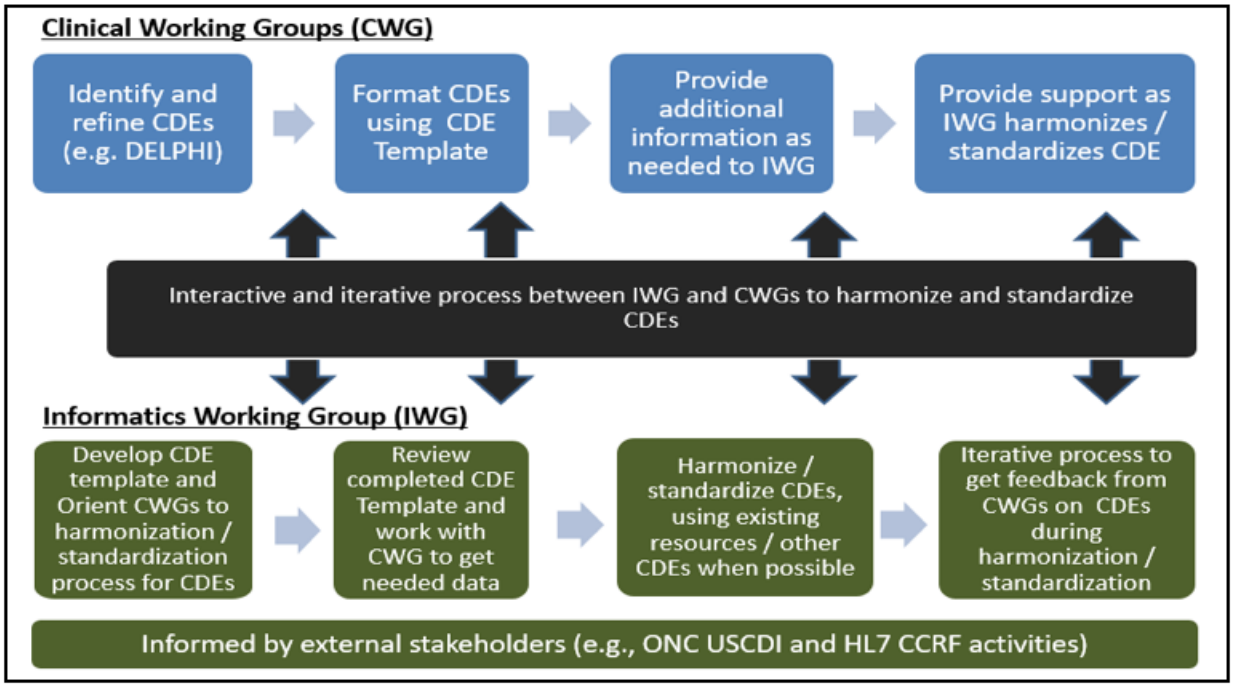
Important variables that need to be captured are unique to each medical condition, however, numerous variables do overlap. It is therefore important to harmonize variables across each registry to ensure that linkages between the registries are possible and that data elements in existing registries are used consistently. Following the identification of core minimum datasets for each of the clinical conditions, the WHT-CRN partners worked to identify common data elements (CDEs) among all four clinical areas and to harmonize and standardize these elements (see Figure 15).

Figure 15: CRN CDE Collection – Target Endpoint



To this end, the informatics working group developed a core data element collection template and workplan for the clinical working groups to organize their initial datasets and begin the process of working interactively with the informatics team to standardize and harmonize data elements across the CRN and within each clinical area (see Figure 16).

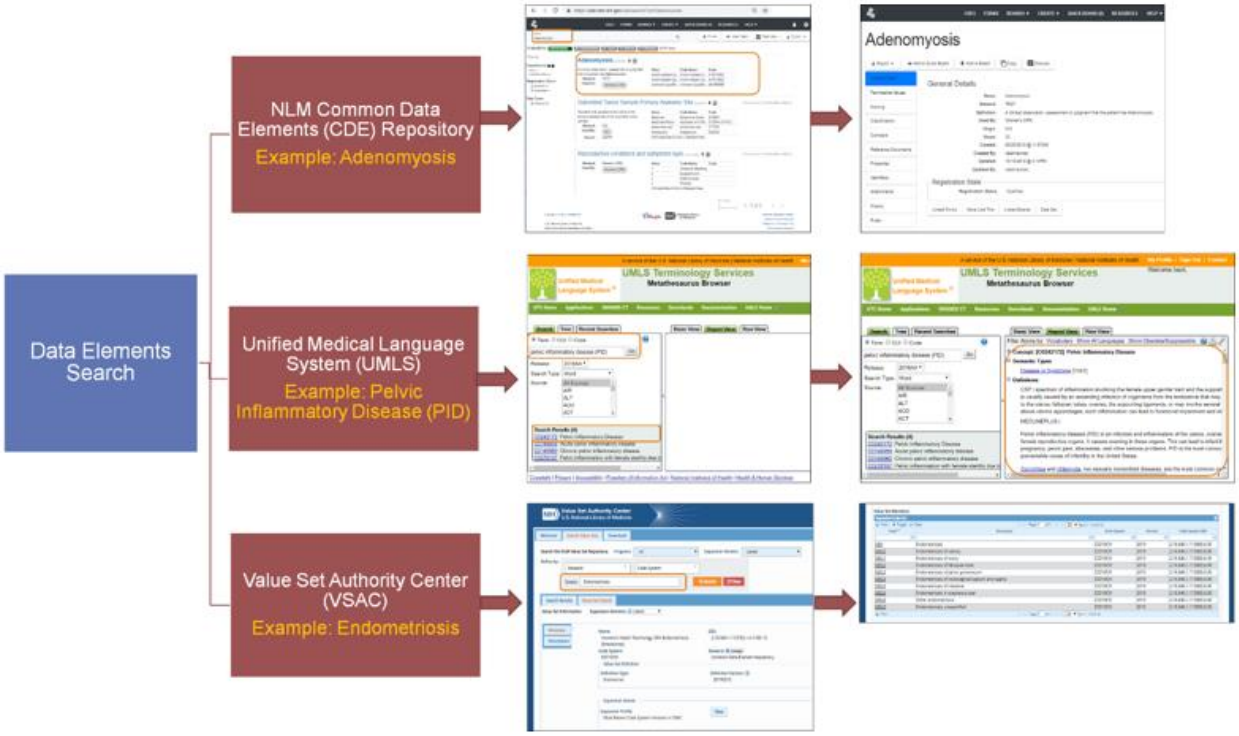
Figure 16: Overview of Key Steps for CRN-CDE Harmonization and Standardization



First, a frequency analysis was performed to identify the most common comparable concepts across the groups. Subsequently, NLM presented the comparable concepts to the informatics working group and CWGs for feedback and further refinements. NLM also demonstrated the use of value sets and groupings in VSAC (NLM Value Set Authority Center) to support permissible values for the harmonized data elements. After several iterations, the WHT-CRN partners finalized the recommendation for an initial harmonized set of data elements across the different women's registries, and NLM delivered an Excel template with the initial set to the Implementation Guide (IG) work group, for inclusion with the WHT-CRN FHIR® IG submission. Additionally, NLM created a form in the National Institutes of Health (NIH) CDE Repository representing the initial set of harmonized data elements.

To standardize and facilitate the harmonization of different registries, data elements were identified in the NIH CDE Repository, Unified Medical Language System (UMLS), and VSAC system. If a data element and/or its permissible values were already present in one of the three databases, then its corresponding information (e.g., variable name, definition, question code, etc.) was extracted and recorded. Data elements that were not present in the three repositories were flagged (see Figure 17).

Figure 17: Examples of Data Element Identification in the NIH CDE Repository, Unified Medical Language System (UMLS), and VSAC system



Key Messages:

- Technical standards for data collection, optimal workflow integration, the exchange of collected data, and the linkage of registries, while reducing the data collection burden currently exist.
- The technical standards in place were leveraged to develop registries focused on women's health technologies. The WHT-CRN FHIR® IG facilitates the capture and exchange of data within women's health technology registries. The WHT-CRN FHIR® IG was created by integrating core minimum data elements into HL7 FHIR® profiles. Furthermore, data requirements for unique device identification (UDI) were utilized to support efforts to establish a new standard for medical device identification and tracking. All created data definitions within the WHT-CRN can be implemented using the HL7 FHIR® standard and SMART API design. This infrastructure allows for the integration with EHRs and further building of interoperable tools. The increased interoperability of datasets will facilitate linkages between datasets that further increases the capability of the Women's Health Technologies-Coordinated Registries Network (WHT-CRN).

Incorporation of data elements into HL7 FHIR® Profiles

The HL7 FHIR® standard was determined to be the best mechanism for the WHT-CRN infrastructure. FHIR® is envisioned to be the global standard for exchanging healthcare information electronically. Healthcare data represented in the FHIR® format are easily human-readable and highly structured for computational use. The WHT-CRN team leveraged the HL7

FHIR® standard to develop an IG that outlines the technical requirements to promote interoperability for data collection and exchange.

FHIR® consists of "resources", where a single resource represents a single healthcare concept. For example, a "Patient" is a FHIR® resource, as is a "CarePlan", a "Questionnaire" and a "Condition". One might think of a Resource as a representation of a paper form. Each form contains information - clinical, administrative, financial, etc. – for capture and sharing.[lxxii] Currently, there are approximately 140 FHIR® resources defined across the gamut of healthcare.

FHIR® Resources are generic since they are expected to be used in a wide range of different contexts, by a wide range of clinicians and systems across the world. Every healthcare environment has unique data elements and other constraints. For this reason, FHIR® Resources are designed to be easily and formally extensible from the start. A resource definition, say "Patient" may be "extended" to accommodate unique situations in which the patient resource is to be used. For example, while the basic Patient Resource contains no information regarding the concept of 'consent', a healthcare provider may require this information and can define an extension to the resource to contain the patient's consent agreement.[lxxiii]

A Resource definition extended or constrained and subsequently published as a formal definition is called a resource Profile. Many common or important resource profiles have been developed and officially incorporated into the FHIR® standard. Refer to the HL7 FHIR® Profile List[lxxiv] page for the list of FHIR® profiles.

The WHT-CRN FHIR® IG[lxxv] includes the list of data elements curated by NLM by working with the various registries and FDA Clinical Working Groups. The table below contains the data element lists provided by the working groups, which helped create the final common data element (CDE) list (see Table 2).[lxxvi]

Table 2: FDA Clinical Working Groups and Data Elements Identified

FDA Clinical Working Group Name	List of Data Elements Identified for WHT-CRN project
Long-Acting Reversible Contraceptives (LARC)	LARC Draft Data Elements[lxxvii]
Pelvic Organ Prolapse (POP)	POP Draft Data Elements[lxxviii]
Uterine Fibroids (UF)	UF Draft Data Elements[lxxix]

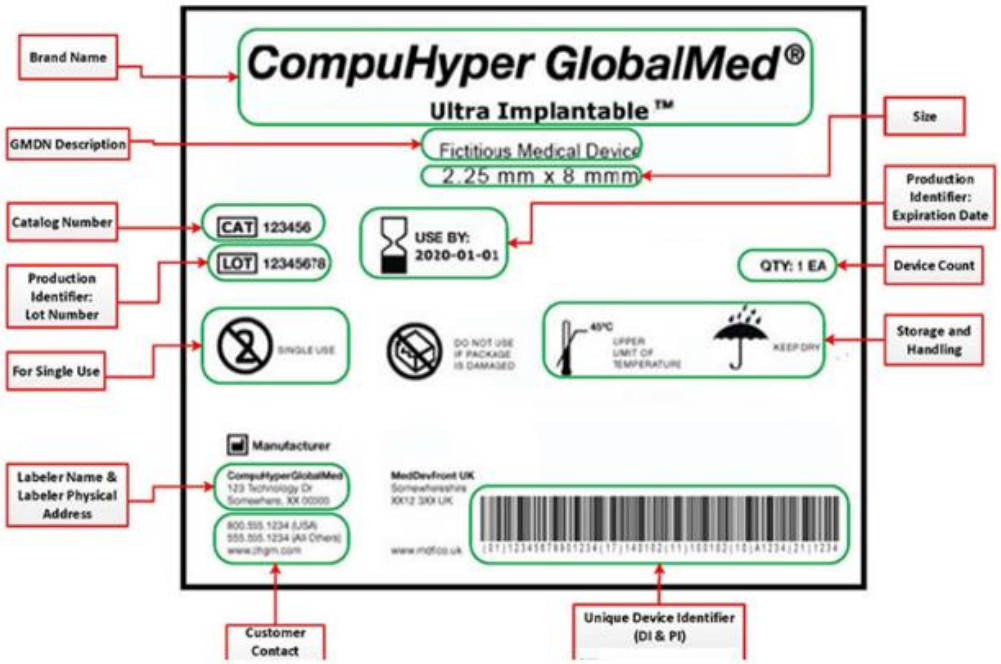
In the WHT-CRN FHIR® IG, the CDEs are mapped to various profiles which exist in the following IGs:

- US-Core IG[lxxx] - based on the Common Clinical Data Set from the ONC 2015 Edition EHR Certification Criteria (2015 Edition)
- SDC IG - provides the framework for using Questionnaire and Questionnaire Response resources to collect data in a structured manner
- Patient Reported Outcomes (PRO) FHIR® IG - provides the framework on how to use the Questionnaire Resource for capturing Patient Reported Outcome data.

New profiles and extensions were created in cases where the data elements were not directly able to map to existing profiles from the other IGs. The results of the mapping can be found on the Mapping and Profiles[lxxxi] tab of the WHT-CRN IG.

The lack of standards for clearly identifying the use of a medical device led the medical device regulators around the world to establish a new standard to help clearly identify a medical device from manufacturing through distribution to patient use. International Medical Device Regulatory Forum (IMDRF) published a guidance (N7) in 2013 that was followed by US FDA for creating a UDI system. IMDRF published an update to UDI guidance in 2019 UDI System Application Guide(N48). A UDI is present in machine and human readable format on the label of the device or for devices that are used more than once, the UDI is marked on the device (see Figure 18 for details of UDI formatting).

Figure 18: Formatting Requirements of the UDI



The FDA Informatics team led the device-specific information needs of the clinical registry networks for each of the women's health registries and adoption of the UDI data requirements. An important part of this work was focused on an informatics review and alignment of CDEs against other CDE initiatives (e.g., US Core Data for Interoperability (USCDI), HL7 CIC CCRF, etc.) as well as ongoing development of proposed and/or retired CDEs (e.g., tobacco and substance use). The main development focused on standards activities including, but not limited to: enhancements of HL7 FHIR® resources, development of profiles and contributions to the resulting IG. The work was aligned to multiple existing profiles (e.g., FHIR® US Core Implantable Device Profile, Structured Data capture, etc.). This enabled the development of specifications for the extraction of data from electronic health records, pulling data from external sources (e.g., AccessGUDID APIs) and collection of additional data into the women's health registries. Organizations can use the WHT-CRN FHIR® IG requirements to procure systems that meet the

various current WHT-CRN use cases. This IG provides a solid platform for organizations to build new use cases.

Implementation Guide

The WHT-CRN FHIR® IG focuses on capturing and exchanging data related to women's health. The data that is captured can be made available to both providers and authorized researchers. While the WHT-CRN FHIR® IG can be applied to multiple use cases, the current requirements have been drawn from PCORNet use cases and implementations. The capabilities described as part of the IG are intended to be leveraged to build a US data infrastructure for a Learning Health System (LHS). As previously mentioned, the WHT-CRN FHIR® IG leverages the US-Core IG and profiles for the resources that overlap with US-Core. The WHT-CRN FHIR® IG also leverages the SDC FHIR® IG and the PRO FHIR® IG.

The WHT-CRN FHIR® IG was developed through a series of extended steps. The environmental assessment was conducted to examine the current state of women's health registries and CRNs. This assessment also examined the use of health standards and other relevant tools.

The information from the environmental assessment contributed to the WHT-CRN FHIR® IG by providing the existing processes, workflows, and practices used for data exchange.

Through the clinical working group Delphi processes, data elements were analyzed and harmonized into a set of CDEs. NLM curated the CDEs into a metadata structure with definitions, data types, and value sets (when needed) to provide a list that was incorporated into the WHT-CRN FHIR® IG.

The WHT-CRN project followed the formal HL7 process for creating the IG. This process started with launching the WHT-CRN IG Workgroup (WG) to address the needs of the IG. Over several months, the work group met to prepare the IG for balloting. First, the team developed the HL7 Project Scope Statement (PSS), which was reviewed, edited and approved by all WHT-CRN partners. The HL7 PSS described the technical standards and process for capturing and exchanging the WHT-CRN data. At this point, NLM tested and verified that the NIH CDE Repository supported FHIR® observations and encounters in support of the needs for the HL7 PSS. NLM also assessed the NIH CDE Repository to identify ways it could better support the use of FHIR® for this project. The PSS received sponsorship from the relevant HL7 working groups (Biomedical Research and Regulation (BR&R), Orders and Observation (O&O), and the CIC). Subsequently, the HL7 process broadly included creating the IG content, submitting the notice of intent to ballot (NIB), balloting the IG, reconciling the ballot comments, completing the IG updates, submitting the publication request and publishing the IG.

Lastly, the WHT-CRN selected two pilot sites to test the specifications of the WHT-CRN FHIR® IG (including the capabilities and actors) and helped refine and validate the approach on capturing and exchanging clinical care data related to women's health. The pilot implementations were important in establishing real-world implementations and usability of the IG.

D. Summary of Registry Development

Stress Urinary Incontinence

Registry Development

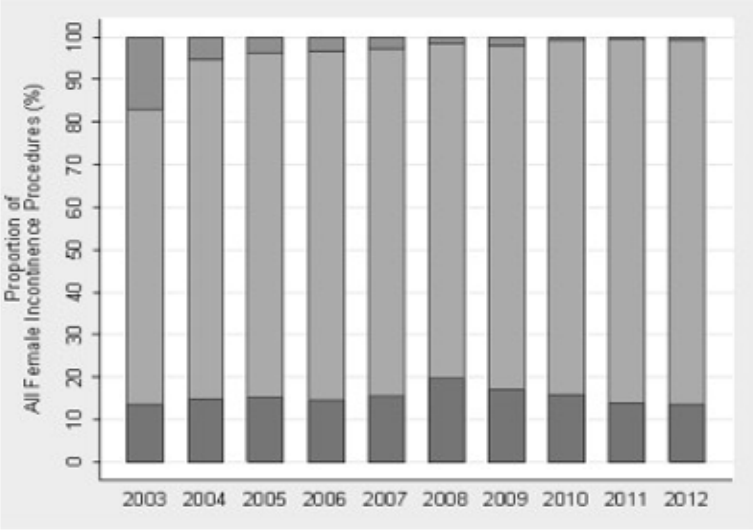
The WHT-CRN Coordinating Center at WCM provided funding to AUGS to collaboratively build the SUI Surgery Module as a component of AQUIRE. The module is collecting quality data on all types of SUI surgeries including slings, burch procedures and periurethral bulking agents. In the fall of 2017, the minimum dataset was reviewed by AUGS clinical experts with input from SUFU, Cornell, and FDA. The dataset includes objective and subjective surgery information, outcomes for stress urinary incontinence procedures, and information on implanted devices. Importantly, the registry module is designed around the diagnosis of SUI rather than around a particular surgery or device. This module is designed to collect quality data on all types of SUI surgeries. This SUI surgery module can gather information on quality assessment and PROs for quality improvement. It also captures data on the long-term effects of treatments. Following the development of the SUI module data elements, AUGS worked with its registry vendor, 'Prometheus Research' to create a data dictionary and begin building the SUI Surgery module within the existing AUGS AQUIRE. The SUI Surgery module started as a new component of AQUIRE in September 2018.

The SUI surgery module is currently enrolling patients and patient reported outcomes are collected at 6 weeks follow-up and up to 3 years follow-up post-operatively. AUGS has recruited 11 high-volume SUI surgery sites, including 20 physicians, that collect data and provide feedback about the registry. Additionally, AUGS is creating a patient community within AUGS' existing Voices for PFD website specifically for SUI patients enrolled in the registry. Enrollment started October 1, 2017 and will go on until October 1, 2020. There are currently 1,180 patients who had consultative visits and 1,103 patients who had surgery as of January 2020.

The procedures that are captured in the SUI surgery module are described below

- Midurethral slings: retropubic, transobturator, single incision. Pubovaginal slings: Any material, characterized by placement and fixation at the urethrovesical junction, fixation to abdominal wall or pubis)
- Burch or Marshall-Marchetti-Krantz procedure: Open or laparoscopic (these are traditional procedures)

Figure 19: Trends in the use of female incontinence procedures among certifying urologists between 2003 and 2012.

