AN ASSESSMENT OF KNOWLEDGE TRANSLATION PARTICIPATION IN CLINICAL LABORATORY SCIENCE

by

ANNE BRACEWELL RANNE

(Under the Direction of Ronald Cervero)

ABSTRACT

With the advances in clinical laboratory testing it has become more difficult for physicians to keep up with the clinical information as well as their diagnostic knowledge. Healthcare insurers and Medicare are applying pressure on healthcare institutions to reduce costs Knowledge translation has been investigated as an approach to solving these issues. Without a process to move research to practice the healthcare community has been slow in utilizing advanced clinical testing modalities.

The purpose of this study was to understand clinical laboratory scientists' participation in four knowledge translation activities: awareness, acceptance, adoption, and adherence. This study obtained data from clinical laboratory professionals on their use of knowledge translation in introducing a new test or instrument into their clinical laboratory. A 48-item questionnaire was developed to measure the four knowledge translation components. The study also sought to establish whether the participation in specific activities was predicted by personal characteristics and situational factors. The survey was completed electronically by clinical laboratory professionals who held membership in the American Society for Clinical Laboratory Science.

The respondents' participation in the four knowledge translation components indicated high correlation in acceptance, adherence, and adoption when introducing a new test. The lowest level of participation was the awareness activities. On awareness items, communication with the vendor's representative was selected by most of the respondents while the lowest awareness participation was with other laboratory professionals and fellow healthcare professionals. The questionnaire indicated the respondents had limited participation in collaborative investigation of how new tests could improve patient care as well as developing interpretative test narratives, or test algorithm. The predictive indicators used in the questionnaire were gender, age, education, job description, and location of laboratory. The variables had very slight statistical significance on the clinical laboratory scientist's participation in knowledge translation.

The conclusions of this study revealed that more emphasis should be placed on patient-centered collaborative activities. By increasing participation in awareness activities the clinical laboratory scientist could help to remove the barriers that exist between healthcare professionals. Gaps, redundancies, and errors can be avoided by collaborating with others through shared problem solving and shared decision-making.

INDEX WORDS: Knowledge translation, clinical laboratory science, medical technologist, medical laboratory scientist, medical laboratory technician, healthcare practitioner, adult education

AN ASSESSEMENT OF KNOWLEDGE TRANSLATION PARTICIPATION IN CLINICAL LABORATORY SCIENCE

by

ANNE BRACEWELL RANNE

B.S., Mercer University, 1966

M.S., Georgia State University, 1978

A Dissertation Submitted to the Graduate Faculty of the University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2011

AN ASSESSMENT OF KNOWLEDGE TRANSLATION PARTICIPATION IN CLINICAL LABORATORY SCIENCE

by

ANNE BRACEWELL RANNE

Major Professor: Ronald Cervero

Committee: Thomas Valentine
Laura Bierema
Barbara Russell

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
August 2011

DEDICATION

I would like to dedicate this dissertation to my loving husband, Arland Ranne. When I decided to begin this educational journey, I discussed it with him because I knew it would take time away from enjoying our adventures and life together. He supported my educational quest and stated he would do anything necessary to support me. He has certainly supported me financially as well as emotionally. He has also shared his information technology expertise with me when I needed tech support. He has taught me so much about taking one day at a time and one course at a time. I could not have made it to the completion of my doctoral program without him.

ACKNOWLEDGEMENTS

I would like to thank the many people who made this goal attainable. I first would like to acknowledge my family. My brother, Bill Bracewell, took the time to proof my first three chapters. He has always been a source of support through many events in my life. I would also like to recognize my son and his wife, Brian and Brenda Roebuck, for understanding that I would not always be available for family activities, especially the grandchildren's events.

From the initial beginning of my graduate program Dr. Ron Cervero has been a constant advocate for me. He taught my first graduate course, and I knew at that moment I had selected the right graduate program. Even when he moved into another position at the University of Georgia, he continued to advise and support me through the dissertation process. His devotion to lifelong learning and passion for providing a voice to all adult learners has inspired me. He provided the support I needed to begin a conversation about the value of my profession to a new collaborative healthcare community.

Dr. Tom Valentine deserves my utmost appreciation for sticking with me through the hard times. He was patient with me in my struggles to understand the quantitative methodology involved in my research study. We spent many hours together creating the questionnaire and analyzing the statistical data. It was a pleasure working with him and even though he had many more students waiting at his door he devoted time with me. I hope I can be as supportive with my graduate students as he was with me.

Dr. Barbara Russell, a faculty colleague at Georgia Health Sciences University, was invaluable in evaluating my research. She is passionate about our profession and her conversations gave me additional insights into the development of my research from a clinical laboratory scientist's viewpoint. I would also like to thank Dr. Laura Bierema for her support and expertise in human resource development. She was always willing to talk about other areas that should be covered in my research. She was a valuable resource to me throughout my graduate program.

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER I

INTRODUCTION

Rapid advances in medical research have brought forth investigations into how to improve the introduction of new research into healthcare. It has been estimated that it takes as long as two decades to translate original research into medical practice (Davis, Evans, Jadad, Perrier, Rath, et al., 2003). Although the transfer of knowledge is not a new concept in business circles, healthcare organizations are just beginning to investigate the process, choosing to label the process as knowledge translation. Without effective translation, quality patient care will be greatly reduced today and in the future (Sussman, 2006). The knowledge translation process can be a framework for building a more efficient and effective healthcare system if there is a collaborative commitment among healthcare professionals, researchers, and other relevant stakeholders (Sudsawad, 2007).

