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Subclinical Atherosclerosis Vascular Evaluation (SAVE): Nurse Practitioner Barriers to and Facilitators of Research Utilization Regarding Screening for Subclinical Atherosclerosis

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Abstract

The project identified factors affecting implementation of evidence-based non-invasive screening tests to identify early stage cardiovascular disease (CVD). The use of coronary artery calcium scores and carotid intima media thickness testing improves accuracy of risk stratification over risk factor scoring systems alone. The purpose of this project was to identify NP's perceived barriers to and facilitators of utilization of evidence-based non-invasive CVD screening tests and to make recommendations for improvements in implementation. The SAVE project consisted of a cross-sectional survey of 64 nurse practitioners, recruited using a multi-pronged strategy, using Funk's barriers instrument plus two additional qualitative questions regarding intent to implement. Roger's diffusion of innovations model provided the framework to identify perceived barriers and facilitators. The results revealed the top six barriers were related to characteristics of the nurse practitioner, the organization, and communication. Themes, based on Roger's adoption phase, were apparent in the NP-identified facilitators. The five facilitator themes were communication and education, partnerships, clinical applicability, guidelines, and availability of the research. These facilitators could be helpful in overcoming the barriers to utilization of the evidence-based strategies, leading to early detection and appropriate treatment recommendations.

Keywords: nurse practitioner, barriers, facilitator, subclinical atherosclerosis, cardiovascular disease screening

Introduction

Since 1919, cardiovascular disease (CVD) has been the leading cause of death in the United States accounting for one in three deaths which is more than all types of cancer combined (Benjamin, et al., 2017). Annual CVD costs total more than 32.1 billion dollars in the US and are projected to increase (Briffa & Tonkin, 2013). The American Heart Association (AHA) 2020 impact goal is to improve cardiovascular health and reduce CVD deaths (Benjamin, et al., 2017). Identification of CVD disease presence or absence is important for both improving CV health and reducing CVD deaths. Mortality and cost statistics combined with the AHA improvement goal highlights the opportunity to screen for and intervene early in the CVD process before a costly devastating heart attack or ischemic stroke occurs.

Most heart attacks and strokes occur from small areas of ruptured plaque which cause thrombi. Early stage arterial atherosclerosis identification provides not only increased accuracy of risk stratification, but also an increased opportunity for appropriate treatment recommendations for atherosclerotic disease process stabilization. Both computed tomography coronary (CT) artery calcium scoring (CACS) and ultrasound carotid intima-media arterial (CIMT) evaluation are safe, non- invasive screening tests for early stage arterial atherosclerosis identification. Although supportive evidence exists for the additive value of these tests to traditional risk factor-based, the tests are not widely utilized.

Problem Statement

Accurate risk assessment improves appropriate treatment recommendations to minimize progression of atherosclerotic disease and mitigate the potential for a cardiovascular event occurrence. A gap exists between research and clinical practice regarding the use of various types of CVD risk stratification (Doneen, 2014).

Purpose

The purpose of the "Subclinical Atherosclerosis Vascular Evaluation (SAVE): Nurse Practitioner Barriers to and Facilitators of Research Utilization Regarding Screening for Subclinical Atherosclerosis" project was to identify barriers to and facilitators of nurse practitioner implementation of CVD non-invasive screening tests, CACS and CIMT, into clinical practice.

Review of Evidence

Currently the most widely utilized CVD risk stratification methods are risk factor scoring systems such as the Framingham Risk Score, Reynolds Risk Score, and the Cardiovascular Risk Predictor (Goff, et al, 2014; Mookadam, Moustafa, Lester, & Warsame, 2010; Peters, den Ruijter, Bots, & Moons, 2012). Because these traditional CVD event risk prediction methods, do not include a comprehensive assessment of all risk factors, patients are often categorized inaccurately. One alternative literature-supported disease identification model emphasizes understanding the individual's state of arterial health - even in asymptomatic, healthy individuals with non-invasive screening tests using CACS or CIMT (Cheng, et al., 2016; Feng, et al., 2015; Naqvi, et al., 2010; Peters, et al., 2012).