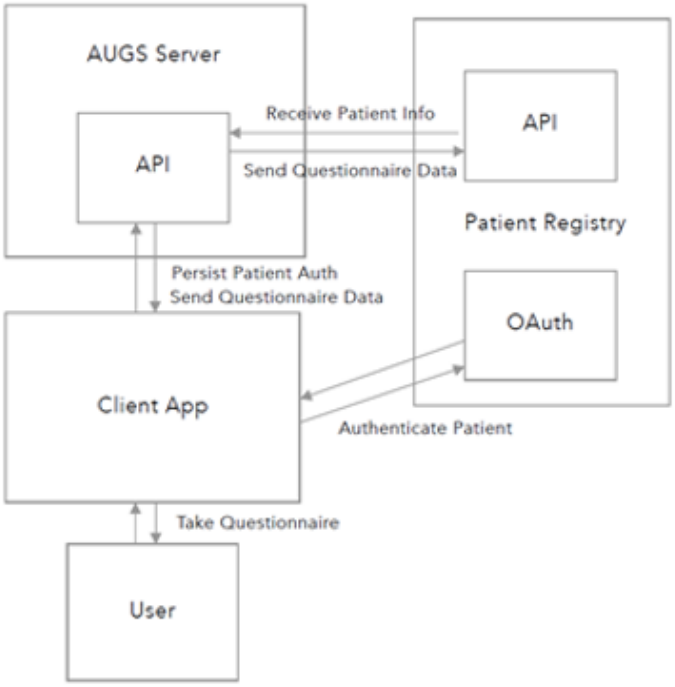


Note: Dark gray indicates periurethral injections; Light gray indicates midurethral slings; Medium gray indicates traditional procedures

- Periurethral bulking agent injection (**Figure 19**)

Patient-Generated Data Plans

Figure 20: Proposed Information Flow



There are several SUI instruments/ questionnaires, including a 6-week follow-up and a 1-year follow-up, that are included in the AQUIRE SUI Surgery Module. The International Consultation on Incontinence Questionnaire (ICIQ) system is a validated questionnaire that measures the severity of individual symptoms and is used as a part of the follow-up. These questionnaires have two versions, one for mesh patients and the other for non-mesh patients. The WHT-CRN is currently developing a patient-facing mobile app to collect PROMs for both SUI and POP. SUI is one of the most common conditions affecting women's quality of life and often the symptoms are severe enough to warrant an intervention using mesh based mid-urethral slings (see Figure 20). Concerns about serious although uncommon mesh erosions and reoperations need to be weighed against Quality of Life (QoL) benefits observed after the intervention using PROs. This app will be integrated with the newly created SUI Surgery Registry Module within the WHT-CRN and the AQUIRE registry for SUI and mid-urethral slings. Specifically, the first iteration of the app will include capturing the minimum dataset and validated questionnaires that are part of the PRO section of the SUI Surgery Registry Module.

The app will provide PROs, education, community development, opportunities for engagement, as well as generation of real-world PROs, including relevant safety, efficacy, and quality of life outcomes related to SUI surgery and the associated devices. The app development is ongoing and will be integrated with the registry process and patients will be able to download the app and register with the registry at the baseline. Integration within the workflow of the registry will enable continuous engagement and PRO data capture in the longer-term.

Pelvic Organ Prolapse

Registry Development

The WHT-CRN also funded AUGS to collaborate with the WHT-CRN to build the POP Surgery Module as a new component of AQUIRE. As mentioned earlier in this report, the POP working group used the Delphi method (an expert consensus process) to create a core minimum dataset to be used as the foundation for building the POP Surgery Modules within AQUIRE. Upon the completion of the Delphi process, the data elements identified for pelvic organ prolapse were then reviewed by a committee of subject matter experts who are also users of the current AQUIRE

registry, including users of the SUI Surgery Module. While the committee was discouraged from adding or removing critical elements, some flexibility was acknowledged based on workflow. The committee focused on organization and dependency logic to facilitate a smooth workflow for providers. Additionally, the committee is working with patients to identify patient-reported outcomes of POP surgery, which were not included in the original set of data elements from the Delphi process.

With WCM coordinating center facilitation, AUGS partnered with ONC as a pilot site to test the WHT-CRN FHIR® IG, with a focus on the use of the POP data elements. The POP specific data elements and the core minimum data set are represented in the Questionnaire and data collected to satisfy these elements can be posted to the registry as the Questionnaire Response. The second pilot site that used the POP data elements was implemented within MDEpiNet HIVE and the WCM/NYP urology departments. AS this project continues, the newly created POP registry will collect data and serve as storage for data to be available to AUGS and SUFU. It is expected that the second version of the POP registry will include PROs as identified by our patient groups. In addition, the registry is collecting unique device identifiers and validating device data against the information contained in AccessGUDID database.

Patient-Generated Data Plans
Despite thousands of years of documentation, POP remains highly stigmatized condition because women typically find POP symptoms embarrassing to talk about. In spite of all the significant physical, emotional, social, sexual, fitness, and employment QoL impact of POP, inadequate efforts have been made to stimulate forward momentum regarding POP awareness, screening, practice, and policy.

The WHT-CRN is working on the development of a patient-facing Mobile App to collect PROs for the POP registry to further support the evaluation of technologies used for Pelvic Organ Prolapse.

The instruments/questionnaires used to evaluate POP include: PFDI-20, Patient global impression of improvement (PGI-I), Pelvic Floor Impact Questionnaire (PFIQ-7), the Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire (PISQ-12), the International Consultation on Incontinence Questionnaire – Urinary Incontinence Short Form (ICIQ-UI SF, and PROMIS Global Health Questionnaire (derived from the Registry Protocol–Research Registry (PFDR-R), Version 1.3, Aug 2016.).

Uterine Fibroids

Registry Development
As mentioned in the previous section, the WHT-CRN convened a working group of experts and stakeholders in this clinical area. The Uterine Fibroids working group used the Delphi method to create a core minimum dataset for uterine fibroids. The WHT-CRN has been collaborating with COMPARE-UF to pilot the core minimum dataset through continuous enrollment of an ablation device that is used by some COMPARE-UF sites (see '*Technology Pilots and Demonstration Projects*' in chapter V 'Regulatory Assessment of Registries and Enhancing the Infrastructure).

Patient-Generated Data Plans
Because of multiple alternative therapies for UF, there is a continuous need for patient engagement. Patients' perspectives are critical to evaluating and comparing the success of various treatments. There are several recommended PROMs that have been evaluated for patients with UF. These include the UFS-QOL (Uterine Fibroid Symptom and Quality of Life Questionnaire), the SF-36 (MOS 36-item Short Form Health Survey), and the EQ-5D (European Quality of Life Instrument). The SF-36 and EQ-5D are considered as preference and generic measures depending on the purpose of measurement. The UFS-QOL is the only disease-specific instrument that is used specifically for UF. These measures are captured in a patient facing mobile app that is under development.

Sterilization/LARC

To build a registry in this area, the WHT-CRN convened a working group of experts and stakeholders in this clinical area. As mentioned earlier in this report, the Sterilization/LARC working group used the Delphi method to create a core minimum dataset to be used as the foundation for building the Sterilization/LARC registry. The registry building process is under discussion with relevant stakeholders. Claims data analyses conducted by the WHT-CRN team were shared with FDA to help inform FDA decision making
The WHT-CRN is currently using MDEpiNet HIVE for LARC core minimum data implementation and pilot testing for building future prospective data collection infrastructure related to these devices.

Patient-Generated Data Plans
As Essure was removed from the market WHT-CRN did not develop a plan for patient reported outcome (PRO) measurement or app development. For women with existing Essure devices app development will be considered in future if registry is developed.

Key Messages:

- Administrative claims data can be utilized to address some evidence gaps, however, may not be sufficient to address all gaps. Existing registries, such as AQUIRE and COMPARE-UF, are data sources that can be leveraged to aid in the creation of new device registries or new device modules within existing registries. Currently, no patient facing applications exist to collect PRO data among patients being treated for SUI, POP, UF, and Sterilization/LARC. PRO data is needed to complement a device registry.
- **SUI/POP:** After careful assessment of registry capabilities an effort was planned to define core minimum data for the creation of a stress urinary incontinence registry and a pelvic organ prolapse registry. The developed registries are funded by the FDA grant and are collecting device-specific data through two separate modules within AQUIRE. The SUI registry module was implemented within many clinical sites that enabled AQUIRE to grow and collect device specific data and the POP module will be launched soon. The SUI and POP claims data studies informed FDA decisions on mesh use in POP and SUI and the CRN is part of key scientific infrastructure for FDA for research and surveillance. Patient-

facing mobile applications for SUI and POP are being developed to collect patient-reported outcomes. The mobile apps will be tested in real-world medical settings for feasibility and usability and evaluated with feedback from patients and physicians.

- **UF:** Registry capabilities were assessed, and an effort was planned to define core minimum data elements for a UF registry. Subsequently, a pilot project collecting device specific data for a registry was conducted. Claims data were utilized to identify and define predictors and outcomes that should be captured in the device registry. Patient facing mobile apps were conceived to help collect validated PROs. The collected PROs will further complement the developed registry.
- **LARC:** A registry for sterilization/LARC is being developed using the core minimum dataset identified through the WHT-CRN. In addition, claims analyses conducted by the WHT-CRN team contributed to the evidence leading to Essure being removed from the market.

E. Technology Pilots and Demonstration Projects

Technology Pilots

Conducting pilot testing was necessary to help refine and validate the WHT-CRN FHIR® IG as an approach for capturing and exchanging the minimum core clinical care data related to women's health.

Operational registries were selected as pilot sites for testing and refining specifications in the WHT-CRN FHIR® IG[lxxxii] in a test or production environment (i.e., clinical or provider setting). The pilot sites tested the CRN capabilities mapped to specific actors and interactions of the technical specifications. The feedback obtained from the pilot sites was used to revise the technical approaches (the WHT-CRN FHIR® IG and the SMART on FHIR® app), identify challenges, and document how the proposed solutions can be scaled to a national level and for future registries work.

Two pilot sites conducted a total of three rapid-cycle development sprints that lasted for approximately ten (10) weeks each under this ONC effort:

1. AUGS – POP data
2. MDEpiNet High-performance Integrated Virtual Environment (HIVE), the SUFU, and New York Presbyterian Hospital (NYP) – SUI data

The WHT-CRN pilot studies focused on two clinical areas, POP and SUI, which have their own unique data sources which captured information related to treatment, procedures, outcomes, health status, patient experience and much more.

AUGS Pilot – Pelvic Organ Prolapse Data Elements

AUGS conducted one 10-week sprint development cycle (Figure 19) which focused on the use of POP data elements and the WHT-CRN FHIR® IG to test the capabilities (see Table 3) that corresponded to the real-world system (actor) within their organizational registry.

Table 3: CRN Capabilities 1-2

Actors	Capabilities
CRN Instrument and Metadata Repository	1. Ability to publish a CRN Instrument
External CRN Data Collection System	2. Ability to retrieve the CRN instrument, render the instrument and collect the necessary data

There were various milestones the pilot sites needed to achieve to successfully test each capability.

- Capability 1 – AUGS created a CRN instrument and metadata repository by standing up a FHIR® server that was populated with Basic & Populatable CRN instruments. The repository was equipped with the ability to search for and publish CRN instruments to other systems using FHIR® APIs.
- Capability 2 – In order to be able to retrieve and render (display) the CRN instrument from the repository and collect the necessary data within the instrument, a system had to be designed and built. This system was a SMART on FHIR® app that was created to not only render the instrument and collect the data, but also validate the data against both the AccessGUDID database and terminology server and finally post that data to the registry.

HIVE/SUFU/NYP Pilot – Stress Urinary Incontinence Data Elements

The MDEpiNet HIVE, SUFU, and NYP conducted two 10-week sprint development cycles that focused on the use of SUI data elements and the WHT-CRN FHIR® IG to test the capabilities (see Table 4) that corresponded to the real-world system (actor) within their organizational registry.

Table 4: CRN Capabilities 1-6

Actors	Capabilities
CRN Instrument and Metadata Repository	1. Ability to publish a CRN Instrument
External CRN Data Collection System	2. Ability to retrieve the CRN instrument, render the instrument and collect the necessary data 3. Ability to retrieve, render and auto-populate the CRN instrument and collect additional data. 4. Ability to retrieve, and render the CRN instrument and collect data and transform data into FHIR® Resources.
Women's Health Registry	5. Ability to receive CRN instrument and collected data. 6. Ability to receive CRN instrument, collected data and other FHIR® Resources.

- Capability 1 & 2 – The work completed during the AUGS sprint cycle (development of the SMART on FHIR® app) further evolved for use within the HIVE/SUFU/NYP ecosystem by customizing the app for the POP and SUI clinical areas.
- Capability 3 – While Capability 2 focused on the collection of the core minimum clinical care data related to women's health, HIVE/SUFU/NYP's external data collection system collected additional data outside of the core minimum. The app used APIs from the AccessGUDID database (specifically, the Device Lookup API and Parse UDI API) to auto-populate fields in the instrument used for data collection.
- Capability 4 - HIVE/SUFU/NYP further added to the initial capability of the external CRN collection data system by transforming all of this data into other FHIR® resources outside of the core minimum (Observations, Conditions, Allergy Intolerance, and Medication Statement).
- Capability 5 – Data being collected from the external data collection system (the SMART on FHIR® app) relevant to the POP clinical domain must then be accepted by a women's health registry and made available to researchers and other stakeholders. This was done by the creation of a FHIR® server within HIVE's network and creating FHIR® APIs to collect the data. FHIR® APIs were also created to help researchers and other stakeholders retrieve this data.
- Capability 6 – HIVE/SUFU/NYP further expanded on the initial capability (Capability 5) by also being able to collect and share data from other FHIR® resources.

These activities improved the quality of data captured at the point of care, the workflow, the access to and analysis of aggregated data and patient outcomes. This pilot provided the infrastructure to link registries but was unable to locate another FHIR®-enabled registry to test linking between the registries.

Demonstration Projects

A project to analyze the medical device adverse events reporting using Natural Language Processing (NLP)

Device adverse event reports in the MAUDE database provide information complementary to observational studies using secondary data sources. Due to the narrative nature of device adverse event reports, research using them is limited. NLP is a powerful method to handle complex narrative data in biomedical research. This project aimed to develop an annotation model and apply NLP to device adverse event reports of reoperations following hysteroscopic sterilization to summarize associated patient- and device-specific complications as well as additional surgeries following the procedure. The following elements were extracted from the reports: reporting source, medical confirmation or legal process related to the case, patient events, device events, implantation and reoperation timing, and reoperation procedures. Using a developed annotation model and NLP, we found that most adverse event reports of reoperations after hysteroscopic sterilization reported patient events of pain, menstrual disorder, and bleeding and device events of device dislocation, organ perforation, and device breakage. The demonstration project highlighted the importance of preserving this valuable albeit limited resource for surveillance.

UCSF project– Uterine Fibroids Data Elements

The University of California San Francisco (UCSF) project team led the uterine fibroids working group in the development of a core minimum data set for all surgeries or procedures to treat UF, with a focus on medical devices used during these procedures. The aim of this demonstration project is to integrate that core minimum data set into the electronic health record at UCSF in the form of a universal operative report. The operative report would be utilized by every surgeon during the typical clinical workflow. With this approach, core minimum data can be captured from every patient undergoing fibroid surgery with no additional work required by the surgeon. This project will also involve creating standardized result reports extracted from the EHR minimum data set that can serve as research data, as well as for quality improvement and regulatory and educational purposes.

At the end of the project, the following deliverables will be complete:

1. An operative report template in EPIC that incorporates all key core minimum data elements
2. A data analytics draft report that extracts and presents results from the operative report
3. Pilot testing of the operative report with fibroid surgeons using the report over 3 months

Results of this testing will include the percent of successful use of the form among all fibroid cases.

To date, the following work has been completed on the project at UCSF:

1. From the full set of core minimum data, the UCSF team selected data elements that are aligned with the standard Operative Report at UCSF. These data elements were vetted by high volume fibroid surgeons.

2. The UCSF team created a draft template operative form with core data elements for integration into the EHR.

3. The UCSF team engaged the EHR IT team to gain support for this project. Regular meetings have occurred to establish a project plan and timeline. Progress to date includes:

- Discussed and planned multiple strategies to automate fields from various data sources into EHR.
- Developed a plan to personalize operative report based on each surgeon's dictation (a request and feedback from high volume surgeons)
- Discussed strategies to incorporate UDI and plain text fields into operative form

4. The roll-out of the project was discussed with high volume fibroid surgeons. Feedback was received on many aspects of the form to improve implementation and uptake.

VII. BUILDING GOVERNANCE, SUSTAINABILITY, AND EXPANSION OF THE CRN

A. Continuous Engagement of Stakeholder Community

The second annual WHT-CRN in-person stakeholder working meeting was held on September 7, 2018 at the FDA with stakeholders from patient communities, academia, government agencies, professional societies, and manufacturers. During the September 7th meeting, all of the clinical working groups presented on the following topics: goals of each working group, working group accomplishments thus far, Delphi survey process, the core minimum dataset and the next steps for the working group. Additionally, the informatics leads from ONC, FDA and NLM held a discussion about the short-term next steps for harmonizing and standardizing CDEs among the clinical areas, instantiation of core minimum data set in the HL7 IG and piloting the WHT-CRN's ability to address priority questions from stakeholders.

The next WHT-CRN meeting is planned for early 2020 to allow WHT-CRN collaborators to finalize the deliverables and move to the next exciting phase of the continued growth and implementation of the WHT-CRN. The meeting themes will include leveraging claims and big data for the evaluation of women's health technologies, case-studies of living with mesh (including evidence needs and current challenges), updates from the AQUIRE and SUI/POP modules, the role of RWE and decision making, as well as the perspective and needs from federal partners such as the FDA.

B. Roles and Responsibilities of Partners of the WHT-CRN

Overview

Partners in the WHT-CRN are invited to participate in one or more work streams and committees (**Figure 21**). Experts from partner organizations contribute time and resources to facilitate the overall work of the WHT-CRN and individual projects. The partners share their knowledge related to women's health devices and technologies and their experience in conducting research and infrastructure development. Additionally, all partners help identify evidence gaps and provide input on research prioritization and design.

Collaborating Partners and Work Streams

1. **U.S. FDA:** The FDA has the following responsibilities within the WHT-CRN partnership framework: (1) Providing seed funding for the WHT-CRN Initiative; (2) (2) Establishing project goals and deliverables;; (3) Supporting stakeholder alignment and governance; (6) Reviewing and approving abstracts and manuscripts prior to publication or dissemination; and (7) Collaborating on data analysis, manuscript or white paper writing, review and publication processes. The FDA supported stakeholder alignment and governance in the following ways: (1) Identifying important stakeholders for the CRN and facilitating communications and meetings among parties; (2) Helping establish a CRN governance

structure, including a steering committee and various subcommittees; (3) Hosting the think tank meetings with stakeholders and (4) Participating in periodic conference calls and collaborating on management support as needed.

2. **NLM:** NLM serves as the central coordinating body for clinical terminology standards for the WHT-CRN. In this role NLM offers support in the following ways: (1) Provide expertise, tools, and assistance to assure the general applicability and utility of the project products for the PCOR community; (2) Use the NIH CDE Repository (CDER), the Value Set Authority Center (VSAC), Unified Medical Language System (UMLS), and other terminology services to support development of the WHT-CRN data sharing framework; (3) Work with clinical registries to identify terminology and value set needs; (4) Collaborate with partners to provide terminology, value set, and AccessGUDID support for harmonization; (5) Include initial WHT-CRN content in the CDER and VSAC as appropriate; (6) Contribute to the development of FHIR®, SDC, and other profiles; (7) Participate actively in HL7 balloting; and (8) Provide data element, form, terminology, and value set support to the WHT-CRN pilot activities.

3. **Patient Partners:** Patients are an important partner in the WHT-CRN working alongside clinicians, researchers, device manufacturers, FDA, and other federal agencies to develop and improve real-world data collection and analysis related to women's health technologies. Patient partners serve as representatives of the patient community providing knowledge, experience, and insight into the patient perspective; advising working groups on the needs and interests of the patient community; and helping to develop real-world data infrastructure that collects and communicates clinical evidence and outcomes that are of interest to patients. There is at least one patient partner for each clinical condition of the WHT-CRN. The Responsibilities of patient partners include the following: (1) Serve for one-year in a volunteer capacity as a member of one of the WHT-CRN clinical working groups (i.e., sterilization/LARC, UF, or POP); (2) Provide input to the working groups on data elements, outcome measures, and priority research questions for the CRN that are of interest to patients making decisions regarding treatment options; (3) Participate in monthly meetings and calls, assist with project activities, and complete any tasks between meetings; and (4) Attend and contribute to in-person think-tanks and stakeholder meetings. Patients must meet the following criteria to participate as a patient partner for the WHT-CRN: (1) Willing to commit time and effort to the WHT-CRN project; (2) Has personal experience as a patient, primary caregiver, or patient advocate with the condition or treatment being addressed by the working group; (3) Has the ability to represent a broad spectrum of U.S. patients treated for the condition of interest and gather input to inform working group activities; (4) Has previous experience working constructively with a diverse group of stakeholders; and (5) Has current knowledge of and openness to different treatment options in the clinical area being addressed by the working group. The WHT-CRN patient partners were selected through the following process: (1) The clinical working groups held discussions to determine recruitment strategies for patient partners; (2) A website in collaboration with MDEpiNet was created to help identify patient partners for the WHT-CRN project; (3) As part of the application process, candidates were asked to provide their interest and motivation for becoming a working group member and their experiences as a patient or primary caregiver of patients in the clinical area of interest. (4) A WHT-CRN

Patient Partner Selection Committee was formed for each clinical working group and was charged with interviewing and evaluating candidates based on pre-identified criteria in the following areas: patient community experience, project awareness, ability to work in multi-stakeholder groups, and communication skills; and (5) For each clinical working group, up to three candidates were selected for a one-year term with the option of a one-year extension. Following this selection process, patient partners were provided with an orientation to become familiarized with the WHT-CRN project and activities. Subsequently, the patient partners were introduced to the clinical working groups and involved in monthly meetings and calls. Each of the WHT-CRN patient partners presented their findings and insights during the WHT-CRN Annual Meeting held on September 7th, 2018

4. **MDEpiNet Coordinating Center at WCM:** WCM, as an FDA grantee, serves as the WHT-CRN coordinating center and offers support in a number of ways. First, WCM facilitates the drafting and signing of Memoranda of Understanding (MOU) for project partners. MOUs establish the objectives of the CRN partners and MDEpiNet and how the two parties will work together to reach these objectives. Second, WCM supports stakeholder alignment and governance by: (1) identifying important stakeholders for the CRN and facilitating communications and meetings among parties; (2) helping establish a CRN governance structure, including a steering committee and various subcommittees; (3) holding think tank meetings with stakeholders and managing annual meetings at the FDA; and (4) coordinating periodic conference calls and providing regular management support. Additionally, WCM supports patient engagement for the WHT-CRN through facilitating the recruitment, selection and participation of patient partners. Fourth, WCM conducts Delphi processes to help facilitate consensus on issues like core minimum data development within and across registries participating in the WHT-CRN. Fifth, WCM provides support for pilot projects and studies in the following ways: (1) subcontracting and legal support; (2) data use agreements (DUAs); (3) data purchase, hosting and access; (4) typical costs that we waive for partners: Medicare data costs, hosting and per projects costs that others charge; (5) MDEpiNet HIVE; and (6) analytic support (e.g., data management and cleaning, statistical analysis, dataset linkage, objective performance criteria analysis). Sixth, WCM reviews and approves abstracts and manuscripts prior to publication or dissemination. Finally, WCM supports data analysis, manuscript or white paper writing, review and publication processes.