Clinical laboratory scientists can provide a supportive connection between the new testing methods and healthcare practitioners. The focus of this study was the clinical laboratory scientist's participation in bridging the gap between current advances in testing and the interpretation of these tests to improve patient care. The rapid access to test results crucial for diagnosis, treatment decisions and patient care, places the clinical laboratory scientist in the forefront of building an integrative healthcare system. To explore the inclusion of the clinical laboratory scientist within a collaborative healthcare continuum, an investigation into the skills and training of the clinical laboratory scientist

that support a collaborative contribution was undertaken. The American Society for Clinical Laboratory Science defined the role of the clinical laboratory scientist as very diverse (ASCLS Scope of Practice, 2001). It encompasses the design, performance, evaluation, reporting, interpreting and clinical correlation of diagnostic laboratory tests plus the management of the entire process including pre-and post-analytical circumstances that could invalidate the test results. The utilization of laboratory information is foundational to the practice of all other healthcare professionals (Leibach, 2008). The contribution made daily by clinical laboratory science includes diagnostic laboratory tests identified as part of evidence-based clinical practice guidelines in over 23 main condition/disease categories defined by the National Guideline Clearinghouse (National Status Report, Future of laboratory medicine, 2009). Even though clinical laboratory scientists are a vital part of the diagnostic process, they have limited visibility. The patients never see them, and they have minimal communication with other healthcare professionals.

Not only can the laboratory professionals help to prevent adverse events, they can facilitate detection and recovery from adverse events that occur. Through the practice of laboratory science the national blood supply is protected from infectious agents as well as tissues and organs used for transplantation. The mitigation of threats to the population's health from influenza, severe acute respiratory syndrome, H1N1, and nosocomial infections are supported by laboratory test results. By increasing the clinical laboratory scientist's direct involvement with the healthcare team the interpretation of vital diagnostic information will improve the quality of patient care.

Background of the Problem

Recent researchers revealed that 50 to 60% of all laboratory orders are inappropriate and most (68-87%) of laboratory errors are non-analytical indicating a gap in the knowledge translation process that could be filled by the clinical laboratory scientist (Leibach, 2008). As the flow of new advancements in laboratory testing emerges it will be even more important for the laboratory professional to bridge the gap between the new testing and clinical practice guidelines. An example of this gap was found in the current grant awarded to the Agency for Healthcare Research and Quality (AHRQ) to evaluate if tests offer significant advantages or disadvantages to patient care. The American Association of Clinical Chemistry (AACC) recommended a tighter glycemic control by using more precise and accurate glucose testing methodology. Tighter control of glucose values for hospital patients reduced morbidity, mortality, and length of stay, which was not possible with the current handheld glucometers (Malone, 2009) used for bedside testing since the 1990's. The clinical laboratory scientist has been aware of the discrepancy between the glucometers and the within-laboratory instruments through daily practical experiences, but the lack of participation in an ongoing dialogue with healthcare administrators, physicians, and other relevant stakeholders has produced a long term gap in the improvement of diabetic patient care. Similar situations exist between other handheld instruments used at the bedside to provide a fast result for the practitioner instead of relying on the within-laboratory results. The clinical laboratory scientist can provide an analytical assessment of these over-the-counter testing devices before they are placed at the bedside.

Historical Development of Knowledge Translation

From the findings of earlier research on knowledge translation the clinical laboratory scientist may discover a model that can help reduce the gap between medical research and quality patient care. For many decades, management research has explored the process of moving theoretical research findings into the workplace (Mills, Kelley, & Cooke, 2002). In a study by Lewin and Lippett, the process of taking new research knowledge to practice introduced the dissemination and utilization of scientific knowledge theory (Havelock, 1969). They focused on transformations that occur in the process. The dissemination and utilization research theory described two ways scientific knowledge is transferred into practice. The first path was research generated in the 'scientific' universe and transferred into the hands of the users. The second path was action research with the user defining the type of knowledge required and the researchers formulating the studies around the user's needs. In the 'sustained interactivity' model (the second path), the user was not a target but a participant, actively carrying the research knowledge into their practice community (Havelock). The 'sustained interactivity' was part of the iterative process recently identified as an element of knowledge translation supported by international healthcare organizations (Canadian Institute of Health Research, 2009).

Another study by Huberman (1990) analyzed 23 dissemination cases for the effect on the users' understanding of the process as well as its pertinence on the context. The study revealed that the end users, vocational educators, who were actively involved early in the dissemination process with the researchers and had continued involvement throughout the project, used the new knowledge and made changes in their work

practices based on the research. Additionally, some end users noted they solved other work problems based on the new knowledge acquired from the dissemination process. As current research has been conducted in the healthcare community, the involvement of the practitioner in the development of new medical models has improved adherence (Moore, Cervero & Fox, 2007).

Transferring Knowledge to the End Users

Knowledge translation research models have included the point when the end user becomes engaged in the process. The engagement influences the use of new knowledge in practice (Estabrooks, Floyd, Scott-Findlay, O'Leary, & Gushta, 2003). In assessing the effectiveness of this aspect of knowledge translation, a critical step is how the practitioner's knowledge gained from experience and intuition influences the eventual adoption of new knowledge (Herschel, Nemati, & Seiger, 2001; Moore, Cervero, & Fox, 2007). In the healthcare environment, hierarchical, authoritative, and power-laden relationships promote the 'push' method of placing knowledge into practice. This approach is met with professionals that have experiential and tacit knowledge which conflicts with the new knowledge being pushed onto practice guidelines (McWilliam, 2006). Within this contextually complex situation the healthcare professionals representing diverse disciplines combine or replace the research results with tacit or experiential learning acquired from professional training, socialization, procedure manuals, and/or colleagues (McWilliam, Kothari, Ward-Griffin, Forbes, & Leipert, 2009). A thorough understanding of the organization's role in knowledge translation and the learning process is essential in identifying some barriers or roadblocks existing on the path to the effective movement of research to practice. The clinical laboratory scientist

must navigate the complex organizational structure found in healthcare to engage the end user in laboratory testing advances (Grol & Grimshaw, 2003).

Movement toward Knowledge Translation Activity in Clinical Laboratory Science

According to Susan Snyder, CDC senior economist, the laboratory professionals should develop and use a review methodology that appraises existing research to synthesize knowledge and compare the outcomes to the effectiveness of the practice (Malone, 2009). At this time an appraisal system within clinical laboratory medicine does not exist to evaluate new research, and its effectiveness in treating patients. Currently, the clinical laboratory professional gives the physician a number without evaluating the tests results and providing interpretative text for the physician. Often the physician ordering the tests has no idea what the results may mean for the patient's diagnosis. Many mistakes are made in ordering that even if the physician receives an accurate test result, it will not provide any insight into the patient's condition (Laposata, 2004). In a survey conducted by Laposata, 98% of the responding physicians said they wanted interpretations of laboratory test results to assist them in treating the patient. They also stated in most cases they would order fewer laboratory tests and develop a more accurate patient care plan with a thorough interpretation of the results.