Initially, atherosclerosis is a silent disease existing in the artery wall as subclinical atherosclerosis (Belcaro, et al., 2001). Atherosclerotic plaque is potentially dangerous even if it is not flow-limiting and clinically silent, because relatively small areas of plaque have the potential to rupture, form thrombus, occlude vessels acutely, causing subsequent myocardial infarction or ischemic cerebral vascular accident (Arbab- Zedah, et al., 2012; Belcaro, et al., 2001). In the groundbreaking study, 39% of individuals with non flow-limiting, small areas of atherosclerosis experienced a cardiovascular event within ten years (Belcaro, et. al., 2001).

The use of non-invasive testing to screen for subclinical atherosclerosis and assess arterial wall health (rather than or in addition to traditional risk factor scoring systems) leads to early detection, more accurate risk stratification, and early intervention to halt the disease process (Baber, et al., 2015; Belcaro, et al., 2001; Doneen & Bale, 2013; Lakoski, et al., 2007; Naqvi, et al., 2010; Peters, et al., 2012; Rassi, et al., 2016). Computed tomography-based CACS or ultrasound-based CIMT adds predictive value to screening asymptomatic individuals (Peters, et al, 2012). Improved prediction of heart attack and stroke (Doneen & Bale, 2013) not only improved accuracy of risk predictions and reclassification (Baber et al, 2015) compared with conventional risk factors, but also demonstrated comparable results with either modality.

One prior study focusing on nurse practitioner perceptions of the disease - based model of CVD risk demonstrated that nurse practitioners felt that a disease screening model was more effective than the standard risk factor model and would enhance their current practice (Doneen, 2014). Since the question remains unanswered as to the barriers to and facilitators of implementation of the disease-based model of screening, this project was undertaken.

Theoretical Model

The Diffusion of Innovations model developed by Everett M Rogers in 1983 to provide a basis for understanding the process by which new information or innovations are diffused and implemented provided the theoretical framework for the SAVE project (Rogers, 2003). Although Rogers' model was initially developed for the farming industry, it has since been applied in a variety of professions including business, technology, and health care.

The Diffusion of Innovation Model describes the conditions influencing the likelihood of an innovation's adoption, as well as important aspects of communication regarding an innovation (Rogers, 2003). Rogers described five stages of a decision-making: knowledge, persuasion,

decision, implementation, and confirmation (Figure 1). During the innovation-decision process, an individual or organization moves from knowledge through persuasion to an adoption/rejection decision (Rogers, 2003). For the purposes of the SAVE project, factors influencing knowledge, persuasion, and decision to accept or reject the innovation were considered. Specifically, barriers and facilitators associated with the characteristics of the adopter, organization, innovation, and communication were considered.

Rogers described multiple items affecting adoption including; prior conditions of previous practice, felt needs/problems, innovativeness, and norms of the social system (2003). The knowledge stage is impacted by socioeconomic characteristics, personality variables, and communication behaviors of the decision-making unit. Although the persuasion stage is affected by five perceived characteristics of the innovation; relative advantage, compatibility, complexity, trialability, and observability, the innovation characteristics had the strongest impact on adoption. The decision to adopt, is primarily affected by the characteristics of the decision-making unit (or the receiver) combined with the perceived characteristics of the innovation (Rogers, 2003).

Many nursing researchers have utilized the Diffusion of Innovations model as the framework to assess decision-making and implementation of research or innovation into clinical practice. Rogers' model provided support for early adopters to overcome resistance to change to elicit adoption of evidence-based birth kangaroo care (Maloof-Bury & Russell, 2013). Rogers' Diffusion of Innovation model provided the framework for Jenkins and Calzone (2007) to identify that a lack of knowledge was the limiting factor to adoption of genetics into clinical practice. Using Rogers' model, Dooks identified lack of communication of the research to nurses through education was the limiting factor to adoption of evidence-based and effective

pain management protocols into practice (Dooks, 2001). These studies support the use of Rogers' Diffusion of Innovation model as an appropriate theoretical framework for the Subclinical Atherosclerosis Vascular Evaluation (SAVE) project. Similar to the studies referenced above, identification of the factor(s) impeding the adoption of research or evidence-based CVD screening tests into clinical practice could be useful. The SAVE project focus identified nurse practitioner barriers to and facilitators of decision-making and implementation of evidence-based early stage cardiovascular disease (atherosclerosis) screening tests. The Diffusion of Innovation model provided the characteristics impacting the gap.