5. **AUGS:** As a member of the WHT-CRN, AUGS undertakes the following activities: (1) Providing subject matter experts to participate in Delphi processes and evaluate data elements; (2) Contributing to ongoing harmonization efforts around common data element sets; (3) Reviewing and commenting on implementation guides and protocols for registry development to be submitted to HL7 or other national and international standards bodies; (4) Implementing identified data element sets in the AQUIRE registry including demographics and history, surgical factors, collection of UDI, and surgeon- and patient-reported outcomes both short and long term; (5) Recruiting a network of high-volume surgery sites that commit to enrolling 100% of their patients in the registry and participating in registry and quality improvement activities; (6) Creating a patient community to provide resources, educational materials and a discussion forum for patients

enrolled in AQUIRE. This includes recruiting patients from the community to give additional feedback about the registry and review additional PROs. It also includes designing and implementing a patient dashboard and a patient-facing app to improve patient compliance with surveys; (7) Assisting in planning the WHT-CRN annual meeting, MDEpiNet annual meeting and other relevant meetings as requested (e.g., providing speakers and materials to contribute to the content of meetings); (8) Working with NLM, ONC, FDA and other federal partners on ongoing registry and pilot activities; (9) Participating in WHT-CRN and MDEpiNet Executive Committee calls; and (10) Assisting, when appropriate, in the development and submission of manuscripts to peer-reviewed journals.

6. **SUFU:** Representatives from SUFU participate in the WHT-CRN Leadership Committee to provide perspectives from their society's membership. Additionally, SUFU provides overall clinical leadership from their membership to participate in CRN projects. SUFU also makes recommendations for clinicians to participate in specific subcommittees or working group and engages stakeholders to participate in data mapping. SUFU also shares lessons learned from previous experiences of transferring large amounts of data. Finally, SUFU provides recommendations on what data elements should be captured in the CRN.

7. **ACOG:** Representatives from ACOG participate in the WHT-CRN Leadership Committee to provide perspectives from their society's membership.

8. **AHRQ:** AHRQ representatives participate in the WHT-CRN Leadership Committee to provide perspectives from their organization. Additionally, AHRQ provides overall clinical and informatics leadership from their organization to participate in CRN projects. Finally, AHRQ makes recommendations for experts to participate in specific subcommittees or working groups.

9. **WHT-CRN Leadership Committee:** The Leadership Committee is the main governing body of the WHT-CRN and works to ensure that the WHT-CRN activities reflect the goals of stakeholders and their mission. Two Co-Chairs are involved in the day to day activities and work closely with the Coordinating Center. The Leadership Committee's membership includes representatives from every major stakeholder in the WHT-CRN. The Leadership Committee performs the following functions: (1) holds teleconferences every four weeks; (2) identifies funding sources and gives advice on strategies to secure the funding needed to support the operations of the WHT-CRN and specific projects; (3) votes on recommendations provided by registries and other stakeholders; and (4) votes to approve the partnership framework and any amendments proposed by its members.

10. **WHT-CRN Clinical Working Groups:** There are four clinical working groups (POP, SUI, UF, and Sterilization/LARC) which are responsible for providing clinical leadership and decision-making as needed. For example, each working group participated in a Delphi process to establish core minimum data and harmonized CDEs to be deployed by the CRN, contributed clinical terminology expertise to the definition of both workgroup specific and harmonized data elements (codes and value-sets), and developed priority research questions for pilots and studies.

11. **Informatics Working Group:** The informatics working group provides leadership and expertise in the areas of data element harmonization, data interoperability, and Unique Device Identification (UDI). In terms of UDI expertise, the informatics working group offers support in the following ways: (1) educates CRN vendors, clinicians, and regulators (FDA, CMS, ONC) on the lessons learned and best practices for scanning, integrating AccessGUDID data and capturing structured device data at the point of care; (2) participates as subject matter experts in workshops or forums that are dedicated to adoption of UDI in health data including EHRs and the systems that feed and use EHR data including medical device registries that would be part of the WHT-CRN; (3) works with other WHT-CRN collaborators to provide feedback to manufacturers and resolve data quality issues identified with the use of UDI on manufacturer labels and links to that UDI to quality issues in AccessGUDID.

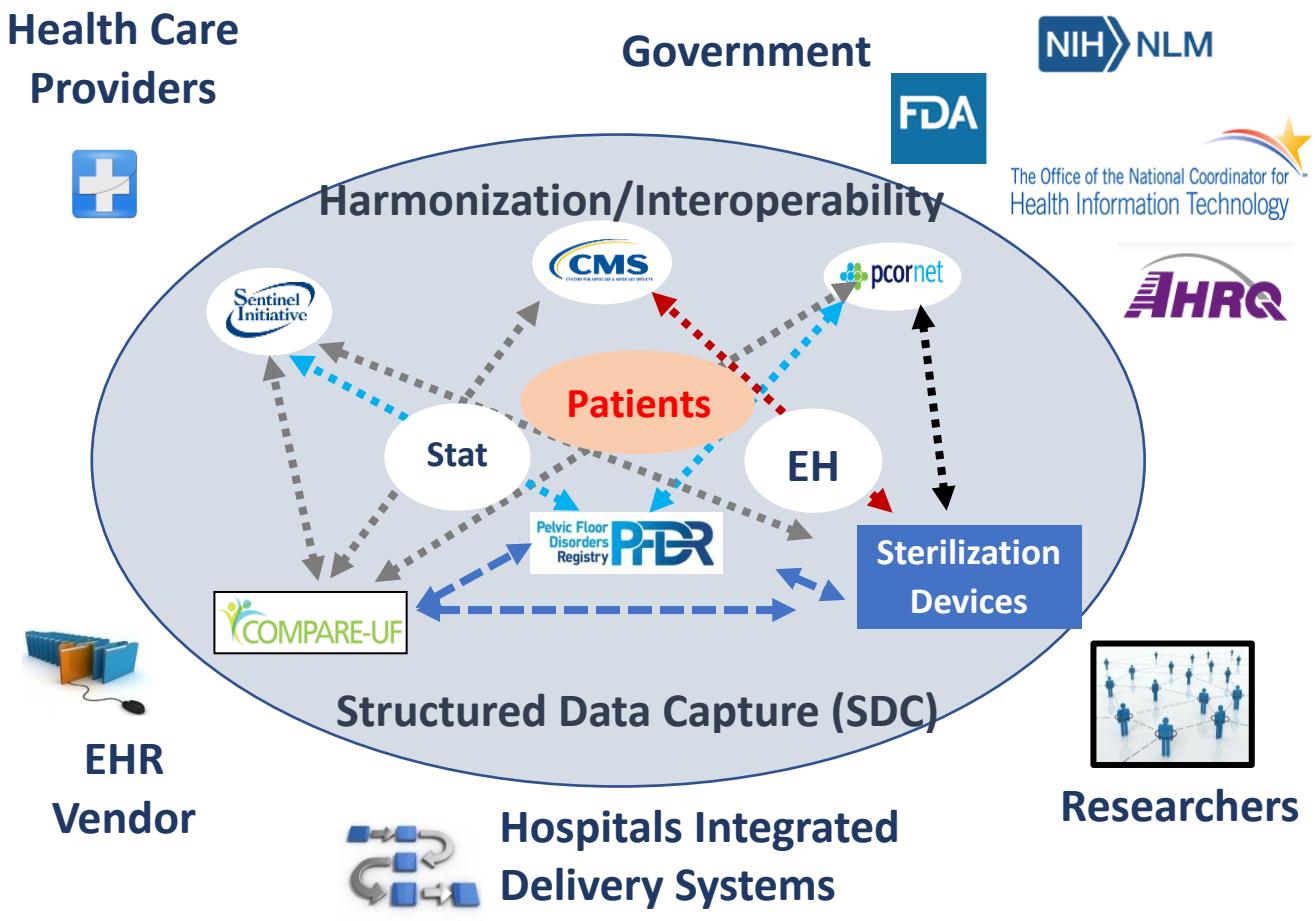
12. **Funding Partners (non-FDA):** Federal/non-federal funding partners share their initiatives in the area of women's health technologies and procedures and make efforts to collaborate with the WHT-CRN. They also share their expertise in health services research, epidemiology, systematic evidence synthesis, and comparative, patient-centered outcomes research. Additionally, funding partners make efforts to advance the overall efficiency and sustainability of WHT-CRN.

13. **Industry:** Industry Partners are proposed to share their knowledge of their global medical device identification process and validate that they have met UDI labeling requirements and are able to effectively link UDI-DIs to catalog numbers and to the appropriate set of data they have submitted to the FDA's GUDID for implantable device identification. They also share their experiences in performing pre- and post-market studies and contribute resources and make efforts to advance the efficiency and sustainability of WHT-CRN.

14. **Payers:** Payer groups share the efforts and knowledge that they have about the safety and effectiveness of women's health technologies. They also share data currently collected for measuring patient outcomes and work collaboratively with registries to see how CRNs will improve the quality of existing data. Additionally, they help identify important gaps and implications for coverage decisions. Finally, payer groups also contribute resources to facilitate the individual projects of WHT-CRN that are relevant to them.

15. **Professional Societies:** Professional society partners contribute their clinical and registry expertise to contribute to foundation to theWHT-CRN infrastructure development. They also assist in rapid dissemination of generated evidence and provide opportunities for the WHT-CRN to organize ancillary meetings as part of their annual meetings.

Figure 21: Vision for the WHT-CRN and Stakeholder



C. Existing Agreements (MOUs, DUAs, etc.)

Use of WHT-CRN data will be governed by specific DUAs between WCM, participating registries, and participating medical device companies. Data will be maintained on a secure server at the hosting location. All WHT-CRN co-chairs have established an MOU with the MDEpiNet Coordinating Center to join the CRN Community of Practice and are members of the MDEpiNet Executive Operations Committee.

D. Sustainability Plan

There are five areas that are foundational to the long-term sustainability of the WHT-CRN, which includes grant funding, professional society engagement, federal agency engagement, industry engagement, and pilot studies.

The WHT-CRN is currently funded by the PCORTF through September 2021. The goal of the current grant is to focus on improving treatments and interventions by introducing new evidence to make better healthcare decisions. Grants from other federal agencies and relevant funders will be sought via collaborative applications.
Currently, there are three professional medical societies that serves as partners of the WHT-CRN: AUGS, ACOG and SUFU. These societies have been actively involved in the WHT-CRN and will continue to play an integral role in the success of the WHT-CRN. To ensure the sustainability of the CRN, the leadership committee plans to increase society collaboration by engaging with the following societies as well: American Association of Gynecologic Laparoscopists (AAGL); American Board of Obstetrics and Gynecology (ABOG); American College of Nurse-Midwives (ACNM); American Society for Reproductive Medicine (ASRM); Society for Assisted Reproductive Technology (SART); Society of Gynecologic Oncology (SGO); Society for Reproductive Endocrinology and Infertility (SREI); Society for Maternal-Fetal Medicine (SMFM).

Federal Partners of the WHT-CRN include: the AHRQ; ASPE; FDA; NLM; ONC. The federal partners (e.g. AHRQ, ASPE, FDA, NLM, and ONC) joined the WHT-CRN efforts at the first meeting, which was held in September 2016. Their kickoff meeting was held in February 2017 and there were subsequent meetings on a bi-weekly basis either in person and/or through conference calls to discuss and update non-federal partners on the project status. Additionally, there were regularly scheduled Women's Technology CRN Gov't Informatics Partners (PCORTF) Project Meetings, which facilitated weekly CRN IG development. The federal partners advance the efficiency and sustainability of the WHT-CRN, identify evidence gaps and provide input on research prioritization and design. Several federal partners, such as the FDA/CDRH, have a long history of working with registries to establish data collection and analysis infrastructure that provide a basis for post-market surveillance of medical devices and for the development of evidence to support medical device innovation. The federal partner informatics team and their contractors continue to meet on a bi-weekly basis to manage the Informatics work across all stakeholder groups.

Additionally, there are many institutes and offices within the NIH which have shown interest in working with the CRN. For example, at the September 2018 meeting, speakers included representatives from the Office of Research on Women's Health (ORWH) and the National Institute on Child Health and Human Development. To further develop this potential collaboration, it would be useful for the CRN leadership group (or representatives) to work with ORWH and convene a meeting to discuss common research needs and interests with NIH Institutes, Centers, and Offices (ICOs) such as: National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK); National Institute on Minority Health and Health Disparities (NIMHD); National Center for Complementary and Integrative Health (NCCIH); National Center for Advancing Translational Sciences (NCATS); National Institute of Nursing Research (NINR); Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD); Office of Behavioral and Social Science Research (OBSSR). CMS has also been indirectly supporting WHT-CRN by designating AQUIRE registry as QCDR for quality improvement activities.

The WHT-CRN provides an opportunity for industry partners to strengthen their surveillance and monitoring abilities by producing real-world data for products. Industry partners could utilize the

WHT-CRN to characterize device users, perform relevant safety and efficacy studies, and support Phase IV studies or randomized clinical trials (RCTs). Results of epidemiological studies could also be used by industry partners to identify safety and efficacy concerns. Additionally, industry partners will contribute to the WHT-CRN by sharing their knowledge of the medical device identification process (including UDI), catalog numbers, and all relevant information needed for implantable device identification. Industry partners will dedicate resources and advance the efficiency and sustainability of the WHT-CRN.

The WHT-CRN has conducted pilots that supported the implementation and refinement of specifications in the WHT-CRN FHIR® IG in a test environment. There remains a need to continue piloting the current WHT-CRN FHIR® IG, underlying standards, and common clinical data sets as defined by the CRN project. The WHT-CRN will also require updates that will need to be re-tested. There is also the need to observe the WHT-CRN FHIR® IG in a production environment and/or manufacturing setting. Characteristics of pilot sites include:

- have the appropriate technical and administrative infrastructure to test the technical specifications in place upon contract awarding;
- willing to share feedback about challenges with structured data capture;
- the ability to identify which capabilities, actors and interactions from the CRN project that the site would like to pilot;
- develop and/or identify solutions if they already exist and address the requirements for one or more of the CRN capabilities;
- currently working within clinical or provider settings/research sites who use data for performing their research as well as working with data sources/data holders who will be able to provide the data necessary for research and have a need for these data;
- willing to freely share implementation resources and seek appropriate stewardship; and
- incorporate the recording of UDI-DI, UDI-PI and linking to AccessGUDID data as a source of device identification as a means of assessing the scan-ability of the UDI and the ability for registries and pull data from AccessGUDID based upon the scanned or recorded UDI-DI.

E. Priority Research Questions

Identification of Priority Research Questions

On September 7, 2018, stakeholders, including representatives from the core team (FDA, NLM, ONC, ACOG, AUGS, and WCM), medical device industry partners, and patient groups, discussed key research questions in the clinical areas of POP, sterilization/ LARC, and UF (see Figure 22). Based on these discussions and input from the clinical working group chairs, 2 to 3 research questions were selected for each clinical working group.

Figure 22: Research Process of the WHT-CRN

Addressing Priority Research Questions

The WHT-CRN will consist of a registry-based core that captures core minimum data elements in each of the clinical areas that are critical for assessing safety, addressing quality improvement, and evaluating effectiveness of women's health technologies related to POP, sterilization/LARC, and UF. The WHT-CRN registry core will be linked to and supplemented with a variety of data sources including other registries, claims data, EHRs, and patient-generated data to address the priority research questions in addition to future quality improvement and research efforts. For each clinical working group, approaches to address the priority research questions that utilize the respective core minimum datasets are proposed.

Priority Research Questions for Pelvic Organ Prolapse

The POP core minimum dataset contains factors related to the patient, device, surgery, facility, and surgeon. Patient factors are captured at different time points in relation to the procedure and include pre-operative (e.g., medical history, surgical history, and anthropomorphic measures), peri-operative (e.g., procedure and discharge variables), and post-operative assessments (e.g., short-term follow-up from 0 to 30 days, short-term follow-up from 31 to 90 days, and long-term follow-up greater than 90 days). The POP clinical working group has identified the following two priority research questions, which can be addressed using the core minimum dataset:

Research Question 1: What patient factors are associated with recurrence rates?

The second research question evaluates the association between patient characteristics and recurrence rates. Patient characteristics will include pre-operative factors, such as SUI history, prior hysterectomy, prior prolapse surgery, POP-Q stage and BMI, as well as peri-operative factors, such as concomitant hysterectomy, concomitant anti-incontinence procedure, and complications. The surgery and follow-up dates will be used to determine an approximate estimate of the time-to-recurrence.

Priority Research Questions for Sterilization/ LARC

The Sterilization/LARC registry has the capability of capturing a number of important device related procedures, including: placement of tubal clips, insertion and removal of an intrauterine device or contraceptive implant, and reversal of prior tubal ligation. The procedures and data elements captured related to patient demographics, past and current comorbidities, as well as post-procedure events allow the registry to answer important questions related to the safety and efficacy of sterilization and LARC procedures. Three priority research questions have been identified by the clinical working group that can be answered using the core minimum dataset.

Research Question 1: What are the risks of adverse events after a procedure?

The first examines the association between procedures and pregnancy related adverse events. Pregnancy related adverse events captured by the dataset include ectopic pregnancy, intrauterine pregnancy, miscarriage, and abnormal pregnancy.

Research Question 2: What patient factors will modify risks of complications?

The second question aims to identify patient characteristics that modify the risk of post-procedure complications. Patient characteristics include patient demographics, medical history (e.g., number and outcome of previous pregnancies, endometriosis, fibroids), and current comorbidities (e.g., diagnosis of a bleeding disorder or autoimmune disease). The association between these patient characteristics and device-related complications such as device expulsion, nerve injury, and vascular injury will be examined. Furthermore, complications such as nausea and vomiting or fainting and dizziness can be assessed using the registry. These events are captured by the registry and are otherwise not captured by claims.

Research Question 3: What are the long-term risks of cancers after a procedure?

Finally, the third question utilizes the potential linkage with claims databases to assess the long-term risk of gynecological cancers after a procedure. This analysis would account for a history of breast cancer and gynecological cancers as captured by the registry.

Priority Research Questions for Uterine Fibroids

Priority research questions were identified by the chairs of the UF clinical working group. Below, we have developed a methodology as an example to show how the core data elements, which capture factors related to medical history, imaging, procedures and follow-up, can answer these research questions.

Research Question 1: What are the rates of need for additional treatment and time to additional treatment in women undergoing different procedures for symptomatic fibroids?

To capture the time to additional procedure, assuming, that all records with the same Patient Identifier are linked within the registry, we will utilize the initial procedure date and assess whether the patient experienced an unsuccessful procedure and if another fibroid procedure due to

treatment failure was performed. If the answer is "Yes" to both, we will examine the second procedure date and type of procedure performed based on the Patient Identifier.