With the healthcare reforms moving forward within the next decade the clinical laboratory scientist must develop those skills needed to support knowledge translation within the healthcare community. There is a need for someone to advise the physician on new tests and to interpret the current test results. It would shorten patients' hospital stays and drive down healthcare costs. With the aid of information technology the laboratory professional could review physician's test-ordering patterns to reduce errors or

redundancy. Advanced specialized testing now available in molecular and genetic testing requires highly skilled laboratory professionals to be collaborative members of the healthcare team.

Statement of the Problem

Knowledge translation, a multi-dimensional process, is complex and not clearly understood. The conversation about knowledge translation has been complicated by the use of over 29 terms to describe the phenomena (Graham, Logan, Harrison, Straus, Tetroe, Caswell, Robinson, 2006). Knowledge transfer, research utilization, implementation, knowledge exchange, and evidence-based decision making are a few of the terms. Selecting Pathman's awareness-to-adherence knowledge translation model as a theoretical framework, the objective of this study was to assess the clinical laboratory scientist's participation in knowledge translation (Pathman, Konrad, Freed, Freeman, & Koch, 1996). The current gap that exists between new research and patient care is blocking the improvement of healthcare, and the rapid increase in advanced testing methodologies will continue to widen the gap. Kitson (2008) examined the problems that interfere with the movement of knowledge to practice. One situation is the stakeholders (end users) engagement in the process. She identified the involvement of the end user to include education and personal development, control of immediate physical resources, control of the immediate context and increased autonomy and control of the external environment (Kitson, 2008). As found by earlier researchers, the end user's engagement influenced the use of new knowledge into practice (Estabrooks, Floyd, Scott-Findlay, O'Leary, & Gushta, 2003). While there has been research focused on the knowledge translation process in several healthcare professionals (Davis, Evans, Jadad, Perrier, Rath,

Ryan & et al., 2003; Graham & Logan, 2004; Grimshaw, Santesso, Cumpston, Mayhew & McGowan, 2006; Rycroft-Malone, 2007), a thorough literature review did not reveal any published research that focused on the clinical laboratory scientist's participation in knowledge translation.

To anchor this research on an established conceptual framework, the model developed by the University of Toronto Knowledge Translation Program was selected (Pathman et al., 1996). It provided significant research on specific cognitive and behavioral characteristics that influence practitioners to embrace or reject new clinical guidelines. In 1996 Pathman et al. conducted a study on physicians' response to the national pediatric vaccine recommendations. The study discovered that the clinicians progress through a series of cognitive steps before complying with new guidelines. The awareness-to-adherence model addressed the steps leading to compliance. They surveyed over 3,014 family physicians and pediatricians. Generally, the study found 87.9% of the physicians surveyed proceeded through sequential, cognitive, and behavioral steps of awareness, agreement, adoption, and adherence. Not surprisingly, the largest drop along the awareness-adherence sequence was from adoption to adherence.

The clinical laboratory scientist's knowledge translation pathway showed participation in all four behaviors, but the extent of participation in these behaviors was measured to assess actual involvement. This study looked at personal and situational variables that impact knowledge translation participation. Since new ideas do not follow in a logical flow from generation to implementation, the multidimensional and multilayered aspects of end user participation requires further investigation (Kitson, 2008).

Purpose of the Study

The purpose of this study was to understand clinical laboratory scientists' participation in the knowledge translation process. The questions central to this study were:

1. To what extent do clinical laboratory scientists participate in the four major components of knowledge translation (awareness, acceptance, adoption, and adherence)?
2. To what extent do personal characteristics (demographics) and situational factors (location of laboratory) of the clinical laboratory scientist predict the level of participation in each of the knowledge translation components?

Significance of the Study

The World Health Organization (2005) described knowledge translation as "the synthesis, exchange, and application of knowledge by relevant stakeholders to strengthen health systems and improve people's health" (p. 2). Clinical laboratory scientists play a significant role in the health system, but there is no current research into their contributions in advancing knowledge translation. This study evaluated if laboratory professionals participate in knowledge translation to advance medical research to practice. The new advancements in laboratory testing allow them to use existing skills in transitioning new methodologies and tests into practical application. They can become involved in the implementation of new testing platforms from the initial investigation of the test to the evaluation, training, and interpretation of the new test results to the healthcare practitioners, bridging the gap in this knowledge translation process.

Even though the medical community has created various definitions and complex models illustrating how knowledge translation can reduce the gap between research and practice, the gap still exists. Multiple studies have focused on barriers to knowledge translation (Davies, Nutley, & Walter, 2008; Graham et al., 2006), but the literature does not provide definitive research supporting improvements in the process. Grol and Grimshaw (2003) demonstrated the complex process of implementing a simple healthcare technique. Hand hygiene can reduce patient infections by 15% to 30%, but the implementation of this protocol is extremely difficult. Simply giving the end users the new knowledge and providing the necessary tools does not produce the expected change. Organizational, social, and professional contextual barriers block implementation. In the Grol and Grimshaw study, the end users received several interventions including educational material, continuing medical education (CME) activities, feedback on performance, reminders, and computerized decision support. The study revealed no single intervention strategy made a dramatic change in the health care professionals' use of the hand hygiene protocol. A variety of strategies did make some change. The study did indicate that these strategies must be interactive, continuous, and include discussion of evidence, feedback on performance and personal/group learning plans (Grol & Grimshaw). To engage the end user in moving new knowledge to practice there are several action steps the person or group must go through before deciding to accept or reject the knowledge into their practice. If the clinical laboratory scientist is not an active participant in the transition of new testing methodologies, the success of the implementation will suffer. As demonstrated in Grol's study, the manufacturer or the

research community did not address the contextual needs and clinical applications essential in the health care environment.