The Barriers questionnaire, designed using Rogers' Diffusion of Innovation model, identified nurses' perception of barriers to implementation of research into clinical practice, and was the tool for the SAVE project (Funk, Champagne, Wiese, & Tornquist, 1991). The use of the Barriers tool and the Diffusion of Innovations model provided the structure to identify factors impacting the nurse practitioner's decision to implement evidence-based atherosclerosis screening tests.

Project Design

The SAVE project design was a cross-sectional survey to describe barriers to and facilitators of nurse practitioner adoption of CVD screening tests into clinical practice.

Population

Nurse practitioners were invited to participate via social media, email campaigns, and in person at health care provider meetings. The mixed sampling method of recruitment was used in an effort to diversify and enlarge the number of potential participants.

Sources of Data/Instruments/Measurements

Demographic data was obtained and the Funk Barriers scale was used for the survey

(Funk, et al., 1991). The Funk Barriers scale contains 28 items using a Likert scale and three short answer questions with reported psychometrics of Cronbach alphas ranging from 0.65-0.80 on the four tool factors. The four factors *characteristics of the adopter* including the nurse's research values, skills, and awareness (8 items; Cronbach's alpha 0.80), *characteristics of the organization* including setting, barriers and limitation (8 items; Cronbach's alpha 0.80), *characteristics of the innovation* including qualities of the research (6 items; Cronbach's alpha 0.72), and *characteristics of communication* including presentation and accessibility of the research (6 items; Cronbach's alpha 0.65). At the end of the Funk Barriers scale survey, two short answer questions were added: "Do you intend to implement non-invasive screening tests into your practice?" and "If so, how?"

Data Collection Process and Procedures

Nurse practitioners completed the survey in person, on paper, or electronically using the link provided. The electronic responses were collected using Qualtrics survey software. Data analysis was conducted using the statistical package for the social sciences (SPSS 24.0) statistical software. Statistical analyses included descriptive statistics on the demographic data and ranking of the "moderate extent" and "greatest extent" answers to the Likert questions.

Results

Sixty-four nurse practitioners voluntarily participated in the SAVE project and completed the survey. The majority of the nurse practitioners were female (89.10%), identified the master's degree as their highest level of education (78.10%), and were credentialed as Family Nurse Practitioners (75%). Half of the respondents practiced in the primary care setting with an average number of years in practice as a nurse practitioner of 8.97. See Table 1.

The 29 Likert questions were designed to identify the barriers to implementation of the

research regarding non-invasive screening testing for cardiovascular disease. Participants were asked to rate each of the 29 items on the barriers scale according to the extent to which they were perceived as barriers. The Barriers questions fit into one of the four factors as identified by Funk (1991) congruent with Roger's Diffusion of Innovations model: characteristics of the adopter/nurse practitioner, characteristics of the organization, quality of the research, availability and awareness of the research.

To identify which barriers were of greatest significance the responses were ranked according to the percentage of "moderate extent" and "great extent" answers. The highest percentage barrier was 'nurse is unaware of the research' with 65% (n=42) in the 'characteristics of the Nurse Practitioner' category. The top six greatest barriers and categories of each item are listed in Table 2. The top six barriers identified fit into characteristics of the adopter/nurse practitioner, characteristics of communication, and characteristics of the organization. Of the top six greatest barriers, two fit into the category of characteristics of the adopter or nurse practitioner: Nurse practitioner's research values, skills, and awareness. Three of the top six greatest barriers fit into the category of characteristics of the organization: Settings, barriers, and limitations. One of the top six greatest barriers fit into the category of communication: Presentation and accessibility of the research. The fourth category studied, characteristics of the innovation: Qualities of the research, was not included in the top six barriers; and was the least identified impactful barrier category. The quality of the research is commonly the fourth category of significance in the nursing innovation diffusion literature (Dooks, 2001; Oh, 2007). Qualities of the research falling into the last category of significance is congruent with previous studies.

Participants were asked to identify facilitators to adopting the research into practice by

providing free text responses. Seven themes emerged from the thirty-six participant's answers. The themes identified were: Communication and education, partnerships, clinical applicability, guidelines, research availability, cost, and research quality. The top five facilitator themes and percentage rank are listed along with examples in Table 3.

Lastly participants were asked if they planned to implement CVD non-invasive screening testing into their practice, and if so, how. Of the sixty who responded to the question, twenty-one participants answered yes. Fifteen of those answering 'yes' included a comment regarding "how". See Table 4.