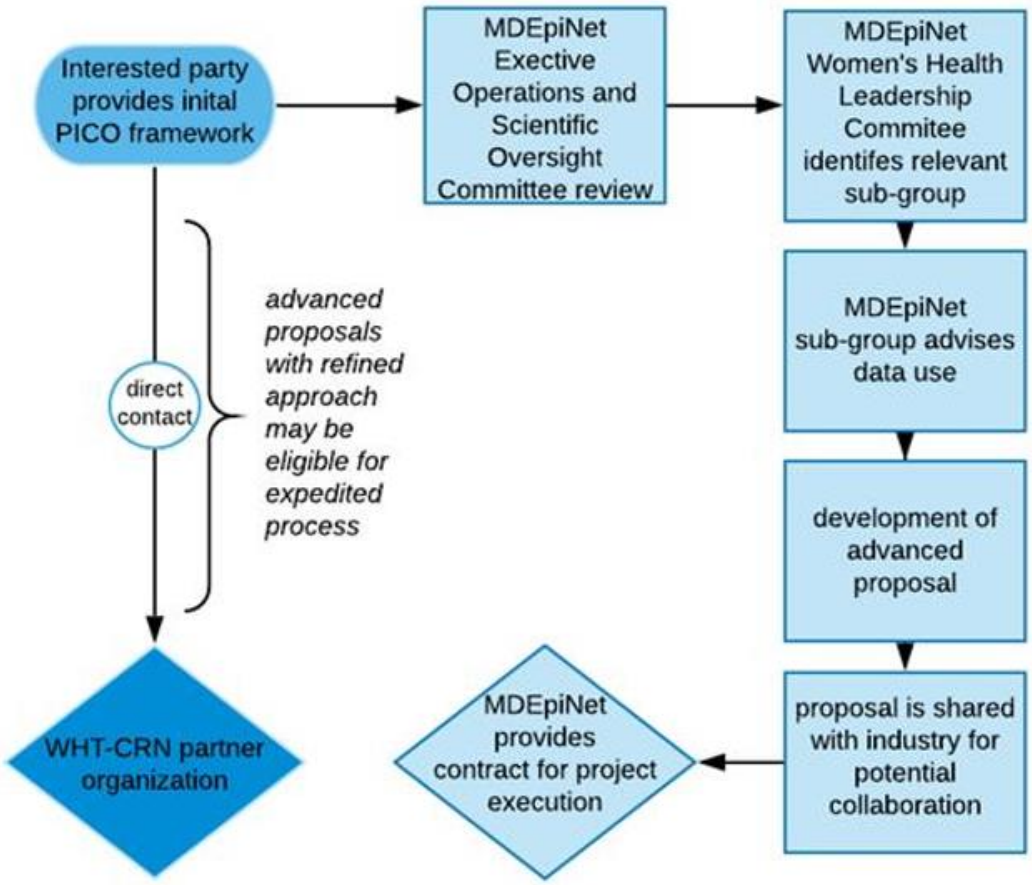
Research Question 2: For any given procedure, what elements of the core data predict (a) perioperative adverse events, (b) need for additional treatment and (c) long-term adverse events?

For this research question, we will examine the associations between relevant medical history data elements (e.g. history of blood clots in legs or lungs, history of endometriosis, number of prior UF procedures, etc.) with perioperative adverse events, need for additional treatment, and long-term adverse events by procedure type (e.g., abdominal myomectomy, hysteroscopic myomectomy, laparoscopic myomectomy, etc.). Examples of perioperative adverse events that will be examined include uterine perforation, transfusion due to intra-operative blood loss, injury to bowel, injury to the bladder or ureter, and injury to vasculature. Similar to research question 1, we will capture the need for additional treatment by examining whether the patient reported having another fibroid procedure due to a previous treatment failure. Long-term adverse events that will be examined could include complications related to bleeding, urinary tract infections, or bowel lesions.

F. How stakeholders can use WHT-CRN to address research questions moving forward

The workflow for engaging the stakeholders is depicted in **Figure 23**.

Figure 23: Workflow of WHT-CRN Resources to Address Priority Research Questions



VIII. APPENDICES

A. Core Minimum Datasets

Uterine Fibroids Core Minimum Dataset

MEDICAL HISTORY	
General Medical History (6)	High blood pressure Diabetes Thyroid Problems Blood clots in legs or lungs Endometriosis Adenomyosis
Menstrual Cycle/Flow (4)	Are your periods regular (in timing and predictable within 5 days)? Do you have a history of anemia related to your heavy periods or fibroids? If yes, did this anemia ever require a blood transfusion? Heaviness of flow
Pregnancy History (5)	Have you ever been pregnant? If yes, how many pregnancies have you had? For each pregnancy, outcome: For each pregnancy, when did you deliver? For each pregnancy, what type of delivery did you have?
Uterine Fibroid History (2)	Are you currently having any symptoms related to your fibroids? If yes, select all fibroid-related symptoms are you currently experiencing
Prior Uterine Fibroid Procedures (17)	How many prior procedures? Abdominal Myomectomy* If yes, year of procedure Hysteroscopic Myomectomy (Telescope inside the uterus removing fibroids) If yes, year of procedure Laparoscopic or Robotic Myomectomy, (DaVinci Robotic Surgery)* If yes, year of procedure Myomectomy, Vaginal* If yes, year of procedure Focused ultrasound (ExAblate; Sonalleve) If yes, year of procedure Endometrial ablation (Any type; examples include: NovaSure impedance, Her Option, HydroTherm, Microsulis (microwave), Thermachoice balloon, resectoscope) If yes, year of procedure Radiofrequency ablation (Acessa) (Destroying the fibroid with heat from a needle that is inserted into the fibroid using a telescope inserted through a small abdominal incision) If yes, year of procedure Uterine arterial embolization/ uterine fibroid embolization (UAE) (Inserting particles to block fibroid blood vessels using a slender, flexible tube) If yes, year of procedure
Current Uterine Fibroid Therapies Or Supplements (6)	Do you use hormonal birth control? If yes, do you use it for: If yes, what type of hormonal birth control? Tranexamic acid (Lysteda) Lupron Anti-inflammatory medication or NSAIDs (e.g., ibuprofen, Motrin, Aleve, Advil, Anaprox, etc.)

IMAGING DATA	
Imaging Data (10)	Date of Imaging Type of Modality Fibroid location Fibroid sizes/measurement How many fibroids are visualized (e.g., present or seen)? How many fibroids are measured? Report all dimensions listed Adenomysosis? Endometriosis? Uterine lesion suspicious for malignancy?
PROCEDURE DATA	
Planned Procedure (3)	Planned Procedure Was the planned procedure completed? If no, was another uterine fibroid procedure performed?
All Procedures (12)	Procedure Date Discharge Date Primary Surgeon Primary procedure performed Intraoperative Adverse Events If any AEs, was AE device-related? Ovarian Pathology Findings Uterine Pathology Findings Other Operative Findings Estimated Blood Loss (in cc/ml) Post-operative events Other procedures performed
Hysterectomy (6)	Surgical Route Route for Removal of Uterus Was Morcellation Used? If yes, was morcellation contained? If yes, what device was used to morcellate and/or contain tissue? Uterine Weight
Abdominal Myomectomy (3)	Incision Type Cumulative weight of excised fibroids # of excised fibroids
Hysteroscopic Myomectomy (2)	Cumulative weight of excised fibroids # of excised fibroids
Endometrial Ablation (1)	Type
Laparoscopic Or Robotic Myomectomy (5)	Was Morcellation Used? If yes, was morcellation contained? If yes, what device was used to morcellate and/or contain tissue? Cumulative weight of excised fibroids # of excised fibroids
Uterine Artery Embolization (2)	Uterine Arteries Embolized? Ovarian Arteries Embolized?

Magnetic Resonance-Guided Focused Ultrasound (3)	Device # of Treated Fibroids Injury to other structures diagnosed post-procedure
Radiofrequency Ablation Via Laparoscopy (2)	# of Fibroids Visualized on Ultrasound # of treated fibroids
POST-PROCEDURE DATA	
Post-Procedure Data (4)	Treatment failure: did you have another fibroid procedure? Was cancer found during follow up? If cancer was found, was it LMS? Post-procedure adverse events
LONG-TERM FOLLOW-UP DATA	
Long-Term Follow-Up Data (4)	Treatment failure: did you have another fibroid procedure? Was cancer found during follow up? If cancer found, was it LMS? Post-procedure adverse events

ADD NEW PATIENT	
PATIENT FACTORS COLLECTED BY SURGEON BEFORE SURGERY (15)	Collected when patient agrees to participate in registry, prior to surgery 1. *Select Patient: (Search an existing patient using MRN or Name)* 2. *Patient MRN (text box) 3. *Patient First Name *(text box)* 4. Patient Middle Name *(text box)* *5.* *Patient Last Name *(text box)* 6. *Email Address *(text box)* *7.* *Date of Birth *(date)* 8. Phone Number *(text box)* 9. *Gender - *(Male, Female, default selection should be female)* 10. Ethnicity *(FYI: dropdown box with the following options)* a. Hispanic/Latino b. Not Hispanic/Latino c. Not disclosed 11. Race *(FYI: dropdown box with the following options)* d. Native American/Alaska Native e. South East Asian f. Black/Afro-Caribbean/African American g. White h. Middle Eastern/North African i. South Asian/Indian j. Native Hawaiian/Other Pacific Islander k. Other l. Not Disclosed 10. Street Address *(text box)* *11.* City *(text box)* 12. State *(text box)* *13.* Zip Code *(Numerical)* *14. 'Proceed to Visit Information' button - (FYI: It should navigate the user to Add visit information screen).* *15. 'Cancel' button - (FYI: it should cancel/discard that screen and system should navigate the user to the previous screen he came from)*
PATIENT FACTORS COLLECTED BY SURGEON COMMON ACROSS VISIT TYPES (5)	NOTE: Please select an appropriate answer for the below questions. Questions with * mark are mandatory. --(FYI: should be displayed for Consulting, Surgery & Unscheduled.) 1. *Date of Visit 2. *Date of Surgery 3. * Age (In years) --(Text Box) (Age should be auto-calculated and should be disabled) 4. *Visit Type 5. Check box: Send an email to a patient for feedback (Patient will receive an email with a patient portal URL only when Index Surgery tab filled)

PRE-OPERATIVE INFORMATION: DEMOGRAPHICS AND HISTORY TAB	
PRE-OPERATIVE INFORMATION COLLECTED BY SURGEON (9)	(FYI: Can be collected at pre-operative visit, or immediately prior to surgery) 1. *Height (in inches) (Number) 2. *Weight (in pounds) (Number) a. Form should calculate Body Mass Index: BMI=(weight in pounds/height in inches^2)*703 3. *In the last month has the patient been using vaginal estrogen (Y/N/Not Applicable - Patient is Premenopausal) 4. *Does the patient currently smoke? (Y/N) 5. What is the diagnosis: Stress urinary Incontinence or Urgency urinary Incontinence or Mixed urinary Incontinence (FYI: drop-down, select only one; If Urgency or Mixed then: a. Is the patient currently taking medication for overactive bladder syndrome? (Y/N) 6. Pre-Operative Quality Measures: a. *Was a urinalysis performed? (Y/N) b. *Was a physical exam performed (including POP-Q)? (Y/N) c. *Was preoperative cough stress test (CST) performed? (Y/N) d. *Was urodynamic testing performed? (Y/N) e. *Was preoperative postvoid residual (PVR) assessed? (Y/N) 7. *Has the patient been diagnosed with pelvic organ prolapse? (Y/N) 8. *Does patient have existing urogynecologic mesh? (FYI:Y/N if YES then dropdown box with the following question and options-can choose one or both) -*Please select the type a. Existing mesh for SUI b. Existing mesh for other urogynecologic condition 9. Has the patient tried conservative therapy for SUI? (Y/N)
ICIQ-UI SHORT FORM COMPLETED BY PATIENT (4)	The following four questions are to be completed by the patient, thinking about the past FOUR WEEKS 1. How often do you leak urine? (FYI: Drop-down, can select only one) a. Never b. About once a week or less often c. Two or three times a week d. About once a day e. Several times a day f. All the time 2. We would like to know how much you think leaks. How much urine do you usually leak (whether you wear protection or not)? (FYI: Drop-down, can select only one) a. None b. A small amount c. A moderate amount d. A large amount 3. Overall, how much does leaking urine interfere with your everyday life? Please enter a number between 0 (not at all) and 10 (a great deal) (FYI: Number b/t 0 and 10) 4. When does urine leak? (Check all that apply) (FYI: Checkboxes in drop-down, select as many as desired) a. Never-urine does not leak b. Leaks before you can get to the toilet c. Leaks when you cough or sneeze d. Leaks when you are asleep e. Leaks when you are physically active/exercising f. Leaks when you have finished urinating and are dressed g. Leaks for no obvious reason h. Leaks all the time

INDEX PROCEDURE INFORMATION TAB

INFORMATION COLLECTED BY SURGEON IMMEDIATELY AFTER INDEX PROCEDURE (7)	(FYI: Collected immediately after index procedure) 1. *Were the nonsurgical and non-mesh alternatives, all relevant risks, and the expectations of success and failure for this procedure discussed with the patient? (Y/N) 2. *Were pre-operative antibiotics given? (Y/N) 3. *Type of incontinence procedure performed (FYI: dropdown box with the following options, can select only one) a. Midurethral sling (Enter UDI) b. Pubovaginal sling c. Burch or Marshall-Marchetti-Krantz procedure d. Periurethral bulking agent injection (Enter UDI) 4. *Did the patient have a concomitant procedure? (FYI: Y/N; If YES, list appears, checkboxes, select as many as desired) (FYI: If Y, then display the following sub question with dropdown having multiselect availability.) -*Please select the procedure type. a. Hysterectomy b. Anterior compartment prolapse repair c. Posterior compartment prolapse repair d. Apical prolapse repair e. Prolapse mesh implantation f. Other (no text box) 5. Was cystoscopy performed intraoperatively? (Y/N) 6. *Was any injury or complication related to the incontinence procedure observed? (FYI:Y/N; If YES, display the below question, list appears, checkboxes, select as many as desired) - *Please select the type of injury. a. Bladder perforation b. Bladder injury requiring repair c. Urethral injury d. Ureteral injury e. Bowel injury f. Vascular injury g. Blood product transfusion h. Death i. Other 7. *Did injury unrelated to incontinence surgery occur? (Y/N)

DEVICE INFORMATION TAB	
DEVICE INFORMATION COLLECTED BY SURGEON AT TIME OF INDEX PROCEDURE (18)	(FYI: Collected at time of index procedure (immediately before or after) 1. *List of manufacturing companies: (FYI: Drop-down with following options, Can select only one option) (It should display the sample images which has lot number and UDI highlighted) "UDI Number and Lot Number " will be enabled after selecting Manufacturing company (FYI: This message should be displayed on dashboard, just below the drop-down of manufacturing companies) - Coloplast A/S - Uroplasty, Inc. - Ethicon Sàrl - Ethicon Inc. - Boston Scientific Corporation - Caldera Medical, Inc. “Please see the above image to check the barcode format as per manufacturer.” - (FYI: this message should be displayed on dashboard with sample image of the barcode when a user selects the manufacturer from the drop-down) 2. *UDI Number: Only numeric and characters input are allowed. - (FYI: Display this text just below the ‘UDI Number’ and ‘Re-enter UDI’ fields) 3. *Re-enter UDI Number: 4. Lot Number: (FYI: If UDI cannot be scanned, should have the option to enter this number manually, but the rest of the information is not editable) 5. Brand Name: (text box) (FYI: Device Identifier Information (from AccessGUDID website) Not to display on UI) 6. Version or Model: (text box) 7. Company Name: (text box) 8. Device Description: (text box) 9. Primary Device Identifier Number: (Number) 10. What MRI safety information does the labeling contain?: (text box) 11. Device required to be labeled as containing natural rubber latex or dry natural rubber. (Y/N) 12. Device labeled as “Not made with natural rubber latex”. (Y/N) 13. For Single-Use (Y/N) 14. Kit (Y/N) 15. Combination Product (Y/N) 16. Human Cell, Tissue or Cellular or Tissue-Based Product (HCT/P) (Y/N) 17. GMDN: (FYI: text box for name, not description; can contain more than one GMDN, comma separated) 18. FDA Product Code: (text box) “Fetch Details” Button: (FYI: When user enters the UDI twice and clicks on “Fetch Details” systems should fetch the details from AccessGUDID website.) “Clear” Button: (FYI: Clear button should be displayed when user enters the valid bar-code and click on fetch details at that time system gets the details from FDA database on the dashboard. ‘Clear’ button should clear/erase all the data which is present on the Device information Tab.)

PERI-OPERATIVE INFORMATION TAB	
PERI-OPERATIVE INFORMATION COLLECTED BY SURGEON (7-9)	(FYI: Collected 6 weeks after index procedure) (FYI: If surgeon selects a in question 3 of the Index Procedure form above, he or she should receive the following questionnaire:) Note: These questions apply to the SUI surgery you performed 6 weeks ago. Complications reported here should be related to the SUI surgery (not related to concomitant surgeries). 1. *Was the patient readmitted to the hospital overnight or did the patient return to the OR for SUI surgery-related complication? (Y/N) 2. *Has the patient had any SUI sling mesh exposure since the SUI surgery? (Y/N) 3. *Has the patient had reoperation for SUI sling mesh exposure? (Y/N) 4. *Has the patient had any pain attributed to the SUI surgery? (Y/N/Unknown If YES then: a. Has the patient had treatment for SUI surgery-related pain? (Y/N/Unknown) 5. *Has the patient been treated for a urinary tract injury since the index surgery? (Y/N If YES then: a. Description (free text box) 6. Has the patient been treated for a bladder infection? (Y/N) 7. *Has the patient been transfused with blood products since the SUI surgery? (Y/N; If YES then: a. Was it related to the SUI surgery? (Y/N) 8. *Has the patient had reoperation for voiding dysfunction or retention, or does patient still use a catheter? (Y/N) 9. *Has the patient been treated for other complications related to the SUI surgery? (Y/N) (FYI: If provider selects b, c or d in question 3 of the Index Procedure form above, he or she should receive the following questionnaire:) Note: These questions apply to the SUI surgery you performed 6 weeks ago. Complications reported here should be related to the SUI surgery (not related to concomitant surgeries). 1. *Was the patient readmitted to the hospital overnight or did the patient return to the OR for SUI surgery-related complication? (Y/N) 2. *Has the patient had any pain attributed to the SUI surgery? (Y/N/Unknown If YES then: a. Has the patient had treatment for SUI surgery-related pain? (Y/N/Unknown) 3. *Has the patient been treated for a urinary tract injury since the index surgery? (Y/N If Yes then: a. Description (free text box) 4. Has the patient been treated for a bladder infection? (Y/N) 5. *Has the patient been transfused with blood products since the SUI surgery? (Y/N If Yes then: a. Was it related to the SUI surgery? (Y/N) 6. *Has the patient had reoperation for voiding dysfunction or retention, or does patient still use a catheter? (Y/N) 7. *Has the patient been treated for other complications related to the SUI surgery? (Y/N)

PERI-OPERATIVE INFORMATION COLLECTED BY PATIENT (7-8)	(FYI: Collected 5 weeks after index procedure) (FYI: If provider selects a in question 3 of the Index Procedure form above, patient should receive the following questionnaire:) (FYI: These questions ask about the surgery you had 5 weeks ago that was done to treat your urine leakage (incontinence) - Not to display on UI 1. *Date questionnaire completed (Date) - (FYI: Keep it on patient side- It should pick the final date.) 2. *Age (Number) 3. *Since your surgery, have you used estrogen in your vagina? (Y/N) 4. *Do you currently smoke? (Y/N) 5. *Are you currently taking medication for overactive bladder syndrome or urgency urinary incontinence? (Y/N) 6. Have you had a UTI since your surgery (whether or not you were treated for it)? (Y/N) 7. *Have you been readmitted to the hospital overnight or returned to the operating room for procedures related to the incontinence surgery you had 5 weeks ago? (Y/N) 8. *Since your incontinence surgery 6 weeks ago, have you been treated for exposure of surgical mesh? (Y/N) (FYI: If provider selects b, c or d in question 3 of the Index Procedure form above, patient should receive the following questionnaire:) (FYI: These questions ask about the surgery you had 5 weeks ago that was done to treat your urine leakage (incontinence)-Not to display on UI 1. *Date questionnaire completed (Date) 2. *Age (Number) 3. *Since your surgery, have you used estrogen in your vagina? (Y/N) 4. *Do you currently smoke? (Y/N) 5. *Are you currently taking medication for overactive bladder syndrome or urgency urinary incontinence? (Y/N) 6. Have you had a UTI since your surgery (whether or not you were treated for it)? (Y/N) 7. *Have you been readmitted to the hospital overnight or returned to the operating room for procedures related to the incontinence surgery you had 5 weeks ago? (Y/N)

POST-OPERATIVE INFORMATION TAB

POST-OPERATIVE INFORMATION COLLECTED BY SURGEON (7-8)	(FYI: Collected 1 year, 2 years and 3 years after index procedure) (FYI: If provider selects a in question 3 of the Index Procedure form above, he or she should receive the following questionnaire:) Note: These questions apply to the SUI surgery. Complications reported here should be related to the SUI surgery (not related to concomitant surgeries). 1. *Has the patient been seen since SUI surgery follow up? (Y/N; If YES, questions 2-4 appear) 2. Has the patient had any SUI sling mesh exposure since the SUI procedure? (Y/N/Unknown) 3. Has the patient had reoperation for SUI sling mesh exposure? (Y/N/Unknown) 4. Has the patient had any pain attributed to the SUI surgery? (Y/N/Unknown If YES then:) a. Has the patient had treatment for SUI surgery-related pain? (Y/N/Unknown) 5. *Was CST performed at this visit? (Y/N If Yes then: a. Was CST positive for SUI? (Y/N) 6. *Does the patient report SUI symptoms? (Y/N) 7. *Has the patient been retreated for SUI in any way (including medication, exercises, etc.)? (Y/N/Unknown if YES: a. Has the patient had a subsequent SUI surgery (Y/N) 8. *Does the patient report de novo OAB syndrome? (Y/N/Unknown) (FYI: If provider selects b, c or d in question 3 of the Index Procedure form above, he or she should receive the following questionnaire:) Note: These questions apply to the SUI surgery. Complications reported here should be related to the SUI surgery (not related to concomitant surgeries). 1. *Has the patient been seen since SUI surgery follow up? (Y/N; If YES, questions 2-3 appear) 2. Has the patient had any pain attributed to the SUI surgery? (Y/N/Unknown If YES then:) a. Has the patient had treatment for SUI surgery-related pain? (Y/N/Unknown) 3. Has the patient had reoperation related to the SUI procedure? (Y/N/Unknown) 4. *Was CST performed at this visit? (Y/N If YES: a. Was CST positive for SUI? (Y/N) 5. *Does the patient report SUI symptoms? (Y/N) 6. *Has the patient been retreated for SUI in any way (including medication, exercises, etc.)? (Y/N/Unknown if YES: a. Has the patient had a subsequent SUI surgery (Y/N) 7. *Does the patient report de novo OAB syndrome? (Y/N/Unknown)