Kitson (2008) supported the critical view that the medical community is using knowledge translation in a linear manner and ignoring the contextual aspects. The movement of research to practice viewed from a social science approach allows the individual professional to participate in the facilitation of research to practice. As the U.S. funding agencies require demonstrations on how knowledge translation is helping to advance patient care, it places greater demands on the healthcare community to discontinue the discussion on how barriers are stopping the process and to focus more efforts toward involvement of healthcare professionals in advancing new knowledge to practice. The clinical laboratory scientists can add to the advancement of quality patient care, if they are participants in a collaborative knowledge translation team within the healthcare community.

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this study was to understand clinical laboratory scientists' participation in the knowledge translation process. The literature review relevant to this study involved the concepts advanced in knowledge translation, a multidimensional and complex ideology that supports the improvement of outcomes, quality, effectiveness, efficiency and cost of care through partnerships between healthcare professionals (Sussman, Valente, Rohrbach, Skara, Pentz, 2006). To set the context of the study, the first section of the chapter reviews literature on the development of clinical laboratory science, and the significance of this laboratory professional's work within the patient care environment. The second section focuses on knowledge translation literature as the conceptual framework of the study. The literature review provides definitions, models, and addresses Pathman's(1996) four main components of knowledge translation surrounding the end user's cognitive and behavioral characteristics. The last section will address the barriers and strategies in using knowledge translation to improve patient care and advance healthcare in the United States.

Development of Clinical Laboratory Science

Clinical laboratory science (CLS) is an allied healthcare profession. The job opportunities are predominately in hospitals or reference laboratories that are emerging as private, profit-oriented providers owned by large corporations (Michel, 2010). Even though it is an allied healthcare profession, it is not visible to the patient as other health-related careers. Within the medical hierarchy the clinical laboratory scientist is located in

a subunit of pathology (clinical pathology) with usually a pathologist as the medical director. Laboratory professionals currently are not viewed as having a major role in healthcare (CAP Compass Group, 2008), and research also indicates that within the profession, gender stratification limits women's opportunities to move into administrative roles within the healthcare institution as compared to men (Blau & Tatum 2000). With the advancement of technology and one-step testing the future may see further marginalization of the clinical laboratory scientist (CAP Compass Group). The integration of knowledge translation into the existing clinical laboratory scientist's skill sets focuses more on patient outcomes including valuable and clinically useful information to the clinicians.

Physician's Assistant in the Laboratory

In the 1920's, internists generally practiced clinical pathology testing as an adjunct to their patient practices. These physicians wanted to enhance diagnosis by utilizing laboratory testing. Since the AMA gave physicians little recognition for this type of activity, they established a national organization, The American Society for Clinical Pathologists (ASCP). The goal of the organization was to "achieve greater scientific proficiency in clinical pathology, and to maintain the status of clinical pathologists on an equal plane with other specialists" (ASCP, History of ASCP, 2007). The all male organization was formed in 1922 with one of its main objectives to encourage closer cooperation between the practitioner and the clinical pathologist. In 1928, the American Society for Clinical Pathologists developed a national certification exam for medical technologists (clinical laboratory scientists). The medical technologists would perform the laboratory tests, thus giving the pathologist more time to pursue

anatomic pathology and communicate with other physicians concerning the anatomic pathology results (biopsy and tissue findings). It was not until 2001 (72 years later) that ASCP made two concessions. The organization changed its name to American Society for Clinical Pathology and in 2003, non-physicians were invited to be active members and serve on committees (ASCP, History of ASCP).

In the 1930's and 1940's men dominated the field, but as the war and higher wages in other healthcare fields appeared men left the profession (Chapman, Lindler, & Ward-Cook, 2005). As women entered the field the profession continued to offer lower wages than other allied health professions with no career ladder, and the laboratory staff were identified as service workers as defined by Acker (2006). Married women, both middle and working class, were attracted to the profession. They could work off- shift positions, so the husband could work during the day. The wife would take a night or evening position increasing the family income while still taking care of the home and children (England, 2005). Acker (2006) noted a recent U.S. report indicated that only about 15% of women continuously employed over a 15 year period worked in male-dominated occupational sectors and that only 8% of continuously employed men worked in female-dominated sectors. These statistics are supported in the clinical laboratory science profession. In 2005 there were 160,760 clinical laboratory workers in the U.S. with women representing three-fourths of the certified practitioners. The diversity of the profession is represented by 7% Asian, 15% Black, 71% White, Nonhispanic, 6% Hispanic, and 1% Other (Chapman, Lindler, & Ward-Cook, 2005). Even though there is limited patient contact, laboratory practitioners are providing a service to people that improve their health, therefore the profession fits into the care work job description

(Acker, 2006). England (2005) found a net pay penalty of 5% to 10% for working in an occupation involving care work. In contrast to the care work job description, the clinical laboratory scientist provides assessment of disease severity, monitors treatment outcomes, and identifies the cause of infections, but seldom is recognized as a vital healthcare partner in improving patient care.

Professional Organizations

As clinical testing methods became more sophisticated, educational programs began in large hospital laboratories and later universities. The educational programs offered a two-year associate degree, Medical Laboratory Technician (MLT), as well as a four-year baccalaureate program, Medical Technologist (MT), providing a two-tiered ladder. Declining enrollment plus cost of maintaining the programs caused the closure of many hospital and college programs. In 1975 there were 770 MT programs. By 2007 only 222 programs were opened in the U.S. (Chapman, Lindler, & Ward-Cook, 2005). An American Society for Clinical Pathology article (Bennett, Thompson, Holladay, Bugbee, & Steward, 2009) described a turnover rate in clinical laboratory scientist's staff positions in hospital laboratories increasing 30% over a 2008 survey. The loss of talented individuals in the profession creates limited advancements in quality diagnostic laboratory testing. Some states established licensure laws requiring a laboratory worker to be licensed as a technician or technologist. Twelve states and Puerto Rico require licensure to perform complex clinical laboratory testing (ASCLS, Current Events, 2008). Even if a state does not have a licensure law, national certification can be used as a requirement for employment in the state, but the numerous certifying agencies have various educational requirements (AMT, ABB, and ASCP). In 2009, a bill was

introduced in Georgia, HB 944, which would, if passed, eliminate state licensure requirements for clinical laboratories (Georgia HB 944). This bill would suspend personnel requirements mandated by Georgia in previous legislation. The House retracted the bill because of controversial issues addressed in the bill not related to personnel requirements.