Discussion

The top six barriers identified occurred in three of the four categories identified by Funk. It is interesting that 'nurse practitioner', 'organization', and 'communication' characteristics were acknowledged by the participants. Perhaps the occurrence of three of the four categories suggests the need for a comprehensive approach to support NPs in practice implementation of these categories of the literature- supported CVD screening techniques. These SAVE findings are congruent with previously published work supporting a comprehensive or multi-faceted solution (Dooks, 2001; Hommelstad & Ruland, 2004; Hutchison & Johnston. 2004; Paramonczyk, 2005).

The top barrier to implementation of the research, regarding non-invasive screening testing for CVD was a "lack of awareness of the research". This top barrier, related to characteristics of the nurse practitioner, has been identified as a barrier in awareness. Prior studies using the Funk Barriers scale identified lack of awareness of the research as a key factor in the research practice gap. Specifically, Oh (2008) found 59% identified lack of awareness as a top barrier (59%) to research utilization and Hutchinson & Johnston (2004) reported similar

results with 66.2% reporting "lack of awareness" as either a moderate extent or greatest extent barrier to research utilization. The identified barriers in the SAVE project are consistent with previously published research.

The barrier "implications for practice are not made clear" (48.44%) tied with barrier "facilities are inadequate for implementation". The same 'implications' barrier ranked high in a study of 54 Norwegian perioperative nurses (Hommelstad & Ruland, 2004) and for nurses reluctant to use genetics in clinical practice (Maloof-Bury & Russell, 2013). The barrier 'facilities are inadequate' was ranked highly in a survey of 1,487 registered nurses in public and private hospitals in Hong Kong (Chau, Lopex, & Thompson, 2008). The identified barriers in the SAVE project are consistent with previously published research.

The barriers "nurse does not have time to read the research", "insufficient time on the job to implement new ideas", and "nurse is isolated from knowledgeable colleagues with whom to discuss the research" tied with 45.31% each. Paramonczyk (2005) and Yava et al (2009) reported "nurse does not have time to read the research" was ranked as a barrier to research utilization. Lewis, Prowant, Cooper and Bonner (1998) revealed "insufficient time on the job to implement new ideas" as the number one greatest barrier to research implementation. The identified barriers in the SAVE project are consistent with previously published research.

The top facilitators identified in the SAVE project were related to communication or dissemination of information and education about the new knowledge. Dooks (2001) also identified the need for communication of the research to nurses through education to impact research utilization. The SAVE project results concur with previously published research.

The top three categories of barriers were related to the characteristics of the nurse practitioner, communication, and organization. These three barriers merit closer consideration

for implications and recommendations. The SAVE project uncovered several key barriers to CVD non-invasive screening test research utilization among nurse practitioners. Strategies to overcome these barriers can be grouped into three main (but overlapping) categories: nurse practitioner-specific, communication, and organizational-related. The SAVE project findings support the need to focus efforts on increasing nurse practitioner awareness of the research, clarifying implications for practice, and enhancing opportunities for discussion with other colleagues. Lack of awareness and understanding of incorporating these tests into practice are hurdles that can be overcome through effective education and communication. Because lack of awareness of the research was the top barrier identified, efforts to address this top barrier include the use of technology to enhance correspondence, presentations at national, regional, and local NP and multi- disciplinary symposia, webinar programs, social media, and publications. The topic of SAVE could be more prevalent in electronic news outlets and social media forums and via email correspondence. Prior researchers have suggested widespread distribution of condensed versions of research findings in the form of fact sheets. Valente (2003) discussed the one-page fact sheet or synopsis of the research as an effective dissemination strategy. A follow-up evaluation form was recommended by Valente to solidify and further understanding. Using internet technology, distribution of a research fact sheet and follow-up evaluation could be helpful. The feedback gained from the follow-up evaluation could provide solutions to further enhance NP awareness, understanding, and overcoming obstacles in the practice-setting – all accomplished in the "on-line" community. This approach could address barriers of lack of awareness, time constraints, and need for discussion.