POST-OPERATIVE INFORMATION COLLECTED BY PATIENT (11-14)	(FYI: Collected 1 year minus 1 week, 2 years and 3 years after index procedure) (FYI: If provider selects a in question 3 of the Index Procedure form above, patient should receive the following questionnaire:) (FYI: These questions ask about the surgery you had that was done to treat your urine leakage (incontinence)- Not to display on UI) 1. *Date questionnaire completed (Date) 2. *Since your surgery, have you been treated for exposure of the mesh that was placed for incontinence? (Y/N) 3. *Since your surgery, have you experienced pain related to the mesh that was placed for incontinence? (Y/N) 4. *Since your surgery, have you been treated for pain related to the mesh that was placed for incontinence? (Y/N; If Yes then: a. What was the treatment? Describe in a few words (free text box) 5. *Have you had pain in the pelvis, vagina, or groin that lasted at least 4 weeks that was not present before your surgery? (Y/N) 6. *Have you had pain during intercourse that lasted at least 4 weeks that was not present before your surgery? (Y/N) 7. *Have you experienced increased urgency, daytime urinary frequency, or leakage with urgency, that is new since your surgery? (Y/N) 8. *If you had to do it over, would you go through your incontinence surgery again? (Y/N) The next four questions refer to the PAST FOUR WEEKS 9. How often do you leak urine? (FYI: drop-down option, can select only one) a. Never b. About once a week or less often c. Two or three times a week d. About once a day e. Several times a day f. All the time 10. We would like to know how much you think leaks. How much urine do you usually leak (whether you wear protection or not) (FYI: drop-down option, can select only one) a. None b. A small amount c. A moderate amount d. A large amount 11. Overall, how much does leaking urine interfere with your everyday life? Please enter a number between 0 (not at all) and 10 (a great deal) (FYI: Text box for a single number b/t 0 and 10) 12. When does urine leak? (Check all that apply) (FYI: Checkboxes, can select as many as desired) a. Never-urine does not leak b. Leaks before you can get to the toilet c. Leaks when you cough or sneeze d. Leaks when you are asleep e. Leaks when you are physically active/exercising f. Leaks when you have finished urinating and are dressed g. Leaks for no obvious reason h. Leaks all the time 13. Show only if Question 9 is b-f: Have you had any additional treatment, other than medicine, for urine leakage since your surgery? (Y/N) 14. Please provide any additional feedback about your surgery (free text box) (FYI: If provider selects b, c or d in question 3 of the Index Procedure form above, patient should receive the following questionnaire:) (FYI: These questions ask about the surgery you had that was done to treat your urine leakage (incontinence) - Not to display on UI 1. *Date questionnaire completed (Date)

	2. *Have you had pain in the pelvis, vagina, or groin that lasted at least 4 weeks that was not present before your surgery? (Y/N) 3. *Have you had pain during intercourse that lasted at least 4 weeks that was not present before your surgery? (Y/N) 4. *Have you experienced increased urgency, daytime urinary frequency, or leakage with urgency, that is new since your surgery? (Y/N) 5. *If you had to do it over, would you go through your incontinence surgery again? (Y/N) The next four questions refer to the PAST FOUR WEEKS 6. How often do you leak urine? (FYI: drop-down option, can select only one) a. Never b. About once a week or less often c. Two or three times a week d. About once a day e. Several times a day f. All the time 7. We would like to know how much you think leaks. How much urine do you usually leak (whether you wear protection or not) (FYI: drop-down option, can select only one) a. None b. A small amount c. A moderate amount d. A large amount 8. Overall, how much does leaking urine interfere with your everyday life? Please enter a number between 0 (not at all) and 10 (a great deal) (FYI: Text box for a single number b/t 0 and 10) 9. When does urine leak? (Check all that apply) (FYI: Checkboxes, can select as many as desired) a. Never-urine does not leak b. Leaks before you can get to the toilet c. Leaks when you cough or sneeze d. Leaks when you are asleep e. Leaks when you are physically active/exercising f. Leaks when you have finished urinating and are dressed g. Leaks for no obvious reason h. Leaks all the time 10. Show only if Question 6 is b-f: Have you had any additional treatment, other than medicine, for urine leakage since your surgery? (Y/N). 11. Please provide any additional feedback about your surgery: (free text box)
IF NEEDED: ADDITIONAL UNSCHEDULED VISIT INFORMATION COLLECTED BY SURGEON (7)	-(FYI: Collected at time of unscheduled visit or immediately thereafter) 1. *Date of visit (Date) 2. *Available Surgery Date - (FYI: It should display all the available surgery dates based on the date surgeon selects for date of visit) 3. What is the reason for this visit? Briefly describe (free text box) 4. *Has the patient had any SUI sling mesh exposure since the SUI procedure? (Y/N/Unknown/Not Applicable) 5. *Has the patient had reoperation for SUI sling mesh exposure related to the SUI surgery? (Y/N/Unknown/Not Applicable) 6. *Has the patient had any pain attributed to the SUI surgery? (Y/N/Unknown) 7. *Has the patient had treatment for SUI surgery-related pain? (Y/N/Unknown; If YES then: a. Briefly describe treatment (free text box)

Pelvic Organ Prolapse Core Minimum Dataset

PATIENT FACTORS: Pre-Operative	
Medical History (15)	Number of births (parity) Number of vaginal births History of Cesarean section (Y/N) Co-morbidity index (Y/N) Diabetes mellitus (Y/N) Smoking status (never, past, current) Menopausal status (Y/N) Sexual activity (Y/N) If yes, does the patient have pain with sexual activity? Stress urinary incontinence (Y/N) Urgency urinary incontinence (Y/N) Mixed urinary incontinence (Y/N) Chronic constipation (Y/N) Receipt of hormone therapy and type (systemic estrogen, vaginal estrogen, other) Vaginal bulge symptoms (Y/N)
Surgical History (12)	Prior hysterectomy (Y/N) If yes, type of prior hysterectomy (e.g., total, supracervical) If yes, approach of prior hysterectomy (vaginal, abdominal, laparoscopic/robotic) If yes, indication for prior hysterectomy Prior urogynecological mesh (Y/N) If yes, location of mesh use (sling, prolapse repair) Prior anti-incontinence surgery (Y/N) If yes, type of prior anti-incontinence surgery Prior prolapse surgery (Y/N) If yes, type of prior prolapse surgery (e.g., sacrocolpopexy, etc.) Previous abdominal surgery (Y/N) If yes, type of previous abdominal surgery
Examination (3)	BMI (respondents can choose to enter both height and weight if they do not have BMI available) Pelvic Organ Prolapse Quantification System (POP-Q) stage (0-IV) Compartment with greatest anatomic prolapse (anterior, posterior, apical, multiple)

PATIENT FACTORS: Peri-Operative	
Procedure (23)	Surgery date Total operating room time in minutes ASA physical status classification status (1-5) Concomitant hysterectomy (Y/N) If yes, type of hysterectomy (total, supracervical) If yes, indication for hysterectomy (prolapse, other) Concomitant anti-incontinence procedure (Y/N) If yes, what type of anti-incontinence procedure If yes, was mesh used for midurethral sling Was mesh used for prolapse repair (Y/N) If yes, type of mesh used (permanent, absorbable, biologic) If yes, approach of mesh (abdominal/vaginal/robotic/laparoscopic (select all that apply)) If yes, compartment that mesh was placed in (posterior, anterior, apical, multiple) Type of vaginal apical vault suspension Type of abdominal apical vault suspension Was hysteropexy (apical support procedure leaving uterus in place) performed (Y/N) Anterior repair performed (Y/N) Enterocele repair performed (Y/N) Posterior repair performed (Y/N) Obliterative prolapse procedure (LeFort, vaginectomy, colpectomy) (Y/N) Complication (Y/N) If yes, select all complications that occurred (see drop down list options below) Bleeding requiring Blood Transfusion Ureteral injury Urethrotomy/Repair Vascular Injury Visceral Organ Injury (Bladder/Small bowel/Large bowel/Rectum) Mesh kit trocar injury Other operative complication/injury Aborted Procedure Conversion to Laparotomy Mesh Kit / Device Malfunction Death If yes, Clavien-Dindo Scale (respondent will select Clavien-Dindo only for the most severe complication that occurred)
Discharge (3)	Re-operation during index hospitalization (Y/N) Discharge date (date) Discharge disposition (home, VNA, SNF, LTC, deceased, other)

PATIENT FACTORS: Post-Operative	
Short-Term Follow-Up (0-30 days) (6)	Follow-up date Early postoperative complications (includes events while in hospital and after discharge in first 30 days after surgery) (Y/N) If yes, select all complications that occurred (see drop down list options below) Cardiovascular --> if yes, branch to AMI, non-ST elevation MI, CVA, TIA, cardiac arrest Pulmonary --> if yes, branch to prolonged intubation (intubation past the PACU), ICU admission, reintubation Systemic infection --> If yes branch to: pneumonia (CXR or positive sputum cultures required), SIRS, Septic shock, sepsis, pyelonephritis, urosepsis VTE --> If yes, DVT or PE SSI --> If yes, branch to superficial SSI, deep SSI, organ space SSI UTI --> culture proven or initiation of antibiotics for empiric treatment within 30 days of surgery C. Diff colitis Bleeding --> blood transfusion within 3 days of index surgery, hematoma requiring imaging (CT scan) or further management (IR drainage, surgical evacuation) GI --> postoperative ileus, SBO Organ injury (recognized after index surgery and/or discharge) --> If yes, ureteral injury, bladder injury and/or perforation, bowel injury, other Fistula (lots of options) Peripheral nerve injury Vaginal cuff dehiscence Suture Exposure in Vagina Suture Erosion into Viscera Mesh Exposure in Vagina Mesh Erosion into Viscera (bladder, urethra, ureter, small bowel, large bowel, rectum, other) Foreign Body left during procedure Other Death If yes, Clavien-Dindo Scale (respondent will select Clavien-Dindo only for the most severe complication that occurred) Readmissions within 30 days (Y/N) Emergency room visits within 30 days (Y/N)

Short-Term Follow-Up (31-90 days) (5)	Follow-up date Complications noted at short-term follow-up (31-90 days) (Y/N) If yes, select all complications that occurred (see drop down list options below) Vaginal Scarring Vaginal Shortening Suture Exposure in Vagina Suture Erosion into Viscera Mesh Exposure in Vagina Mesh Erosion into Viscera (bladder, urethra, ureter, small bowel, large bowel, rectum, other) Difficulty emptying bladder/urinary retention Pelvic pain Dyspareunia (de novo/worsening) SSI --> If yes, branch to superficial SSI, deep SSI, organ space SSI Fistula (lots of options) Visceral organ surgical injury (options) Ileus / Bowel Obstruction Thrombotic Event Cardiac Event Pulmonary Event Neurovascular Event Peripheral Nerve Injury If yes, Clavien-Dindo Scale (respondent will select Clavien-Dindo only for the most Severe complication that occurred) Readmissions within 90 days (Y/N)
Long-Term Follow-Up (>90 days) (8)	Follow-up date Complications noted at long-term follow-up (>90 days) (Y/N) If yes, select all complications that occurred (see drop down list options below) Vaginal Scarring Vaginal Shortening Suture Exposure in Vagina Suture Erosion into Viscera Mesh Exposure in Vagina Mesh Erosion into Viscera (bladder, urethra, ureter, small bowel, large bowel, rectum, other) Urinary or bowel symptoms/problems Difficulty emptying bladder/urinary retention Pelvic pain Dyspareunia if sexually active (de novo/worsening) Pelvic infection/abscess Bone infection Sinus tract Organ Injury/Fistula Fistula (lots of options) Ureteral injury (lots of options) If yes, Clavien-Dindo Scale (respondent will select Clavien-Dindo only for the most Severe complication that occurred) Symptomatic recurrence (i.e., does the patient see or feel a vaginal bulge) (Y/N) Anatomic Recurrence beyond hymen (Y/N) If yes, POP Q Stage (II, III, IV) If yes, compartment with greatest anatomic prolapse (anterior, posterior, apical, multiple)

DEVICE FACTORS (4)
Unique Device ID (Unique ID for Anterior/ Posterior/ ASC/ Sling)
Manufacturer, Device name
Type of sutures used (absorbable, permanent, both)
Suture capturing device used (e.g., Capio)
SURGERY FACTORS (4)
Trainee Involvement in surgery (Y/N)
Practice Type (Academic, Private, Military, Other)
Center/Hospital identifier
Hospital volume
SURGEON FACTORS (7) **(these variables will auto-populate every time after the first entry)**
National Provider Identifier (NPI)/ML#
Surgeon Age
Training (fellow, not fellow)
Specialty (OB/GYN, Urology, General Surgery)
Board certification (Y/N)
Sub-specialty Certification (FPRMS, Colorectal Surgery)
Surgeon volume

Sterilization/LARC Core Minimum Dataset

	MEDICAL HISTORY
Reproductive/ Gynecological History (5)	Pregnancy History - Number of Previous Pregnancies Pregnancy History - Outcome of Previous Pregnancies (e.g., miscarriage, ectopic, etc.) Currently Breastfeeding? (Y/N) Menstruation History - Regular Cycles? (Y/N) Prior Conditions or Symptoms (specific conditions below) (Y/N) Intracyclic bleeding (Y/N) Dysmenorrhea (Y/N) Pelvic Pain (Y/N) Endometriosis (Y/N) Dyspareunia (Y/N) Adenomyosis (Y/N) Fibroids (Y/N) Pelvic inflammatory disease (PID) (Y/N) Cervical Coneization (e.g., cone biopsy, LEEP procedure) Prior STD (e.g., Gonorrhea, Syphilis, Chlamydia, Other prior STD) (Y/N) Breast Cancer (Y/N) Gynecological Cancer (e.g., uterine cancer, ovarian cancer, cervical cancer) (Y/N) Acute cervicitis, vaginitis, or other lower genital tract infection (Y/N) Uterine abnormality that distorts cavity (Y/N) Absence of menstrual bleeding (Y/N) Anovulatory Condition (Y/N)
Surgical History (4)	Any prior intra-abdominal surgery? (Y/N) If yes, laparoscopic or open? Any prior vaginal/hysteroscopic/cervical surgery? (Y/N) If yes, which type of vaginal/hysteroscopic/cervical surgery? (e.g., endometrial ablation, etc.)

General Medical History (7)	History of chronic pain (e.g., fibromyalgia) (Y/N) Prior Psychiatric Disorders (e.g., Depression, Anxiety, etc.) (Y/N) Autoimmune disease (Y/N) Prior allergic or hypersensitivity reaction possibly or definitely related to materials/substances used in the index procedure (Y/N) If yes, what was the reaction to? (e.g. metal, latex, etc.) (open-ended response) If yes, what was the reaction? (e.g. rash, hives, etc.) (open-ended response) Bleeding disorder (Y/N)
PROCEDURE DATA: Index Procedure, Post-procedure Follow-up	
General Encounter Information (16)	On what date was the index procedure performed? During which time period was this performed? (select one of the options indented below) Interval (more than 6 weeks from delivery/abortion or unrelated to delivery) Post-abortal (same day as abortion / confirmation of abortion) Post-partum (if yes, select one of the options indented below) Post-placental (within 30 minutes of delivery) Prior to hospital discharge and more than 30 minutes after delivery After hospital discharge AND within 6 weeks of delivery Encounter Reason (e.g., New Sterilization/LARC Procedure, Post-Procedure Follow-up, etc.) Procedure Performed (e.g., Total Salpingectomy, Partial Salpingectomy, etc.) Facility where procedure was performed Provider ID Number of Procedures Performed by the Provider in Last Six Months (same procedure performed that was listed above) Pre-procedure imaging? (Y/N) If yes, type of procedure? (e.g., Transvaginal Ultrasound, Hysterosalpingogram, etc.) Inter-procedure imaging? (Y/N) If yes, type of procedure? (e.g., Transvaginal Ultrasound, Hysterosalpingogram, etc.) Post-procedure imaging? (Y/N) If yes, type of procedure? (e.g., Transvaginal Ultrasound, Hysterosalpingogram, etc.) If yes, Post-Procedure Indication for Diagnostic Imaging (for all sterilization/LARC procedures) If yes, were post-sterilization imaging results satisfactory for reliance on device for sterilization? (Y/N)
Other Procedures Performed in Conjunction with Sterilization Procedure (1)	Concomitant Procedures (e.g., c-section, hysteroscopic myomectomy, hysteroscopic polypectomy, hysteroscopic ablation, D&C, laparoscopic adnexal surgery, other)
Procedure Elements (Index Procedure or Follow-up) (7)	Product ID (e.g., Unique Device Identifier (UDI), National Drug Code (NDC)) Placement Success Achieved (Y/N) Fallopian Tube Treated - for hysteroscopic & surgical sterilizations only (e.g., Left, Right, Bilateral) Successful Visualization of Right/Left Tubal Ostia - for hysteroscopic sterilizations only (Y/N) Primary Reason for Unsuccessful Placement (e.g., Procedure-related adverse event, poor distension, poor visualization, etc.) Intraoperative Findings - for hysteroscopic and surgical sterilizations only (e.g., Adhesions, Adnexal Mass, Fibroids, Endometriosis, etc.) Number of unsuccessful procedure attempts (for each unsuccessful attempt, specify reason)

Product Removal Procedure-Specific Elements (7)	Unintended Removal by health care provider (e.g., During Dilation and Cutterage, etc.) Planned Removal (Y/N) Reason for planned removal (e.g., Unable to relay on device, Pain, Bleeding, etc.) Other procedures performed with removal (e.g., Incisional Sterilization, Hysteroscopy, etc.) Complete Device Removal (e.g., Intact Device, All Fragments Removed, N/A) Partial Removal (e.g., Device Breakage Prior to Removal, etc.) Any device or implant abnormalities (Y/N)
MEDICATIONS (20)	
	Pre-procedural Medication (Y/N) If yes, enter Medication Name (pain medication, anesthesia, etc.) If yes, enter Indication If yes, enter Start Date If yes, enter End Date Procedural Medication (Y/N) If yes, enter Medication Name (pain medication, anesthesia, etc.) If yes, enter Indication If yes, enter Start Date If yes, enter End Date Discharge Medication (Y/N) If yes, enter Medication Name (pain medication, anesthesia, etc.) If yes, enter Indication If yes, enter Start Date If yes, enter End Date Follow-up Medication (Y/N) If yes, enter Medication Name (pain medication, anesthesia, etc.) If yes, enter Indication If yes, enter Start Date If yes, enter End Date
ENDPOINTS DURING AND AFTER TREATMENT	
Events or Complications - Permanent Hysteroscopic Sterilization (23)	Hematoma formation (Yes/No | Procedure/Post-procedure | Date) Device expulsion (Yes/No | Procedure/Post-procedure | Date) Device malposition/migration/dislocation (Yes/No | Procedure/Post-procedure | Date) Nerve injury (Yes/No | Procedure/Post-procedure | Date) Thermal injury (Yes/No | Procedure/Post-procedure | Date) Visceral organ injury (Yes/No | Procedure/Post-procedure | Date) Perforation (Yes/No | Procedure/Post-procedure | Date | Specify Organ perforated) Vascular injury (Yes/No | Procedure/Post-procedure | Date) Venous thrombosis within 30 days of procedure (Yes/No | Procedure/Post-procedure | Date) Pulmonary Embolism within 30 days of procedure (Yes/No | Procedure/Post-procedure | Date) Pain requiring prescriptive medication (Yes/No | Procedure/Post-procedure | Date) Vasovagal syncope or seizure on day of placement (Yes/No | Procedure/Post-procedure | Date) Pelvic inflammatory disease (PID) (Yes/No | Procedure/Post-procedure | Date) Other Infection (Yes/No | Procedure/Post-procedure | Date) Anesthesia-related event (Yes/No | Procedure/Post-procedure | Date) Inability to access tubes during procedure (Yes/No) Nausea or vomiting (Yes/No | Procedure/Post-procedure | Date) Fainting or dizziness (Yes/No | Procedure/Post-procedure | Date) Surgical hemorrhage (Yes/No) Other medical product related AE (Yes/No | Procedure/Post-procedure | Date) If yes, specify Other procedure related (Yes/No | Procedure/Post-procedure | Date) If yes, specify