In July 2005, the American Society for Clinical Laboratory Science (ASCLS) Board of Directors commissioned a task force entitled Practice Levels and Educational Needs for Clinical Laboratory Personnel (2007). This task force was asked to address issues raised in ongoing, unresolved discussions on the lack of well-defined practice roles of the technician and the technologist. Another concern among laboratory professionals was the chance for career advancement within the laboratory thus retaining valuable staff (ASCLS Practice Levels and Educational Needs for CLP). The task force was comprised of professional members from ASCLS, ASCP, American Medical Technology (AMT), industry (Abbott Diagnostics) and lab administration (Clinical Laboratory Management Association). The task force collected data by performing a literature review related to clinical laboratory levels of practice, by reviewing the scopes of practice in several health professions, by focus groups and from a national survey. By February 2007, a model was developed based on the analysis of the data. The focus groups indicated a lack of clear distinction between the associate degree and the baccalaureate degree levels of practice, thus creating a retention problem among the younger laboratory professionals. According to the model, baccalaureate degree practitioners should have competencies in creating clinical algorithms for test utilization, consultation with other healthcare practitioners on use and interpretation of advanced molecular testing, and advanced skills

for the new molecular testing. The model more clearly differentiated levels of practice based on education, experience, and certification. It also delineated a career ladder from entry-level positions through the masters' level. In the future, the clinical doctorate would be included in this model. The ASCLS document provided a suggested listing of advanced practice skills for the baccalaureate and masters degree practitioner (CLS/MT) (Table 1). This model identified the actual involvement of practicing clinical laboratory scientists in these advanced practice skills as they integrate new knowledge for the improvement of patient care. Without clearly delineated practice skills the clinical laboratory scientist is adrift in a maze of job descriptions designed by hospital administrators who do not understand the clinical laboratory scientist's role in supporting patient care and are focused on the financial goals of the organization (CAP Compass Group, 2008).

A New Era

In July 2009 the two major laboratory professional organizations reached a decision to merge the National Credentialing Agency for Laboratory Personnel (NCA) supported by ASCLS and the American Society for Clinical Pathology Board of Registry (ASCP BOR) to provide only one national certification exam for the two organizations. Since October 2010 all applicants taking the BOR exam are credentialed as Medical Laboratory Scientists (MLS), the baccalaureate level, or as Medical Laboratory Technician (MLT), the associate level (ASCP Certification Maintenance, 2009). Because of the merger the baccalaureate level laboratory professional may be identified as a clinical laboratory scientist (CLS), medical laboratory scientist (MLS), or medical technologist (MT). This merger was a three-year project between the two organizations.

For the older ASCLS members it is a step back into the patriarchal arms of the pathologists (McLane, 2009). The younger clinical laboratory scientists are glad they no longer have to decide which certification exam they must take (ASCLS NCA vs. ASCP BOR) (Martini, 2009). Only time will reveal how the ASCP physician members will partner with the clinical laboratory scientists in providing adequate representation for all laboratory professionals. At this moment, the pathologists are indicating that ASCP will provide a place at the organization's table for the other laboratory professionals (Rodriquez, 2006). With the support of the pathologist, the clinical laboratory scientist can move into a more integrated position within the healthcare community providing rapidly advancing medical technology to the physician.

Refocus Clinical Laboratory Scientist's Skills

The advancement of the clinical laboratory scientist is critical in providing opportunities for participation in collaborative healthcare teams. By refocusing some of the laboratory professional's skills, it will help provide a platform for launching involvement in this collaborative conversation. The missing link within the healthcare system is the clinical laboratory professional who is dedicated to and who has the breadth of knowledge to make sure the appropriate laboratory tests are ordered, the laboratory test information is used effectively, and the consultation with other healthcare team members include interpretation of laboratory generated information in reference to clinical signs and symptoms (Leibach, 2008). The clinical laboratory curriculum has been reviewed to address the skills necessary for the graduates to provide the critical interface across the

Table 1

*Summary of Proposed Model for Advanced Levels of Practice in CLS/MT**

Level	Practice Skills:	Education	Relevant Experience	Certificate
V	Infection Control/Epidemiology Method Evaluation/Test Development Patient Education POC Oversight Front Line Supervision Research Protocols Safety Officer Student/Staff Education and Training Oversight Technical Consultation Informatics	BS+ Additional education And/or experience	Yes	CLS / MT
	Cytogenetics Advanced Molecular / PCR *(Modify existing tests, troubleshooting, method evaluation, research and development)* Advanced Flow Cytometry Cellular Therapy – Stem Cell Transplantation Histocompatibility Specialist in (BB, Chem, Heme, Coag, etc)	BS + Additional education and experience	Yes	Specialty Cert.
VI	Compliance/Coding/Regulatory Quality Management Risk/Patient Safety Management Operations/Business Management *(Overall management of the laboratory, Regulatory Affairs / Compliance, Quality Assurance, Process Improvement, Information Management, Personnel Management, Pro ductivity and Performance Monitoring, Inter and Intra disciplinary management, Financial Management (capital, operating, and personnel), Projecting and Monitoring, Contractual Agreements/Business Planning*)	Masters Degree in relevant area	Yes	CLS / MT plus other relevant cert.
	Technical Management (*Coordinates, plans, manages and monitors testing activities and R & D, Data Management and Problem Solving, Instrument Selection, Test Development and Method Evaluation)* Educational Program Director	Masters Degree in relevant area	Yes	CLS/MT plus other relevant certification

*From "Practice levels and educational needs for clinical laboratory personnel", 2007,ASCLS.

healthcare system and assure improved patient outcomes and cost effective patient care (Forsman, 2002). The National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) has competencies for the clinical laboratory scientist that includes additional skills advancing knowledge translation. These competencies include:

1. Communications to enable consultative interactions with members of the healthcare team, external relations, customer service and patient education;
2. Financial, operations, marketing, and human resource management of the clinical laboratory to enable cost-effective, high-quality, value-added laboratory services;
3. Information management to enable effective, timely, accurate, and cost-effective reporting of laboratory-generated information, and;
4. Research design/practice sufficient to evaluate published studies as an informed consumer. (Standards of Accredited Educational Programs for the Clinical Laboratory Scientist/Medical Technologist, 2009).