Because the SAVE project indicated organizational barriers are problematic, efforts could be targeted on time allocation for nurse practitioners to learn about, discuss with colleagues, and

institute strategies for incorporation into one's own setting. The barrier of 'facilities are inadequate' may indicate a variety of barriers in different settings. For example, the testing may or may not be readily available in or nearby one's facility. Information regarding resources available in one's community, diagnostic centers or companies offering the testing must be communicated to NPs and shared among colleagues. Opportunities for discussion with colleagues combined with strategizing and problem-solving about the availability of these tests and ease of implementation could be prioritized. Also, the employer may or may not be supportive of or aware of the need for this type of testing. A commitment on the part of one's facility or organization could facilitate changes needed for implementation of these tests. Paramonczyk (2005) addressed the barrier of facility or setting characteristics, stating that while nurses have a responsibility to stay current with research data, employers' support is important for implementation. Addressing organizational barriers related to nurse practitioner time is critical to lasting success. Some settings may require a cultural shift to place a high value on research utilization and the time necessary for the nurse practitioner to effectively implement.

The facilitators identified by respondents primarily focus on communication, education, and colleague support and provided logical strategies to overcome the greatest barriers. The top facilitator themes are communication and education, partnerships, clinical applicability, guidelines, and availability of results. Thus, the research findings, education regarding the utility and clinical applicability along with implementation strategies in the various clinic settings could be promoted to facilitate adoption of the literature-supported screening tests. Time to discuss with colleagues, strategize, problem-solve, and support one another are important components for success. Professional organizational participation is an accessible avenue for collegial discussions, strategy development, guideline and protocol development and professional support.

Implications for Practice

The SAVE project findings present an opportunity for nurse practitioners, individually and collectively, to create forums for conversation about and dissemination of the research surrounding the disease-based model of screening and early detection for CVD. Nurse practitioners can use this data for renewed support to continue defining roles in work environments, communities, health care organizations, professional organizations, and through health care policy. Efforts must be focused on impacting organizational change. Through these efforts NPs can positively influence the lives and health of patients by impacting cardiovascular disease - the number one killer of people in the US.

Strengths and Limitations

Rogers Diffusion of Innovation model provided a robust framework for the SAVE project. The data collection instrument was a validated and reliable tool for assessing barriers to research utilization (Funk, et al., 1991). The instrument, however, has some ambiguity with the use of broad terms such as 'facility'. Facility-related issues could be related to space, resources, remote location or decision-makers' lack of support or mandates, for example. Facility-related issues would also likely be different in the United States as compared to some other countries. The sample size was small and non-randomized. The study provides a launching pad for future studies to build upon, with a focus on the NP role in CVD prevention research utilization.

Conclusion

In order to support NP use of non-invasive CVD screening, efforts must focus on raising awareness and providing education regarding implications for practice. The SAVE project confirms barriers previously published. Moving forward NPs must bridge the gap between literature supported CVD screening tests and clinical practice implementation. Bridging this gap

could lead to improvement in risk assessment accuracy and positively impact patient lives and health care outcomes. Practitioners have the opportunity to surmount these known barriers by engaging in effective strategies to improve awareness of these important screening tests.

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Table 1: Demographics

Demographics	Sample
n(%)	64(100.00)
Gender	
Female	57(89.06)
Male	7(10.94)
Highest Educational Degree	
Master's Degree	50(78.13)
Doctorate Degree	14(21.88)
Credentials	
FNP	48(75.00)
GNP	3(4.69)
ACNP	4(6.25)
NP	4(6.25)
CNS	1(1.56)
CNM	1(1.56)
WHNP	2(3.13)
ANP	1(1.56)
Clinical Practice Area	
Primary Care	32(50.0)
Hospital	4(6.25)
Emergency	1(1.56)
Urgent Care	7(10.93)
Education	2(3.13)
Other	18(28.13)
Years in Practice	
Number of years in practice as an RN m(sd)	21.65(11.92)
Number of years in practice as NP m(sd)	8.97(7.85)

Table 2: Top Six Greatest Barriers

Barriers	n	%	Characteristic Categories
The nurse is unaware of the research.	42	65.63	Nurse Practitioner Np's Research Values, Skills, and Awareness
Implications for practice are not made clear.	31	48.44	Communication Presentation and Accessibility of the Research
The facilities are inadequate for implementation.	31	48.44	Organization Settings, Barriers, and Limitations
The nurse does not have time to read research.	29	45.31	Organization Settings, Barriers, and Limitations
There is insufficient time on the job to implement new ideas.	29	45.31	Organization Settings, Barriers, and Limitations
The nurse is isolated from knowledgeable colleagues with whom to discuss the research.	29	45.31	Nurse Practitioner NP's Research Values, Skills, and Awareness