Events or Complications - All Other Permanent Surgical Sterilization (24)	Hematoma formation (Yes/No | Procedure/Post-procedure | Date) Device expulsion (Yes/No | Procedure/Post-procedure | Date) Device malposition/migration/dislocation (Yes/No | Procedure/Post-procedure | Date) Nerve injury (Yes/No | Procedure/Post-procedure | Date) Thermal injury (Yes/No | Procedure/Post-procedure | Date) Visceral organ injury (Yes/No | Procedure/Post-procedure | Date) Perforation (Yes/No | Procedure/Post-procedure | Date | Specify Organ perforated) Vascular injury (Yes/No | Procedure/Post-procedure | Date) Venous thrombosis within 30 days of procedure (Yes/No | Procedure/Post-procedure | Date) Pulmonary Embolism within 30 days of procedure (Yes/No | Procedure/Post-procedure | Date) Pain requiring prescriptive medication (Yes/No | Procedure/Post-procedure | Date) Vasovagal syncope or seizure on day of placement (Yes/No | Procedure/Post-procedure | Date) Subcutaneous emphysema (Yes/No | Procedure/Post-procedure | Date) Pelvic inflammatory disease (PID) (Yes/No | Procedure/Post-procedure | Date) Other Infection (Yes/No | Procedure/Post-procedure | Date) Anesthesia-related event (Yes/No | Procedure/Post-procedure | Date) Inability to access tubes during procedure (Yes/No) Nausea or vomiting (Yes/No | Procedure/Post-procedure | Date) Fainting or dizziness (Yes/No | Procedure/Post-procedure | Date) Surgical hemorrhage (Yes/No) Other medical product related AE (Yes/No | Procedure/Post-procedure | Date) If yes, specify Other procedure related AE (Yes/No | Procedure/Post-procedure | Date) If yes, specify
Events or Complications - LARC – Contraceptive Implants (15)	Hematoma formation (Yes/No | Procedure/Post-procedure | Date) Device expulsion (Yes/No | Procedure/Post-procedure | Date) Device malposition/migration/dislocation (Yes/No | Procedure/Post-procedure | Date) Nerve injury (Yes/No | Procedure/Post-procedure | Date) Vascular injury (Yes/No | Procedure/Post-procedure | Date) Venous thrombosis within 30 days of procedure (Yes/No | Procedure/Post-procedure | Date) Pain requiring prescriptive medication (Yes/No | Procedure/Post-procedure | Date) Deep placement of implant (Yes/No | Procedure/Post-procedure | Date) Other Infection (Yes/No | Procedure/Post-procedure | Date) Fainting or dizziness (Yes/No | Procedure/Post-procedure | Date) Surgical hemorrhage (Yes/No) Other medical product related AE (Yes/No | Procedure/Post-procedure | Date) If yes, specify Other procedure related AE (Yes/No | Procedure/Post-procedure | Date) If yes, specify

Events or Complications - LARC – Intrauterine Devices (18)	Hematoma formation (Yes/No | Procedure/Post-procedure | Date) Device expulsion (Yes/No | Procedure/Post-procedure | Date) Device malposition/migration/dislocation (Yes/No | Procedure/Post-procedure | Date) Nerve injury (Yes/No | Procedure/Post-procedure | Date) Visceral organ injury (Yes/No | Procedure/Post-procedure | Date) Perforation (Yes/No | Procedure/Post-procedure | Date | Specify Organ perforated) Vascular injury (Yes/No | Procedure/Post-procedure | Date) Venous thrombosis within 30 days of procedure (Yes/No | Procedure/Post-procedure | Date) Pain requiring prescriptive medication (Yes/No | Procedure/Post-procedure | Date) Vasovagal syncope or seizure on day of placement (Yes/No | Procedure/Post-procedure | Date) Pelvic inflammatory disease (PID) (Yes/No | Procedure/Post-procedure | Date) Other Infection (Yes/No | Procedure/Post-procedure | Date) Nausea or vomiting (Yes/No | Procedure/Post-procedure | Date) Fainting or dizziness (Yes/No | Procedure/Post-procedure | Date) Other medical product related AE (Yes/No | Procedure/Post-procedure | Date) If yes, specify Other procedure related AE (Yes/No | Procedure/Post-procedure | Date) If yes, specify
Pregnancy (20)	Date of confirmation of pregnancy Gestational age at presentation (in weeks) Estimated due date (relatively easy to calculate and can be done at the time of presentation) Pregnancy outcome Ectopic (Y/N) If yes, date of diagnosis If yes, treatment Intrauterine (Y/N) (if yes, provide date) If yes, date of presentation If yes, gestational age at presentation If yes, type (select from following options) Termination of pregnancy If yes, trimester (first, second, third) Miscarriage/fetal demise (e.g. IUFD) If yes, trimester (first, second, third) Other abnormal pregnancy (e.g. molar) If yes, trimester (first, second, third) Delivery If yes, choose preterm or term If yes, choose vaginal delivery, cesarean section, or operative delivery
Methods for Evaluations of Endpoints (2)	Did event meet criteria for a serious adverse event? (Y/N - Criteria: Death; Life-Threatening; Hospitalization Required; Prolonged hospitalization; Congenital Anomaly or birth defect; Persistent Disability or Incapacity) Outcome of Treatment of AE (e.g., Recovered, Recovered with Unresolved Sequelae, etc.)

B. Code Sets

The relevant International Classification of Diseases (ICD) procedure codes, current procedure terminology (CPT) codes, and Healthcare Common Procedure Coding System (HCPCS) codes for the conditions or procedures captured by the CRN are listed below.

Uterine Fibroids:

The following codes are used to capture UF related treatments and procedures:

CPT

- 58150–58200
- 58260–58270
- 58275–58280
- 58290–58294
- 58541–58544
- 58550–58554
- 58570–58573
- 37243 Under Vascular Embolization and Occlusion
- 58578 Under Laparoscopic/Hysteroscopic Procedures on the Corpus Uteri
- 58140 Myomectomy, excision of fibroid tumor(s) of uterus, 1 to 4 intramural myoma(s) with total weight of 250 g or less and/or removal of surface myomas
- 58145 Myomectomy, excision of fibroid tumor(s) of uterus, 1 to 4 intramural myoma(s) with total weight of 250 g or less and/or removal of surface myomas; vaginal approach
- 58146 Myomectomy, excision of fibroid tumor(s) of uterus, 5 or more intramural myomas and/or intramural myomas with total weight greater than 250 g, abdominal approach
- 58545 Laparoscopy, surgical, myomectomy, excision; 1 to 4 intramural myomas with total weight of 250 g or less and/or removal of surface myomas
- 58546 Under Laparoscopic/Hysteroscopic Procedures on the Corpus Uteri
- 37204 Laparoscopy, surgical, myomectomy, excision; 5 or more intramural myomas and/or intramural myomas with total weight greater than 250 g
- 58353 Endometrial ablation, thermal, without hysteroscopic guidance
- 58356 Endometrial cryoablation with ultrasonic guidance, including endometrial curettage, when performed
- 58563 Hysteroscopy, surgical; with endometrial ablation (e.g., endometrial resection, electrosurgical ablation, thermoablation)

HCPCS

- C1887 Catheter, guiding (may include infusion/perfusion capability)
- C1769 Guide wire

ICD9

Diagnosis Codes

- 218.0 Submucous leiomyoma of uterus

- 218.1 Intramural leiomyoma of uterus
- 218.2 Subserous leiomyoma of uterus
- 218.9 Leiomyoma of uterus, unspecified
- 593.3 Stricture or kinking of ureter
- 593.4 Other ureteric obstruction
- 625.0 Dyspareunia
- 625.8 Other specified symptom associated with female genital organs
- 625.9 Unspecified symptom associated with female genital organs
- 626.2 Excessive or frequent menstruation
- 788.0 Renal colic

Procedure Codes

- 68.39 Other and unspecified subtotal abdominal hysterectomy
- 68.49 Other and unspecified total abdominal hysterectomy
- 68.31 Laparoscopic supracervical hysterectomy (LSH)
- 68.41 Laparoscopic total abdominal hysterectomy
- 68.4 Total Abdominal Hysterectomy
- 54.21 Laparoscopy
- 68.59 Other and unspecified vaginal hysterectomy
- 68.51 Laparoscopically assisted vaginal hysterectomy (LAVH)
- 68.29 Other excision or destruction of lesion of uterus
- 69.19 Other excision or destruction of uterus and supporting structures
- 68.24 Uterine artery embolization [UAE] with coils
- 68.25 Uterine artery embolization [UAE] without coils
- 68.23 Endometrial ablation
- 38.80 Other surgical occlusion of vessels, unspecified site
- 39.79 Other endovascular procedures on other vessels
- 99.29 Injection or infusion of other therapeutic or prophylactic substance

ICD10

Diagnosis Codes

- D25 leiomyoma of uterus
- D25.0 submucous leiomyoma of uterus
- D25.1 intramural leiomyoma of uterus
- D25.2 subserosal leiomyoma of uterus
- D25.9 leiomyoma of uterus, unspecified
- D50.0 iron deficiency anemia secondary to blood loss; chronic blood loss
- D62 acute post hemorrhagic anemia
- N89.8 other specified noninflammatory disorders of vagina
- N92.0 excessive and frequent menstruation with regular cycle
- N92.1 excessive and frequent menstruation with irregular cycle
- N92.3 ovulation bleeding
- N92.4 excessive bleeding in the premenopausal period
- N92.5 other specified irregular menstruation uterine hemorrhage not otherwise specified
- N92.6 irregular menstruation, unspecified

- N93.8 other specified abnormal uterine and vaginal bleeding
- N93.9 abnormal uterine and vaginal bleeding, unspecified
- N94.1 dyspareunia
- N94.4 primary dysmenorrhea
- N94.5 secondary dysmenorrhea
- N94.6 dysmenorrhea, unspecified
- N94.8 other specified conditions associated with female genital organs and menstrual cycle
- N94.89 other specified conditions associated with female genital organs and menstrual cycle
- 625.5 pelvic congestion syndrome
- N94.9 unspecified condition associated with female genital organs and menstrual cycle
- N94.89 (above)
- R10.2 pelvic and perineal pain

Procedure Codes

- 0UT90ZL Resection of Uterus, Supracervical, Open Approach
- 0UT90ZZ Resection of Uterus, Open Approach
- 0UTC0ZZ Resection of Cervix, Open Approach
- 0UT94ZL Resection of Uterus, Supracervical, Percutaneous Endoscopic Approach
- 0UT94ZZ Resection of Uterus, Percutaneous Endoscopic Approach
- 0UTC4ZZ Resection of Cervix, Percutaneous Endoscopic Approach
- 0WJF4ZZ Inspection of Abdominal Wall, Percutaneous Endoscopic Approach
- 0WJG4ZZ Inspection of Peritoneal Cavity, Percutaneous Endoscopic Approach
- 0WJJ4ZZ Inspection of Pelvic Cavity, Percutaneous Endoscopic Approach
- 0WJP4ZZ Inspection of Gastrointestinal Tract, Percutaneous Endoscopic Approach
- 0WJR4ZZ Inspection of Genitourinary Tract, Percutaneous Endoscopic Approach
- 0UT97ZL Resection of Uterus, Supracervical, Via Natural or Artificial Opening
- 0UT98ZL Resection of Uterus, Supracervical, Via Natural or Artificial Opening Endoscopic
- 0UT9FZL Resection of Uterus, Supracervical, Via Natural or Artificial Opening With Percutaneous Endoscopic Assistance
- 0UT9FZZ Resection of Uterus, Via Natural or Artificial Opening With Percutaneous Endoscopic Assistance
- 0UT97ZZ Resection of Uterus, Via Natural or Artificial Opening
- 0UT98ZZ Resection of Uterus, Via Natural or Artificial Opening Endoscopic
- 0UTC7ZZ Resection of Cervix, Via Natural or Artificial Opening
- 0UTC8ZZ Resection of Cervix, Via Natural or Artificial Opening Endoscopic
- 0U590ZZ Destruction of Uterus, Open Approach
- 0U593ZZ Destruction of Uterus, Percutaneous Approach
- 0U594ZZ Destruction of Uterus, Percutaneous Endoscopic Approach
- 0U597ZZ Destruction of Uterus, Via Natural or Artificial Opening
- 0U598ZZ Destruction of Uterus, Via Natural or Artificial Opening
- 0UB90ZZ Excision of Uterus, Open Approach
- 0UB93ZZ Excision of Uterus, Percutaneous Approach

- 0UB94ZZ Excision of Uterus, Percutaneous Endoscopic Approach
- 0UB97ZZ Excision of Uterus, Via Natural or Artificial Opening
- 0UB98ZZ Excision of Uterus, Via Natural or Artificial Opening Endoscopic
- 0UJD0ZZ Inspection of Uterus and Cervix, Open Approach
- 0UJD4ZZ Inspection of Uterus and Cervix, Percutaneous Endoscopic
- 04LE0DT Occlusion of Right Uterine Artery with Intraluminal Device, Open Approach
- 04LE3DT Occlusion of Right Uterine Artery with Intraluminal Device, Percutaneous Approach
- 04LE4DT Occlusion of Right Uterine Artery with Intraluminal Device, Percutaneous Endoscopic Approach
- 04LF0DU Occlusion of Left Uterine Artery with Intraluminal Device, Open Approach
- 04LF3DU Occlusion of Left Uterine Artery with Intraluminal Device, Percutaneous Approach
- 04LF4DU Occlusion of Left Uterine Artery with Intraluminal Device, Percutaneous Endoscopic Approach
- 04LE0CT Occlusion of Right Uterine Artery with Extraluminal Device, Open Approach
- 04LE0ZT Occlusion of Right Uterine Artery, Open Approach
- 04LE3CT Occlusion of Right Uterine Artery with Extraluminal Device, Percutaneous Approach
- 04LE3ZT Occlusion of Right Uterine Artery, Percutaneous Approach
- 04LE4CT Occlusion of Right Uterine Artery with Extraluminal Device, Percutaneous Endoscopic Approach
- 04LE4ZT Occlusion of Right Uterine Artery, Percutaneous Endoscopic Approach
- 04LF0CU Occlusion of Left Uterine Artery with Extraluminal Device, Open Approach
- 04LF0ZU Occlusion of Left Uterine Artery, Open Approach
- 04LF3CU Occlusion of Left Uterine Artery with Extraluminal Device, Percutaneous Approach
- 04LF3ZU Occlusion of Left Uterine Artery, Percutaneous Approach
- 04LF4CU Occlusion of Left Uterine Artery with Extraluminal Device, Percutaneous Endoscopic Approach
- 04LF4ZU Occlusion of Left Uterine Artery, Percutaneous Endoscopic Approach
- 0U5B0ZZ Destruction of Endometrium, Open Approach
- 0U5B3ZZ Destruction of Endometrium, Percutaneous Approach
- 0U5B4ZZ Destruction of Endometrium, Percutaneous Endoscopic Approach
- 0U5B7ZZ Destruction of Endometrium, Via Natural or Artificial Opening
- 0U5B8ZZ Destruction of Endometrium, Via Natural or Artificial Opening Endoscopic
- 0UDB7ZZ Extraction of Endometrium, Via Natural or Artificial Opening
- 0UDB8ZZ Extraction of Endometrium, Via Natural or Artificial Opening Endoscopic
- 0TTB0ZZ Resection of Bladder, Open Approach
- 0TTD0ZZ Resection of Urethra, Open Approach
- 0UT20ZZ Resection of Bilateral Ovaries, Open Approach
- 0UT70ZZ Resection of Bilateral Fallopian Tubes, Open Approach
- 0UT90ZZ Resection of Uterus, Open Approach With: 2018/2019 ICD-10-PCS 0UTC0ZZ Resection of Cervix, Open Approach

- 0UTG0ZZ Resection of Vagina, Open Approach
- 0DTN0ZZ Resection of Sigmoid Colon, Open Approach
- 0DTP0ZZ Resection of Rectum, Open Approach
- 0UT90ZZ Resection of Uterus, Open Approach
- 0UTC0ZZ Resection of Cervix, Open Approach
- 0UT47ZZ Resection of Uterine Supporting Structure, Via Natural or Artificial Opening
- 0UT48ZZ Resection of Uterine Supporting Structure, Via Natural or Artificial Opening Endoscopic
- 0UT97ZZ Resection of Uterus, Via Natural or Artificial Opening
- 0UT98ZZ Resection of Uterus, Via Natural or Artificial Opening Endoscopic
- 0UTC7ZZ Resection of Cervix, Via Natural or Artificial Opening
- 0UTC8ZZ Resection of Cervix, Via Natural or Artificial Opening Endoscopic
- 0U590ZZ Destruction of Uterus, Open Approach
- 0U593ZZ Destruction of Uterus, Percutaneous Approach
- 0U594ZZ Destruction of Uterus, Percutaneous Endoscopic Approach
- 0U597ZZ Destruction of Uterus, Via Natural or Artificial Opening
- 0U598ZZ Destruction of Uterus, Via Natural or Artificial Opening Endoscopic
- 0UB90ZZ Excision of Uterus, Open Approach
- 0UB93ZZ Excision of Uterus, Percutaneous Approach
- 0UB94ZZ Excision of Uterus, Percutaneous Endoscopic Approach
- 0UB97ZZ Excision of Uterus, Via Natural or Artificial Opening
- 0UB98ZZ Excision of Uterus, Via Natural or Artificial Opening Endoscopic

Stress Urinary Incontinence:

The following codes are used to capture Stress Urinary Incontinence related treatments and procedures:

CPT

- 57288 Sling operation for stress incontinence (eg, fascia or synthetic)
- 57287 Removal or revision of sling for stress incontinence (eg, fascia or synthetic)
- 51990 Laparoscopy, surgical; urethral suspension for stress incontinence
- 51992 Laparoscopic sling operation for stress incontinence
- 57310 Closure of urethra-vaginal fistula
- 57311 Closure of urethra-vaginal fistula, with bulbocavernosus transplant
- 57320 Closure of vesicovaginal fistula, vaginal approach
- 57330 Closure of vesicovaginal fistula, transvesical and vaginal approach

HCPCS

- G8063 and G8067 incontinence- urinary, documentation
- E0740 incontinence treatment system, pelvic floor stimulator, monitor, sensor and/or trainer

ICD9

Diagnosis Codes

- 625.6 Stress incontinence (female) (male)
- 599.82 Intrinsic sphincter deficiency
- 788.32 Urinary incontinence
- 788.31 Urge incontinence
- 788.32 Stress incontinence (male)
- 788.33 Mix incontinence
- 788.37 Continuous leakage
- 788.38 Overflow incontinence
- 788.39 Other specified urinary incontinence
- 788.41 Frequency of micturition
- 788.63 Urgency of urination

Procedure Codes

- 59.3 plication of the urethrovesical junction
- 59.4 suprapubic sling operation
- 59.5 retropubic urethral suspension
- 59.6 paraurethral suspension
- 59.70 or 59.79 other repair of SUI
- 59.71 levator muscle operation for urethrovesical suspension
- 59.72 injection of implant

ICD10

Diagnosis Codes

- N39.3 Stress incontinence (female) (male)
- N36.42 Intrinsic sphincter deficiency
- N36.41 Hypermobility of uretha
- R32 Urinary incontinence
- N39.2 Urge incontinence
- N39.2 Stress incontinence (male)
- N39.46 Mix incontinence
- N39.45 Continuous leakage
- N39.49 Overflow incontinence
- N39.398 Other specified urinary incontinence
- R25.0 Frequency of micturition
- R39.15 Urgency of urination

Procedure Codes

- 0TSC0ZZ Reposition Bladder Neck, Open Approach
- 0TSC4ZZ Reposition Bladder Neck, Percutaneous Endoscopic Approach
- 0TSD0ZZ Reposition Urethra, Open Approach
- 0TSD4ZZ Reposition Urethra, Percutaneous Endoscopic Approach
- 0TQD0ZZ Repair Urethra, Open Approach
- 0TQD3ZZ Repair Urethra, Percutaneous Approach
- 0TQD4ZZ Repair Urethra, Percutaneous Endoscopic Approach
- 0TQD7ZZ Repair Urethra, Via Natural or Artificial Opening
- 0TQD8ZZ Repair Urethra, Via Natural or Artificial Opening Endoscopic

- 0TQDXZZ Repair Urethra, External Approach
- 0TUC0JZ Supplement Bladder Neck with Synthetic Substitute, Open Approach
- 0TUC4JZ Supplement Bladder Neck with Synthetic Substitute, Percutaneous Endoscopic Approach
- 0TUC7JZ Supplement Bladder Neck with Synthetic Substitute, Via Natural or Artificial Opening
- 0TUC8JZ Supplement Bladder Neck with Synthetic Substitute, Via Natural or Artificial Opening Endoscopic
- 0TUC07Z Supplement Bladder Neck with Autologous Tissue Substitute, Open Approach
- 0TUC0KZ Supplement Bladder Neck with Nonautologous Tissue Substitute, Open Approach
- 0TUC47Z Supplement Bladder Neck with Autologous Tissue Substitute, Percutaneous Endoscopic Approach
- 0TUC4KZ Supplement Bladder Neck with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
- 0TUC77Z Supplement Bladder Neck with Autologous Tissue Substitute, Via Natural or Artificial Opening
- 0TUC7KZ Supplement Bladder Neck with Nonautologous Tissue Substitute, Via Natural or Artificial Opening
- 0TUC87Z Supplement Bladder Neck with Autologous Tissue Substitute, Via Natural or Artificial Opening Endoscopic
- 0TUC8KZ Supplement Bladder Neck with Nonautologous Tissue Substitute, Via Natural or Artificial Opening Endoscopic
- 3E0K3GC Introduction of Other Therapeutic Substance into Genitourinary Tract, Percutaneous Approach
- 3E0K4GC Introduction of Other Therapeutic Substance into Genitourinary Tract, Percutaneous Endoscopic Approach

Pelvic Organ Prolapse:

The following codes are used to capture Pelvic Organ Prolapse related treatments and procedures:

CPT

- 57240 Anterior colporrhaphy, repair of cystocele with or without repair of urethrocele, including cystourethroscopy, when performed
- 57250 Posterior colporrhaphy, repair of rectocele with or without perineorrhaphy
- 57260 Combined anteroposterior colporrhaphy, including cystourethroscopy, when performed
- 57265 Combined anteroposterior colporrhaphy, including cystourethroscopy, when performed with enterocele repair
- 57267 Insertion of mesh or other prosthesis for repair of pelvic floor defect, each site (anterior, posterior compartment), vaginal approach (List separately in addition to code for primary procedure
- 57268 Repair of enterocele, vaginal approach (separate procedure)

- 57270 Repair of enterocele, abdominal approach (separate procedure)
- 57280 Colpopexy, abdominal approach
- 57282 Colpopexy, vaginal; extra-peritoneal approach (sacrospinous, iliococcygeus)
- 57283 Colpopexy, vaginal; intra-peritoneal approach (uterosacral, levator myorrhaphy)
- 57289 Pereyra procedure, including anterior colporrhaphy
- 57295 Revision (including removal) of prosthetic vaginal graft; vaginal approach
- 57296 Revision (including removal) of prosthetic vaginal graft; open abdominal approach
- 57423 Paravaginal defect repair (including repair of cystocele, if performed), laparoscopic approach
- 57425 Laparoscopy, surgical, colpopexy (suspension of vaginal apex)
- 57426 Revision (including removal) of prosthetic vaginal graft, laparoscopic approach
- 58400 Under Repair Procedures on the Corpus Uteri
- 57300 Closure of rectovaginal fistula, vaginal or transanal approach
- 57305 Closure of rectovaginal fistula, Abdominal approach
- 57307 Closure of rectovaginal fistula, Abdominal approach with concomitant colostomy
- 57308 Closure of rectovaginal fistula, transperineal approach, with perineal body reconstruction, with or without levator plication
- 57200 Non-obstetrical, colporrhaphy
- 57261 Anteroposterior colporrhaphy
- 57262 Anteroposterior colporrhaphy
- 57263 Anteroposterior colporrhaphy
- 57264 Anteroposterior colporrhaphy
- 57210 Colpoperineorrhaphy, suture of injury of vagina and/or perineum
- 57230 Plastic repair of urethrocele
- 57220 plastic operation on urethral sphincter, vaginal approach
- 57284 Paravaginal defect repair
- 57285 Vaginal approach
- 57291 Construction of artificial vagina, without graft
- 57292 Construction of artificial vagina, with graft
- 57335 Vaginoplasty for intersex state
- 58410 Uterine suspension, with presacral sympathectomy

HCPCS

- C1781 Mesh (implantable)
- C1763 Connective tissue, separate payment made non-human (includes synthetic)
- S2900 Surgical techniques requiring use of robotic surgical system (e.g., robot-assistance sacrocolpopexy)

ICD9

Diagnosis Codes

- 618.00 Genital Prolapse
- 618.01 Cystocele, midline
- 618.02 Cystocele, lateral
- 618.03 Urethrocele

- 618.04 Rectocele
- 618.05 Perineocele
- 618.06 Other prolapse of vaginal walls without mention of uterine prolapse
- 618.09 Genital prolapse
- 618.1 Uterine prolapse without vaginal wall prolapse
- 618.2 Uterovaginal prolapse incomplete
- 618.3 Uterovaginal prolapse complete
- 618.4 Uterovaginal prolapse unspecified
- 618.5 Prolapse of vaginal vault after hysterectomy
- 618.6 Vaginal enterocele congenital or acquired
- 618.7 Old laceration of muscles of pelvic floor
- 618.8 Other specified genital prolapse
- 618.81 Incompetence of weakening of pubocervical tissue
- 618.82 Incompetence or weakening of rectovaginal tissue
- 618.83 Pelvic muscle wasting
- 618.84 Cervical stump prolapse
- 618.89 Other specified genital prolapse
- 618.9 Unspecified genital prolapse

Procedure Codes

- 70.50 Repair of cystocele and rectocele
- 70.51 Repair of cystocele
- 70.52 Repair of rectocele
- 70.53 Repair of cystocele and rectocele with graft or prosthesis
- 70.55 Repair of rectocele with graft or prosthesis
- 70.63 Vaginal construction with graft or prosthesis
- 70.64 Vaginal reconstruction with graft or prosthesis
- 70.76 Vaginal suspension and fixation
- 70.77 Vaginal suspension and fixation with graft or prosthesis
- 70.93 Repair of vaginal enterocele with graft or prosthesis

ICD10

Diagnosis Codes

- N81.0 Urethrocele
- N81.11 Cystocele, midline
- N81.12 Cystocele, lateral
- N81.2 Incomplete uterovaginal prolapse
- N81.3 Complete uterovaginal prolapse
- N81.5 Vaginal enterocele
- N81.6 Rectocele
- N81.81 Perineocele
- N81.82 Incompetence or weakening of pubocervical tissue
- N81.83 Incompetence or weakening of rectovaginal tissue
- N81.84 Pelvic muscle wasting
- N81.85 Cervical stump prolapse

- N81.89 Other female genital prolapse
- N81.10 Cystocele, unspecified
- N81.4 Uterovaginal prolapse, unspecified
- N81.9 Female genital prolapse, unspecified
- N99.3 Prolapse of vaginal vault after hysterectomy

Procedure Codes

- 0JQC0ZZ Repair Pelvic Region Subcutaneous Tissue and Fascia, Open Approach
- 0JQC3ZZ Repair Pelvic Region Subcutaneous Tissue and Fascia, Percutaneous Approach
- 0USG0ZZ Reposition Vagina, Open Approach
- 0USG4ZZ Reposition Vagina, Percutaneous Endoscopic Approach
- 0USG7ZZ Reposition Vagina, Via Natural or Artificial Opening
- 0USG8ZZ Reposition Vagina, Via Natural or Artificial Opening Endoscopic
- 0USGXZZ Reposition Vagina, External Approach
- 0UQK0ZZ Repair Hymen, Open Approach
- 0UQK3ZZ Repair Hymen, Percutaneous Approach
- 0UQK4ZZ Repair Hymen, Percutaneous Endoscopic Approach
- 0UQK7ZZ Repair Hymen, Via Natural or Artificial Opening
- 0UQK8ZZ Repair Hymen, Via Natural or Artificial Opening Endoscopic
- 0UQKXZZ Repair Hymen, External Approach
- 0UUG07Z Supplement Vagina with Autologous Tissue Substitute, Open Approach
- 0UUG0JZ Supplement Vagina with Synthetic Substitute, Open Approach
- 0UUG0KZ Supplement Vagina with Nonautologous Tissue Substitute, Open Approach
- 0UUG47Z Supplement Vagina with Autologous Tissue Substitute, Percutaneous Endoscopic Approach
- 0UUG4JZ Supplement Vagina with Synthetic Substitute, Percutaneous Endoscopic Approach
- 0UUG4KZ Supplement Vagina with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
- 0UUG77Z Supplement Vagina with Autologous Tissue Substitute, Via Natural or Artificial Opening
- 0UUG7JZ Supplement Vagina with Synthetic Substitute, Via Natural or Artificial Opening
- 0UUG7KZ Supplement Vagina with Nonautologous Tissue Substitute, Via Natural or Artificial Opening
- 0UUG87Z Supplement Vagina with Autologous Tissue Substitute, Via Natural or Artificial Opening Endoscopic
- 0UUG8JZ Supplement Vagina with Synthetic Substitute, Via Natural or Artificial Opening Endoscopic
- 0UUG8KZ Supplement Vagina with Nonautologous Tissue Substitute, Via Natural or Artificial Opening Endoscopic
- 0UUGX7Z Supplement Vagina with Autologous Tissue Substitute, External Approach
- 0UUGXJZ Supplement Vagina with Synthetic Substitute, External Approach
- 0UUGXKZ Supplement Vagina with Nonautologous Tissue Substitute, External Approach

- 0JUC07Z Supplement of Pelvic Region Subcutaneous Tissue and Fascia with Autologous Tissue Substitute, Open Approach
- 0JUC0JZ Supplement of Pelvic Region Subcutaneous Tissue and Fascia with Synthetic Substitute, Open Approach
- 0JUC0KZ Supplement of Pelvic Region Subcutaneous Tissue and Fascia with Nonautologous Tissue Substitute, Open Approach
- 0JUC37Z Supplement of Pelvic Region Subcutaneous Tissue and Fascia with Autologous Tissue Substitute, Percutaneous Approach
- 0JUC3JZ Supplement of Pelvic Region Subcutaneous Tissue and Fascia with Synthetic Substitute, Percutaneous Approach
- 0JUC3KZ Supplement of Pelvic Region Subcutaneous Tissue and Fascia with Nonautologous Tissue Substitute, Percutaneous Approach
- 0UUF07Z Supplement Cul-de-sac with Autologous Tissue Substitute, Open Approach
- 0UUF0JZ Supplement Cul-de-sac

Sterilization/LARC:

The following codes are used to capture Sterilization/LARC related treatments and procedures:
Note: *Codes related to medical devices as opposed to oral contraceptives are provided below. However, further clinical insight is needed to determine if these codes are appropriate.*

CPT
- 58300 Insertion, intrauterine device
- 58301 Removal, intrauterine device
- 11981 Insertion, non-biodegradable drug delivery implant
- 11982 Removal, non-biodegradable drug delivery implant

HCPCS
- J7300 Intrauterine copper contraceptive (ParaGard T-380A)
- J7298 Levonorgestrel-releasing intrauterine contraceptive system, 52mg, 5-year duration [Mirena]
- J7302 Levonorgestrel-releasing intrauterine contraceptive system, 52mg
- J7307 Nexplanon implant

ICD9
Diagnosis Codes
- V25.11 Insertion of intrauterine contraceptive device (Encounter for insertion of IUD)
- V25.12 Removal of intrauterine contraceptive device (Encounter for removal of IUD)
- V25.13 Encounter for removal and reinsertion of intrauterine contraceptive device
- V25.2 Sterilization
- V25.5 Insertion of implantable subdermal contraceptive
- V25.42 Surveillance of intrauterine contraceptive device
- V25.43 Surveillance of implantable subdermal contraceptive
- V26.51 Tubal ligation status

Procedure Codes

- 97.71 Removal of intrauterine contraceptive device
- 66.0 Salpingotomy And Salpingostomy
- 66.2 Bilateral Endoscopic Destruction or Occlusion of Fallopian Tubes
- 66.3 Other Bilateral Destruction or Occlusion of Fallopian Tubes
- 66.4 Total unilateral salpingectomy
- 66.5 Total Bilateral Salpingectomy
- 66.6 Other Salpingectomy

ICD10

Diagnosis Codes

- Z30.014 Encounter for initial prescription of intrauterine contraceptive device
- Z30.015 Encounter for initial prescription of vaginal ring hormonal contraceptive
- Z30.018 Initial prescription of other contraceptives
- Z30.43 Encounter for surveillance of intrauterine contraceptive device
- Z30.430 Encounter for insertion of intrauterine contraceptive device
- Z30.431 Encounter for routine checking of intrauterine contraceptive device
- Z30.432 Encounter for removal of intrauterine contraceptive device
- Z30.433 Encounter for removal and reinsertion of intrauterine contraceptive device
- Z30.44 Encounter for surveillance of vaginal ring hormonal contraceptive device
- Z30.2 Encounter for sterilization
- Z30.49 Encounter for surveillance of other contraceptives
- Z97.5 Presence of Implant
- Z98.51 Tubal ligation status

Procedure Codes

- 0UPD7HZ Removal of Contraceptive Device from Uterus and Cervix, Via Natural or Artificial Opening
- 0UPD8HZ Removal of Contraceptive Device from Uterus and Cervix, Via Natural or Artificial Opening Endoscopic
- 0UT50ZZ Resection of Right Fallopian Tube, Open Approach
- 0UT54ZZ Resection of Right Fallopian Tube, Percutaneous Endoscopic Approach
- 0UT57ZZ Resection of Right Fallopian Tube, Via Natural or Artificial Opening
- 0UT58ZZ Resection of Right Fallopian Tube, Via Natural or Artificial Opening Endoscopic
- 0UT5FZZ Resection of Right Fallopian Tube, Via Natural or Artificial Opening With Percutaneous Endoscopic Assistance
- 0UT60ZZ Resection of Left Fallopian Tube, Open Approach
- 0UT64ZZ Resection of Left Fallopian Tube, Percutaneous Endoscopic Approach
- 0UT67ZZ Resection of Left Fallopian Tube, Via Natural or Artificial Opening
- 0UT68ZZ Resection of Left Fallopian Tube, Via Natural or Artificial Opening Endoscopic
- 0UT6FZZ Resection of Left Fallopian Tube, Via Natural or Artificial Opening With Percutaneous Endoscopic Assistance

C. Acronyms

Acronym	Definition
API	Application Programming Interfaces are programming functions that allow a company or organization to share a program with outside programmers for cooperative use in their own programs. API also facilitates the exchange of information between systems.
AHRQ	The Agency for Healthcare Research and Quality
ASPE	The Assistant Secretary for Planning and Evaluation
CDEs	Common Data Elements
CDRH	Center for Devices and Radiological Health
CRN	Coordinated Registry Network whose intention is to leverage the data collected in each registry for multiple use cases for women's health and post-market device surveillance
CMS	The Centers for Medicare & Medicaid Services
CPT	Current Procedural Terminology
Dorsata	A Platform for the Creation and Distribution of Pathway-Based, EHR-Integrated Application
DAF	The Data Access Framework, a completed ONC initiative focused on the data extraction from local and targeted enterprises and from clinical research sites
DUA	Data Use Agreement
EHR	An Electronic Health Record is an electronic version of a patient's medical history that is maintained by the provider over time, and may include all of the key administrative clinical data relevant to that persons care.
FDA	Federal Drug Administration, the agency responsible for drug and device approvals for the country
FHIR®	Fast Healthcare Interoperability Resources (FHIR®) is a draft standard describing data formats and elements (known as "resources") and an application programming interface (API) for exchanging electronic health records, created by HL7
GUDID	Global Unique Device Identification Database
HL7	Health Level Seven International (HL7) is a not-for-profit, ANSI-accredited standards developing organization dedicated to providing a comprehensive framework and related standards for the exchange, integration, sharing, and retrieval of electronic health information that supports clinical practice and the management, delivery and evaluation of health services
ICD	International Classification of Diseases
Interoperability	The ability of computer systems or software to exchange and make use of information
IETF	Internet Engineering Task Force is an international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet
MOU	Memorandum of Understanding
NESTcc	Nest Coordinating Center

NIH	National Institutes of Health, which is a federal agency leading the country's research programs for improving health
NLM	National Library of Medicine, one of 27 Institutes that comprise NIH
MDEpiNet	Medical Device Epidemiology Network Initiative
ONC	The Office of the National Coordinator for Health Information Technology
Point of care	The point in time when clinicians deliver healthcare products and services to patients at the time of care
PCOR	Patient-centered outcomes research: Research that helps people and their caregivers communicate and make informed healthcare decisions, while allowing their voices to be heard in assessing the value of healthcare options. (Source: https://www.pcori.org/glossary)
PCORI	Patient-Centered Outcomes Research Institute, which is an independent US nonprofit organization authorized by Congress to fund comparative clinical effectiveness research, or CER.
PCORTF	Patient-Centered Outcomes Research Trust Fund receives income from three funding streams: appropriations from the general fund of the Treasury, transfers from the Centers for Medicare and Medicaid trust funds, and a fee assessed on private insurance and self-insured health plans (the PCOR fee)
PRA	Paperwork Reduction Act is a US federal law enacted in 1980 designed to reduce the total amount of paperwork burden the federal government imposes on private businesses and citizens
Patient-Reported Outcomes (PROs)	A PRO is directly reported by the patient without interpretation of the patient's response by a clinician or anyone else and pertains to the patient's health, quality of life, or functional status associated with health care or treatment
PRO Measures (PROMs)	PROMs are the tools or instruments used to measure PROs. These tools may measure the patient's health status such as health-related quality of life. These tools are often (patient) self-completed questionnaires
RCT	Randomized Clinical Trials
REDCap	REDCap is a secure web application for building and managing online surveys and databases
RWD	Real World Data
RWE	Real World Evidence
SDO	Standards Development Organization
SMART on FHIR®	Substitutable Medical Applications, Reusable Technologies (SMART) on FHIR® is a set of open specifications to integrate apps with Electronic Health Records, portals, Health Information Exchanges, and other Health IT systems
UDI	Unique Device Identifier
WHT	Women's Health Technologies implying the various technologies that can be used to improve women's health
WHT-CRN	Women's Health Technologies Coordinated Registry Network, a project led by FDA and sponsored by PCORTF

D. General Questions Used for Landscape Analysis

Below are the general questions marked against the interviews, in order to provide a level of uniformity in the analysis.

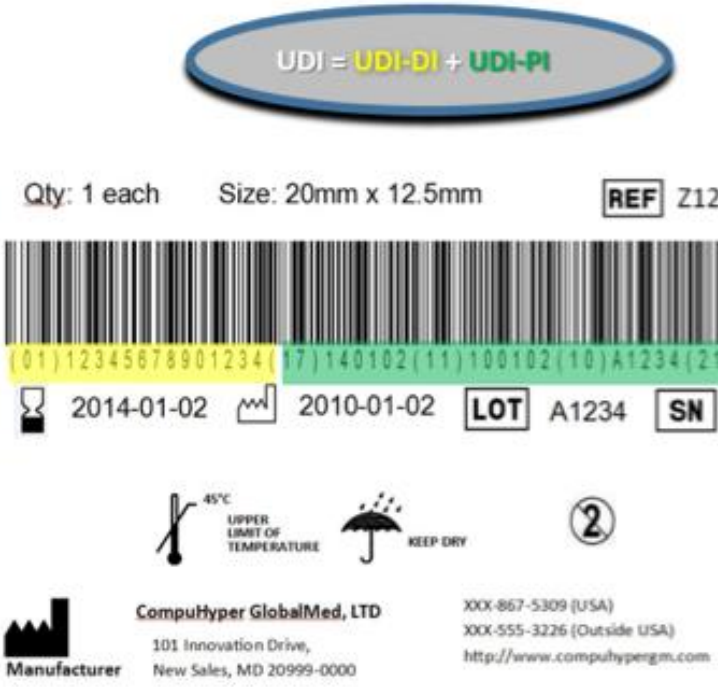
- Who is contributing data to the registry (Ambulatory/Hospitals, others?)
- Are there specific Use Cases that are being addressed by the registry?
- What kind of data is being collected/for what conditions?
- Who is accessing the data/how is it being accessed?
- What tools exist that can be reused?
- Perceived Value from being able to access multiple registries?
- Is there any data related to:
    - Female Sterilization Therapies from CDC
    - UDI data
- What is the primary purpose/founding purpose for your registry?
    - Who uses it for that purpose?
- What are the secondary uses for which data is being collected?
    - Who uses it for those purposes?
- What is your data capture workflow (how is the data received, inputted, and used)?
- Are any of your variables or measures currently defined for electronic capture and exchange?
- What information materials about your data elements do you have to provide (e.g., data dictionary, brochures, and training materials)?
- Where will the data be stored?
- Where will the data be sent to, e.g. FDA?
- What linkages or sources for comparison are being thought about, e.g. Medicare data?
- Are standardized assessments being used or are they individual questions?
- If standardized assessments are being used provide the Name and Version, with citation if known?
- Technical Standards
    - What kind of standards are being used (if any) for:
        - Data collection
        - Data exchanged
        - To be used for structured data collection
    - Expectation on workflow interaction given that data entry is always a burden
    - Thoughts about the FHIR® Standard for data collection
        - HSPC Tools
        - SDC tools and Implementation Guides (IGs)
        - SMART on FHIR® Apps

E. Summary of Stakeholder Findings from Landscape Analysis

Topic Areas	Stakeholder Findings
Stakeholder Use of Data Elements	The environmental assessment determined that registries are collecting various data elements based on their specific use case for women's health. The most common use cases are in both research and industry with data elements being captured vary in number, ranging from a low end of 47 data elements to upwards of 1,500 data elements. There is also a lack of common core data elements across the registries and some (registries) are still in their infancy identifying data elements.
Stakeholder Data Collecting Techniques	Data collection methods among registries indicate significant variations with differing systems, people, processes and workflows involved in the capture of quality data. The most common method includes the use of research coordinators, in varying capacities, to facilitate data collection via Questionnaires to patients or clinicians. These Questionnaires range from Quality of life (USF QOL) to Structured Surveys given to Patients pre and post-op. Some registries developed electronic portals to enter data, and a few are using standalone apps (i.e. Family Planning, Prenatal Apps) that are integrated within EHRs to collect data during clinical visits and will eventually administer PROs. Others are performing telephonic and in-person interviews to collect the data and subsequently enter the data into systems. There are also instances where registries are extracting data from EHR clinical records (manually and automatically) to populate the necessary data elements for the registries. These variations reflect the technical capabilities of different registries where some have the necessary infrastructure and tools to collect the data and while others do not. The techniques described above are uniquely developed for each registries with little standardization among them.
Stakeholder Technologies, Systems and Capabilities	The environmental assessment highlighted the diverse capabilities of registries due to their technologies and systems. As stated previously, some registries developed their own system such as electronic portals to enter data, and a few continue to utilize standalone apps (i.e. Family Planning, Prenatal Apps) which are integrated within EHRs to collect data during clinical visits and will eventually administer PROs. Other registries are using open source web based software such as REDcap due to their security and ability to use de-identified data across institutions. Microsoft Excel and Access were still used among some registries, but have limited capabilities, causing some registries to consider other avenues of technologies and systems. Each technology had moderate to no integration in EHRs. These variations reflect the technical capabilities of different registries where some have the necessary infrastructure and tools to collect the data and while others do not. This results in making the entire infrastructure less interoperable and more complex to create a linked set of registries to achieve the WHT-CRN goals.
Stakeholder Use of Health Standards	It was reported during the environmental assessment that technical healthcare standards are not widely used to define data elements, to collect structured data (data that is machine processable) and to store standardized data. While

	many of the registries are currently not using any standards, a few have implemented some standards (i.e. FHIR®, SNOMED, LOINC) or were using standardized instruments (EQ-5Q, USF QOL). Many factors contribute to the minimal adoption of standards as part of the registry ecosystem and one such factor that stood out was the lack in developments of standards to meet all the needs of various registries.
Stakeholder Data Linkages	The environmental assessment affirmed that there is currently minimal linkage of data across registries The majority of registries have little to no integration with EHRs, such as EPIC and CERNER, or have very minimal integration. There is no common technical infrastructure that exists to help with the registry operations since there is not a coordinated network of registries.
Stakeholder Re-usable Artifacts	Efficient use of technology to collect data and synchronize with EHRs and other necessary systems can significantly reduce the burden placed on providers. This efficiency can be maximized with reusable artifacts that can be shared among registries providing evidence that registries have a wealth of knowledge that can be repurposed by the WHT-CRN project. Some of the reusable artifacts include data dictionaries (which the majority of registries currently have), use cases and workflow designs which have been successfully executed, and some standardized instruments used to collect data (UFS QOL, PROs).