In the 2008-2009 Update on the National Status Report (Patient-centered Care, 2009) a challenge to the health system was a greater engagement by the laboratory professionals into more patient-centric care practice. It mentioned a move from a provider-centric "biomedical" approach to a patient-centric approach. It would require a partnership and collaboration among healthcare providers that includes the laboratory professional. The component of patient-centered care is open communication of vital information and

appropriate education in a manner that facilitates autonomy, self care, and health promotion (Patient-centered Care). Epner (2008) suggested the laboratory professional must partner with health care practitioners to select appropriate utilization of clinical diagnostics and the interpretation of the results. To provide this assistance the clinical laboratory scientist must mine clinical data to support improved evidence-based healthcare processes that would reduce clinician practice variability. In figure 1, Epner demonstrated how the laboratory professional can participate in the patient-centered total testing process. The process moved beyond the pre-analytical, analytical, and post-analytical stages of laboratory testing. It did not dismiss these stages but expanded the clinical laboratory scientist's role to patient education about test results and to physician consultation on the appropriate test selection plus test interpretation. To move beyond the factory-like environment, laboratory professionals must take ownership of the total testing process with follow through on well-defined activities to support patient-centered care. With active participation in knowledge translation there would be actual learning events moving the clinical laboratory scientist closer to patient-centric testing cycle and a more holistic approach to patient care.

In reviewing the modification of educational programs to meet the development of knowledge translation skills for clinical laboratory scientists, the addition of new courses and graduate level programs have been developed. One clinical laboratory science program that has added an Advance Practice graduate degree focuses on a case-based approach to the masters level courses (Ross & Collins, 2009). The Molecular Diagnostics course includes two additional weeks of clinical experience in molecular laboratories for the Advanced Practice (AP) students. Case history presentations, journal

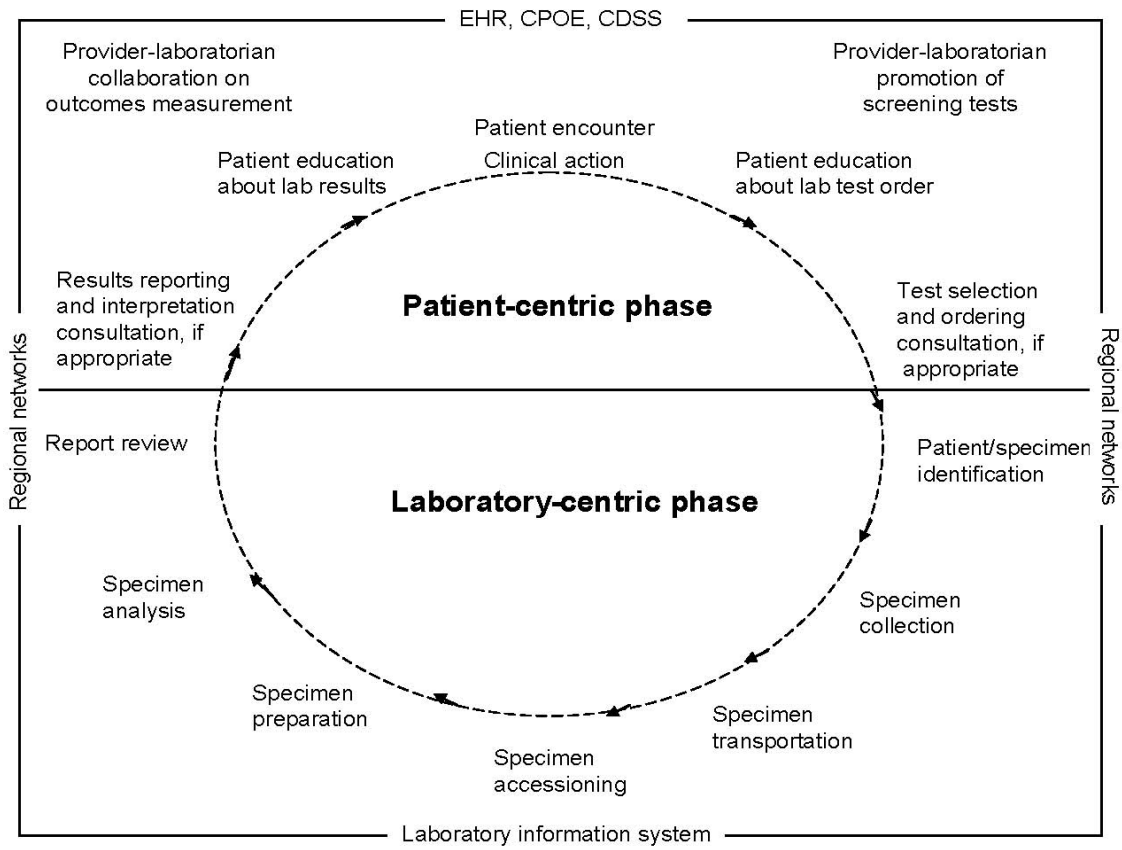

Figure 1. Patient-centered total testing process. [1]

[1]From. "Owning the Total Testing Process" by P. Epner, 2008, *Advance for Administrators of the Laboratory,* 17, p. 65. Copyright 2008. Reprinted with permission of the author.

article critiques, and literature reviews are additional assignments. The final requirement is a project suitable for publication in a clinical journal. One goal of the program is to improve the learner's critical thinking and problem solving skills. Other undergraduate and graduate level programs are adding evidence-based practice, biostatistics, and molecular courses with clinical experience (Georgia Health Sciences University CLS Masters curriculum, 2011). The barriers to the graduate level programs occur in the clinical internship experience. The clinical instructors feel threatened that the career entry-level MS students will demand higher entry-level salaries (Ross & Collins, 2009).