Table 3: Top 5 Facilitators

Facilitators	n	%	Themes
Dissemination of Information Sharing/Email Teaching/Knowledge/CME	11	30.56	Communication and Education
Clinical Partnerships Discussion Collaboration	6	16.67	Partnerships
Relevance to Practice Benefit to Patients Outcomes of Patient Care Easy Updates to Clinical practice	5	13.89	Clinical Applicability
Guidelines Professional Organizations Practice Standards Acceptance and Recommendations	5	13.89	Guidelines
Availability of the Results Knowledge the Research Exists Published Results	4	11.11	Availability of Research

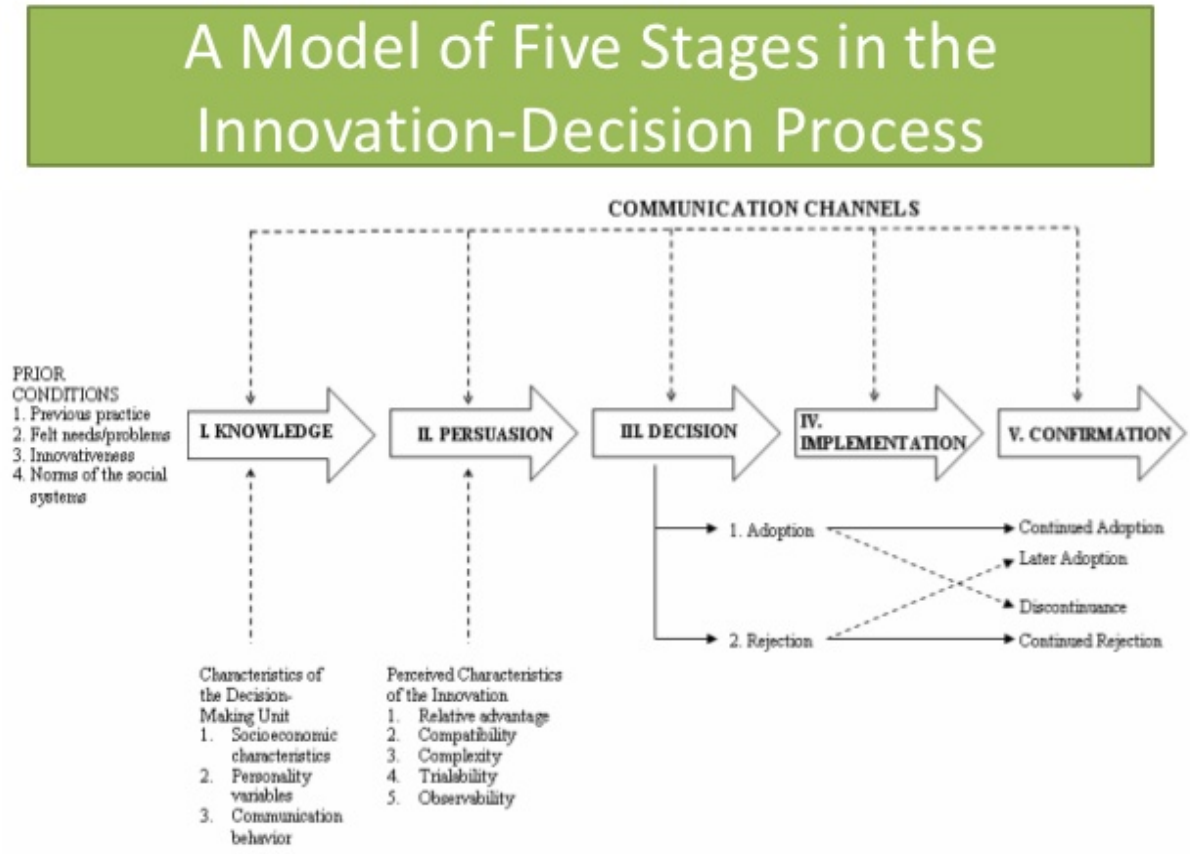
Table 4: Are you planning to implement Non-invasive screening tests into your practice?

	n	%
Yes	21	32.81
Maybe	16	25.00
No	23	35.94
No Answer	4	6.25
Total	n=64	100

If so, How?

Ordering
Partnership
Education
Protocol Development

Figure 1



From: Rogers, 2003, p. 170