F. What is a Unique Device Identifier (UDI) and how to use it in Electronic Datasets



UDI comprises of UDI-DI (UDI-Device Identifier and UDI-PI (UDI- Production Identifier). The UDI must be present on the label of a device in machine readable and human readable formats
UDI-DI is unique to a specific model/version of a medical device
UDI-PI include: Lot Number, Serial Number, Manufacture Date, Expiration Date, Distinct Identification Code

The document available on IMDRF website provides instructions on how to use UDI in healthcare electronic systems: System requirements related to use of UDI in healthcare(N54).

Office of National Coordinator also requires the documentation of UDI for implants (§170.315 (a)(14) *Implantable device list):* https://www.healthit.gov/test-method/implantable-device-list#

IX. References

[i]Chughtai B, Mao J, Buck J, Kaplan S, Sedrakyan A. Use and risks of surgical mesh for pelvic organ prolapse surgery in women in New York state: Population based cohort study. *BMJ*. 2015;350. doi:10.1136/bmj.h2685

[ii] Chughtai B, Barber MD, Mao J, Forde JC, Normand ST, Sedrakyan A. Association Between the Amount of Vaginal Mesh Used With Mesh Erosions and Repeated Surgery After Repairing Pelvic Organ Prolapse and Stress Urinary Incontinence. *JAMA Surg*. 2017;152(3):257-263. doi:10.1001/jamasurg.2016.4200 [doi]

[iii] Walter JR, Ghobadi CW, Hayman E, Xu S. Hysteroscopic Sterilization With Essure: Summary of the U.S. Food and Drug Administration Actions and Policy Implications for Post-marketing Surveillance. *Obstet Gynecol*. 2017;129(1):10-19. doi:10.1097/AOG.0000000000001796

[iv] U. S. Food and Drug Administration. Women's Health Research – Understanding Sex Differences at FDA. Available at: https://www.fda.gov/science-research/womens-health-research/understanding-sex-differences-fda

[v] U. S. Food and Drug Administration. Women's Health Research Roadmap – A Strategy for Science and Innovation to Improve the Health of Women. February 2018. Available at: https://www.fda.gov/science-research/womens-health-research/womens-health-research-roadmap

[vi] U. S. Food and Drug Administration, Center for Devices and Radiological Health. Evaluation of Sex-Specific Data in Medical Device Clinical Studies - Guidance for Industry and Food and Drug Administration Staff. August 2014. Available at: https://www.fda.gov/media/82005/download

[vii] U. S. Food and Drug Administration: Center for Devices and Radiological Health. Health of Women Program, The CDRH Health of Women Strategic Plan, issued September 2019, Silver Spring, Maryland. Available at: https://www.fda.gov/media/130971/download

[viii] U.S. Food and Drug Administration. MAUDE – Manufacturer and User Facility Device Experience. October 2019. Available at: http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfMAUDE/TextSearch.cfm

[ix] Dhruva SS, Ross JS, Gariepy AM. Revisiting Essure—toward safe and effective sterilization. *Obstetrical & Gynecological Survey*. 2016 Feb 1;71(2):86-7.

[x] U. S. Food and Drug Administration. FDA News Release. April 2016. FDA takes action to protect women's health, orders manufacturers of surgical mesh intended for transvaginal repair of pelvic organ prolapse to stop selling all devices. Available at: https://www.fda.gov/news-events/press-announcements/fda-takes-action-protect-womens-health-orders-manufacturers-surgical-mesh-intended-transvaginal

[xi] U. S. Food and Drug Administration. Essure Permanent Birth Control. Available at: https://www.fda.gov/medical-devices/implants-and-prosthetics/essure-permanent-birth-control

[xii] Dhruva SS, Ross JS, Gariepy AM. Revisiting Essure--Toward Safe and Effective Sterilization. *N Engl J Med.* 2015 Oct 8;373(15):e17. doi: 10.1056/NEJMp1510514. Epub 2015 Sep 23. PubMed PMID: 26397951.

[xiii] U.S. Food and Drug Administration. 2015 Meeting Materials of the Obstetrics and Gynecology Devices Panel. March 2016. Available at: https://wayback.archive-it.org/7993/20170112001932/http:/www.fda.gov/AdvisoryCommittees/CommitteesMeetingMaterials/MedicalDevices/MedicalDevicesAdvisoryCommittee/ObstetricsandGynecologyDevices/ucm463457.htm

[xiv] U.S. Food and Drug Administration: Center for Devices and Radiological Health. Strengthening Our National System for Medical Device Surveillance: Update and Next Steps. 2013;(April):11.
[xv] Wu JM, Matthews CA, Conover MM, Pate V, Jonsson Funk M. Lifetime risk of stress urinary incontinence or pelvic organ prolapse surgery. *Obstet Gynecol.* 2014;123(6):1201-1206.
[xvi] Chughtai BI, Elterman DS, Vertosick E, Maschino A, Eastham JA, Sandhu JS. Midurethral sling is the dominant procedure for female stress urinary incontinence: analysis of case logs from certifying American Urologists. Urology. 2013;82(6):1267-1271.
[xvii] U. S. Food and Drug Administration. FDA's Considerations about Surgical Mesh for SUI. May 2019. Available at: https://www.fda.gov/medical-devices/urogynecologic-surgical-mesh-implants/considerations-about-surgical-mesh-sui
[xviii] U. S. Food and Drug Administration. FDA's Activities: Urogynecologic Surgical Mesh. October 2019. Available at: https://www.fda.gov/medical-devices/urogynecologic-surgical-mesh-implants/fdas-activities-urogynecologic-surgical-mesh
[xix] Kocjancic E, Mourad S, Acar Ö. Complications of urethral bulking therapy for female stress urinary incontinence. *Neurourol Urodyn.* 2019 Aug;38 Suppl 4:S12-S20.
[xx] Chughtai B, Barber MD, Mao J, Forde JC, Normand ST, Sedrakyan A. Association Between the Amount of Vaginal Mesh Used With Mesh Erosions and Repeated Surgery After Repairing Pelvic Organ Prolapse and Stress Urinary Incontinence. *JAMA Surg.* 2017 Mar 1;152(3):257-263. doi: 10.1001/jamasurg.2016.4200. PMID: 27902825.
[xxi] Chughtai, B., et al., Failures of Sacral Neuromodulation for Incontinence. *JAMA Surg*, 2018. 153(5): p. 493-494.
[xxii] Chughtai, B., et al., Challenging the Myth: Transvaginal Mesh is Not Associated with Carcinogenesis. *J Urol*, 2017. 198(4): p. 884-889.
[xxiii] Olsen AL, Smith VJ, Bergstrom JO, et al. Epidemiology of surgically managed pelvic organ prolapse and urinary incontinence. *Obstet Gynecol*. 1997;89:501-6.
[xxiv] Boyles SH, Weber AM, Meyn L. Procedures for pelvic organ prolapse in the United States, 1979-1997. *Am J Obstet Gynecol*. 2003;188:108-15.
[xxv] U.S. Food and Drug Administration. Surgical Mesh for Transvaginal Repair of Pelvic Organ Prolapse in the Anterior Vaginal Compartment. in Obstetrics and Gynecology Devices Panel. 2019. Gaithersburg, MD. https://www.fda.gov/files/advisory%20committees/published/OGDP-02.12.19-FDA-Presentation.pdf
[xxvi] Mettu JR, Colaco M, Badlani GH. Evidence-based outcomes for mesh-based surgery for pelvic organ prolapse. *Curr Opin Urol*. 2014;24:370-4.
[xxvii] Sung VW, Rogers RG, Schaffer JI, et al. Graft use in transvaginal pelvic organ prolapse repair: a systematic review. *Obstet Gynecol.* 2008;112:1131-42.
[xxviii] Khan AA, Eilber KS, Clemens JQ, et al. Trends in management of pelvic organ prolapse among female Medicare beneficiaries. *Am J Obstet Gynecol.* 2014;212:463.e1-8.
[xxix] Rogo-Gupta L, Rodriguez LV, Litwin MS, et al. Trends in surgical mesh use for pelvic organ prolapse from 2000 to 2010. Obstet Gynecol 2012;120:1105-15.
[xxx] Altman D, Vayrynen T, Engh ME, et al. Anterior colporrhaphy versus transvaginal mesh for pelvic-organ prolapse. *N Engl J Med.* 2011;364:1826-36.
[xxxi] Hiltunen R, Nieminen K, Takala T, et al. Low-weight polypropylene mesh for anterior vaginal wall prolapse: a randomized controlled trial. *Obstet Gynecol.* 2007;110:455-62.

[xxxii] Sokol AI, Iglesia CB, Kudish BI, et al. One-year objective and functional outcomes of a randomized clinical trial of vaginal mesh for prolapse. *Am J Obstet Gynecol.* 2012;206:86.e1-9.
[xxxiii] Anger JT, Khan AA, Eilber KS, et al. Short-term outcomes of vaginal mesh placement among female Medicare beneficiaries. *Urology.* 2014;83:768-73.
[xxxiv] U.S. Food and Drug Administration. Urogynecologic Surgical Mesh: Update on the Safety and Effectiveness of Transvaginal Placement for Pelvic Organ Prolapse. July 2011. Available at: https://www.fda.gov/media/81123/download
[xxxv] U.S. Food and Drug Administration. FDA's Activities: Urogynecologic Surgical Mesh. 2019 April 16; Available at: https://www.fda.gov/medical-devices/urogynecologic-surgical-mesh-implants/fdas-activities-urogynecologic-surgical-mesh.
[xxxvi] U. S. Food and Drug Administration. FDA presentation on Surgical Mesh for Transvaginal Repair of Pelvic Organ Prolapse in the Anterior Vaginal Compartment. Obstetrics and Gynecology Devices Panel. February 12 2019. Available at: https://www.fda.gov/files/advisory%20committees/published/OGDP-02.12.19-FDA-Presentation.pdf.
[xxxvii] Chughtai B, Mao J, Buck J, Kaplan S, Sedrakyan A. Use and risks of surgical mesh for pelvic organ prolapse surgery in women in New York state: population based cohort study [published correction appears in BMJ. 2015;350:h3060]. *BMJ*. 2015;350:h2685. Published 2015 Jun 2. doi:10.1136/bmj.h2685
[xxxviii] Forde, J.C., et al., Role of concurrent vaginal hysterectomy in the outcomes of mesh-based vaginal pelvic organ prolapse surgery. *Int Urogynecol J*. 2017. 28(8): p. 1183-1195.
[xxxix] Chughtai, B., et al., Long-term Device Outcomes of Mesh Implants in Pelvic Organ Prolapse Repairs. Obstet Gynecol. 2020 Mar;135(3):591-598. doi: 10.1097/AOG.0000000000003689.
[xl] Chughtai, B., et al., Challenging the Myth: Transvaginal Mesh is Not Associated with Carcinogenesis. J Urol, 2017. 198(4): p. 884-889.
[xli] Chughtai, B., et al., Is vaginal mesh a stimulus of autoimmune disease? *Am J Obstet Gynecol*. 2017. 216(5): p. 495 e1-495 e7.
[xlii] Sedrakyan A, Chughtai B, Mao J. Regulatory Warnings and Use of Surgical Mesh in Pelvic Organ Prolapse. *JAMA Intern Med.* 2016;176(2):275–277. doi:https://doi.org/10.1001/jamainternmed.2015.6595
[xliii] U.S. Department of Health and Human Services Office on Women's Health: Uterine Fibroids. Available at https://www.womenshealth.gov/a-z-topics/uterine-fibroids
[xliv] Hartmann KE, Fonnesbeck C, Surawicz T, Krishnaswami S, Andrews JC, Wilson JE, Velez-Edwards D, Kugley S, Sathe NA. Management of Uterine Fibroids. Comparative Effectiveness Review No. 195. (Prepared by the Vanderbilt Evidence-based Practice Center under Contract No. 290-2015-00003-I.) AHRQ Publication No. 17(18)-EHC028-EF. Rockville, MD: Agency for Healthcare Research and Quality; December 2017. www.effectivehealthcare.ahrq.gov/reports/final.cfm. doi: https://doi.org/10.23970/AHRQEPCCER195.
[xlv] U. S. Food and Drug Administration. Updated laparoscopic uterine power morcellation in hysterectomy and myomectomy: FDA safety communication. 2014. Available at: https://wayback.archiveit.org/7993/20170404182209/https:/www.fda.gov/MedicalDevices/Safety/AlertsandNotices/ucm424443.htm
[xlvi] U. S. Food and Drug Administration. Updated Assessment of The Use of Laparoscopic Power Morcellators to Treat Uterine Fibroids. December 2017. Available at: https://www.fda.gov/media/109018/download

[xlvii] Mao J, Pfeifer S, Zheng XE, Schlegel P, Sedrakyan A. Population-Based Estimates of the Prevalence of Uterine Sarcoma Among Patients With Leiomyomata Undergoing Surgical Treatment. *JAMA Surg.* 2015;150(4):368–370. doi:https://doi.org/10.1001/jamasurg.2014.3518
[xlviii] Donnez J, Arriagada P, Marciniak M, Larrey D. Liver safety parameters of ulipristal acetate for the treatment of uterine fibroids: a comprehensive review of the clinical development program. *Expert Opinion on Drug Safety*. 2018 Dec 2;17(12):1225-32.
[xlix] Mendelsohn, A.B., et al., Comparative effectiveness of uterine fibroids procedures using linked medical record and claims data. *J Comp Eff Res*, 2018. 7(12): p. 1209-1218.
[l] Jones J, Mosher W, Daniels K. Current contraceptive use in the United States, 2006-2010, and changes in patterns of use since 1995. Natl Health Stat Report 2012;(60):1-25.
[li] Kerin JF, Cooper JM, Price T, Herendael BJ, Cayuela-Font E, Cher D, et al. Hysteroscopic sterilization using a micro-insert device: results of a multicentre phase II study. *Hum Reprod.* 2003;18:1223–30.
[lii] Chudnoff SG, Nichols JE Jr, Levie M. Hysteroscopic Essure inserts for permanent contraception: extended follow-up results of a phase III multicenter international study. *J Minim Invasive Gynecol*. 2015;22:951–60.
[liii] U. S. Food and Drug Administration. Essure Benefits and Risks. Available at: https://www.fda.gov/medical-devices/essure-permanent-birth-control/essure-benefits-and-risks#s2
[liv] Kolata, G. The Sad Legacy of the Dalkon Shield. The New York Times, December 1987. https://www.nytimes.com/1987/12/06/magazine/the-sad-legacy-of-the-dalkon-shield.html
[lv] Byrne K. Medical records in litigation: the Dalkon Shield story. AMRO. 1992;32(5):11–4.
[lvi] The Dalkon Shield controversy. Structural and bacteriological studies of IUD tails. Tatum HJ, Schmidt FH, Phillips D, McCarty M, O'Leary WM *JAMA.* 1975 Feb 17; 231(7):711-7.
[lvii] Mao, J., et al., Safety and efficacy of hysteroscopic sterilization compared with laparoscopic sterilization: an observational cohort study. *BMJ.* 2015. 351: p. h5162.
[lviii] U. S. Food and Drug Administration. Surgical Mesh for Transvaginal Repair of Pelvic Organ Prolapse in the Anterior Vaginal Compartment, Obstetrics and Gynecological Devices Panel, FDA Presentation, February 2019. https://www.fda.gov/files/advisory%20committees/published/OGDP-02.12.19-FDA-Presentation.pdf.
[lix] Mao, J., et al., Seven-Year Outcomes After Hysteroscopic and Laparoscopic Sterilizations. *Obstet Gynecol.* 2019. 133(2): p. 323-331.
[lx] National Institutes of Health (NIH). All of Us Research Program. 2018, May. Available at: https://allofus.nih.gov/
[lxi] Health Level Seven (HL7) Clinical Interoperability Council Workgroup. (2018). Available at: http://www.hl7.org/Special/committees/cic/index.cfm
[lxii] U.S. Food and Drug Administration, Department of Health and Human Service. Unique Device Identification System; Final Rule. 78 Fed. Reg. 185 (2013, September) (to be codified at 21 C.F.R. pts 16, 801, 803, 806, 810, 814, 820, 821, 822, and 830)
[lxiii] IMDRF UDI Working Group. UDI Guidance, Unique Device Identification (UDI) of Medical Devices. (2013, December). Available at: http://www.imdrf.org/docs/imdrf/final/technical/imdrf-tech-131209-udi-guidance-140901.pdf
[lxiv] IMDRF UDI Working Group. Unique Device Identification system (UDI system) Application Guide. (2018, July). Available at: http://www.imdrf.org/docs/imdrf/final/consultations/imdrf-cons-udi-system-n48-180712.pdf

[lxv] Bashyam, N., Marquard, B. & Haas, E. (2017, March). 'HL7 FHIR® Data Access Framework (DAF) for Research Implementation Guide Release 2.' Health Level 7. Available at: http://hl7.org/fhir/us/daf-research/STU2/index.html
[lxvi] Health Level Seven (HL7) Structured Data Capture (SDC) Implementation Guide (IG) v2. (2018). Available at: http://hl7.org/fhir/us/sdc/index.html
[lxvii] Hillis SD, Marchbanks PA, Tylor LR, Peterson HB. Poststerilization regret: findings from the United States collaborative review of sterilization. *Obstet Gynecol.* 1999 Jun 1;93(6):889-95.
[lxviii] Clark NV, Endicott SP, Jorgensen EM, Hur HC, Lockrow EG, Kern ME, Jones-Cox CE, Dunlow SG, Einarsson JI, Cohen SL. Review of sterilization techniques and clinical updates. J *Minim Invasive Gynecol.* 2018 Nov 1;25(7):1157-64.
[lxix] Brown BB. Delphi process: a methodology used for the elicitation of opinions of experts. 1968.
[lxx] Hsu CaS, BA. The Delphi technique: making sense of consensus. *Practical Assessment, Research & Evaluation*. 2007.
[lxxi] Yousuf M. Using experts' opinions through Delphi technique. *Practical Assessment, Research & Evaluation.* 2007;12.
[lxxii] Health Level Seven: FHIR® Clinical Introduction. (2019, September). Available at: http://www.hl7.org/FHIR/overview-clinical.html
[lxxiii] HL7 FHIR® Patient Consent for Record Sharing example. (2019, September). Available at: https://www.hl7.org/fhir/extensibility-examples.html
[lxxiv] Health Level Seven: FHIR® Profiles. (2019, October). Available at: http://www.hl7.org/FHIR/overview-clinical.html
[lxxv] HL7 FHIR® WHT-CRN IG. (2019, September) Available at: http://hl7.org/fhir/us/womens-health-registries/2019May/
[lxxvi] HL7 FHIR® WHT-CRN IG. (2019, October) Available at: https://drive.google.com/file/d/1GGRZOJcLBAW_p_czcfaSe7xAirs8KPw6/view?usp=sharing
[lxxvii] HL7 FHIR® WHT-CRN IG. (2019, October) Available at: https://drive.google.com/file/d/17h-EFoae123Sfr4YexFsEEM8xzcPRElF/view?usp=sharing
[lxxviii] HL7 FHIR® WHT-CRN IG. (2019, October) Available at: https://drive.google.com/file/d/1Wo0aMvGkfBsamzaO7lBKftkfKZZoDqo5/view
[lxxix] HL7 FHIR® WHT-CRN IG. (2019, October) Available at: https://drive.google.com/file/d/1TTAgkFzDEcVJbfrYI4fQChjokaYTbYEz/view
[lxxx] Health Level Seven (HL7) FHIR® US Core Implementation Guide (IG) v3. (2019). Available at: https://www.hl7.org/fhir/us/core/
[lxxxi] HL7 FHIR® WHT-CRN IG. (2019, September) Available at: http://hl7.org/fhir/us/womens-health-registries/2019May/profiles.html
[lxxxii] HL7 FHIR® WHT-CRN IG. (2019, September) Available at: http://hl7.org/fhir/us/womens-health-registries/2019May/