It is premature to analyze the outcomes of the AP graduate programs within the healthcare environment. Ross and Collins did indicate from a two-year review of their AP graduates, they are promoted to higher level positions with only one year of experience instead of 2 to3 years which is usually required of the BS graduates. The AP graduates have been offered positions in jobs requiring more advanced skills such as; laboratory information systems analyst, point-of-care coordinator, and compliance coordinator. From a review of the few graduate programs for clinical laboratory science, a course involving multidisciplinary case-based integration with clinical laboratory scientists has not been found that places students from various allied health programs and medical schools together communicating on cases that involve a team approach. The clinical laboratory science students establishing a relationship with other allied health students will begin the process of discovering how consulting with each other will identify the value of sharing knowledge and improving patient outcomes.

New Approach in Continuing Professional Education

As the educational programs are attempting to enhance the curricula to include higher level skills that address knowledge translation within clinical laboratory science, continuing professional education (CPE) needs to provide the working laboratory professionals with the opportunity to move forward in the integrated healthcare environment. In a recent ASCP survey concerning CPE, 1297 clinical laboratory professionals indicated that they received CPE from in-services, journals, and self-directed learning. When asked where they prefer to receive CPE they selected external workshops/seminars or web-based learning (ASCP, 2007). The report did not indicate if the participants listed other forms of CPE. Davis (2006) supported effective continuing

education including knowledge translation activities as a means to decrease healthcare costs and improve patient health. One description of CPE that involves knowledge translation for clinical laboratory scientist would include applying critical clinical pathways/test algorithms to patients' testing profile and integrating this information into a patient-centric system (NAACLS, 2008). An example of making tacit clinical knowledge explicit, with the hope of reducing less variation in patient care, can be seen in the patient outcome research teams (PORTS) and the evidence-based practice centers of the Agency for Healthcare Research and Quality (AHRQ) (Ferlie and Shortell, 2001). Placing clinical laboratory scientists in a more active learning environment can enhance problem-solving skills and involves them in a patient-centric focus instead of a provider-centered focus. A learning experience that is contextually centered in a practice setting similar to the actual practice makes a smooth transfer of learning (Moore, Cervero, & Fox, 2007).

Opportunities for the Clinical Laboratory Scientist

The clinical laboratory scientist can be an advocate for the patient by providing consultation to other healthcare professionals as well as educational support. All healthcare professionals should be dedicated to lifelong professional learning. To provide active learning events within rounding teams the clinical laboratory scientist can share valuable information and improve patient care. Grol and Grimshaw (2003) have done extensive research on effective implementation strategies to improve patient care. They noted that complex changes in practice are not easy especially if it requires collaboration between services and change in organization of care. We know how vital laboratory medicine is to patient safety, but the important issue is to understand how new knowledge becomes meaningful to other healthcare professionals. The goal should be to

develop learning strategies that translate evidence into behavioral changes in the clinical settings. To be an educational consultant, the laboratory professional can provide continuous learning opportunities at the bedside that support patient care.

Through the redesign of education curricula and the active learning experiences centered on knowledge translation within continuing professional education (CPE), the clinical laboratory scientists can be prepared for opportunities to improve patient care. The creation of new job descriptions can open the door for the use of the advanced skills provided in these educational activities. The clinical laboratory scientist can become a consultant to practitioners and patients by interpretation of clinical test results. Questionnaires given to family practice practitioners support the consultant role for the clinical laboratory scientist (Clinical Laboratory Improvement Act, 2009). In a response to the statement, "My clinical performance would benefit if there was a mechanism for simple and effective consultation on the selection of laboratory tests, particularly the more complex assays," 92% of the practitioners strongly agreed. Since 2001, Lab Tests Online has provided patients, family members caring for patients, and healthcare providers with valuable information on lab test results. Often the patients do not understand what the practitioner told them about the test results, and they want to know more. Laboratory professionals volunteer to provide information about the tests without focusing on the specific patient's results. Several consumer magazines have honored the Lab Tests Online site for the valuable information the site provides to the public. This site acts as an international consultant to thousands of healthcare practitioners and their patients (Lab Test Online, 2007).

To improve laboratory services the clinical laboratory scientist can create more effective communication with practitioners and nursing units. The computerized provider order entry (CPOE) is an electronic link between the laboratory and other healthcare professionals. To redesign the CPOE to take specific clinical findings entered by the physician and assist in the selection of the correct test profile, would take the "guessing what test to order" out of the process. The clinical laboratory scientist would maintain the database with a current listing of tests with research references and additional information guiding the clinician through a decision tree format.

At the other end of the laboratory-testing spectrum an interpretative report for certain tests will provide a clearer communication of the results. The laboratory professional has been providing a numerical value for the test results and possibly the reference range, but leaving the practitioner to determine how the results impact the patient. According to Dupree and Kemp (2005), the narrative interpretation translates data into knowledge and educates the physician at the point of practice. Advanced technology, the IPOD or PDA, can provide the possibility of receiving patient information when an informed decision is required. Simply giving a numerical result is not providing the best patient care. In the RAND Health Institute Study, 30% to 45% of patients in the U.S. and the Netherlands are not receiving care supported by scientific evidence. The report also shows that 20% to 25% of patient care is not needed or potentially harmful (Laboratory medicine: A national status report, 2009). With the current laboratory skill sets and additional management skills the clinical laboratory scientist can be an asset to the integrated healthcare network. To provide accurate diagnostic test results plus a thorough interpretation of these new, advanced tests will

increase the quality of patient care. Knowledge translation is the link to the successful advancement of these goals for patient care. A thorough discussion outlining the development of knowledge translation in the healthcare field, and the models that define its use can present a view of why clinical laboratory scientists add to the expansion of knowledge translation.

Development of Research in Knowledge Translation

To understand and identify the relevance of knowledge translation within the healthcare community requires a thorough description of the earlier research outside healthcare and how it links into the practitioner's environment. Throughout the discussion, the goal was to identify the benefits of knowledge translation contributing to the optimum healthcare outcomes for the patient. The initial discussion addressed the historical development of knowledge translation within educational and industrial environments. Concurrent research supporting knowledge translation included change theory and diffusion of innovations. The complexity of knowledge translation has produced debates on theoretical perspectives and models. This section will discuss how the various models of knowledge translation offer a clearer understanding of the process and how it can fit within healthcare organizations. A comparison of the models includes the specific phase of knowledge translation upon which each model focuses. Prior to the interest in knowledge translation throughout the healthcare community and development of models, Pathman, Konrad, Freed, Freeman, and Koch (1996) conducted research on the cognitive steps a physician would go through before accepting a new procedure into her practice. Since this research was the framework around which clinical laboratory scientists' participation in knowledge translation was built, a brief discussion will identify

the main points of the process and how it closely resembles the stepwise process found in clinical laboratory practice. Finally, this narrative describes the barriers and strategies in implementing knowledge translation including a meta-analysis by Grol and Grimshaw (2003).

Early Research in Knowledge Translation

The seminal works of Lewin, Lippett, and Lazarsfeld (Havelock, 1973) are the capstone research studies over the last 50 years on the process of taking research knowledge to practice or the dissemination and utilization of scientific knowledge. According to Huberman (1990), Lewin established the fundamental concepts of knowledge utilization. Many empirical studies in the area of Human Resource and Organizational Development (HROD) have explored this earlier work within the scope of knowledge transfer and management. Lewin showed the linkage between individuals in the research community and the community of educational practitioners was pivotal to the research findings reaching the actual practice environment. The studies revealed that the conversation must begin before the initial research study begins and continue throughout the research process (Huberman, 1990).

In the earlier work of Havelock (1969), the focus was on knowledge utilization and dissemination. Subsequently, he developed three models that described this interaction. The first model was a problem-solving method where the user identifies the problem and works with the researcher to develop a solution. The second model was a research-development-and-diffusion model where the researcher developed the innovation, tested the innovation, and presented it to the user. As noted in later healthcare knowledge translation models the research-directed innovations must involve

the user prior to its completion (Sudsawad, 2007). The researcher cannot make the assumption that the user has identified the problem and will utilize the innovation without any assistance from the researcher. Grol and Grimshaw (2003) provided extensive evidence on the types of barriers to implementation when the stakeholders were involved in the initial work. These barriers will be discussed later in this chapter. Havelock's third model (1969) placed emphasis on social interaction. The use of a social network supported the users' identification of the problem, interaction with the researcher in the development phase, and the users' implementation of the innovation with support from the researcher. Finally, Havelock (1973) placed all three models together to provide a more complete picture of knowledge utilization and dissemination. The linkage of the user and researcher created a more reciprocating and lasting relationship that began by identifying the problem and continued through communication after implementation. The collaborative nature of the relationship built a channel between the researchers and the users' community. Havelock (1973) described the user-resource linkage as a problem-solving system

Supporting Havelock's work, Huberman (1990) designed a multiple-case, tracer study and picked eleven projects near the end of the research phase before dissemination by the public. Seven projects were conducted in university research units and four in research-and-development centers. Each project identified two public communities that would be receiving the final research study. The participants were interviewed as the research study was disseminated and again in eighteen months. Huberman was looking for shifts in linkages over time. The findings indicated that continual conversations with the practitioners set up better utilization of the research information. The conversations

created a multidisciplinary collaboration that allowed for the flow of knowledge between the researchers and practitioners. The use of a one-time workshop was found to be problematic causing distortions and simplifications of the knowledge by practitioners (Huberman). Assimilation took time for interaction between researcher and practitioner, so the practitioner could link current knowledge to new incoming knowledge. The practitioners were better prepared to apply the new knowledge to their environment. Havelock's (1973) framework in the early 1960's focused more on the utilization of scientific knowledge. He did suggest collaborative interactions and trusted linkages between researchers and practitioners.

The research conducted by Havelock, Huberman, and others have led the healthcare community to look at the knowledge translation process as a reciprocal process of interaction and exchange among the producers of knowledge and the stakeholders (Jacobson, Butterill, & Goering, 2003; McCormack, Kitson, Harvey, Rycroft-Malone,Tichen, & Seers, 2002). In a literature review by Jacobson, Butterill, and Goering the knowledge translation literature was separated into five domains identified as: (a) the user group, (b) the issue, (c) the research, (d) the knowledge translation relationship, and (f) dissemination strategies. The final strategies they suggested from the researcher's perspective focused on three processes: (a) awareness, (b) communication, and (c) interaction. It is significant that most of the current research has developed around the interconnectedness of the researcher and the stakeholders (Huberman, 1990; Szulanksi, 2000). Jacobson, Butterill, and, Goering (2003) also introduced the use of a knowledge broker to mediate between the researcher and the users. The clinical laboratory scientist could fill this position when introducing new

advanced testing for the healthcare practitioner and assist in the dissemination process using evidence based outcomes in discussing the value of the tests in the practice environment. Active educational interventions are more likely to induce change in the practitioner (Wensing, Bosch, & Grol, 2008).

Concurrent research supporting knowledge translation

An analysis of the multifaceted levels within knowledge translation cannot be complete without a discussion of other research that impacts knowledge translation and has been cited in current knowledge translation literature. When establishing an implementation plan that involves a change in the healthcare professional's daily activity, it is helpful to review the literature on change theory, organization change, change management, and diffusion of innovation. As Hall and Hord (2006) discovered in years of research on change within educational settings, change occurred inside of social systems and through communication. The process of creating cultures of educational change required a collaborative working relationship as described in Hord's (1997) description of professional learning communities. In Rogers' (2003) research on innovation, the adoption rate around change was based on the amount of communication and the number of people involved in the communication. Perceptions and opinion leaders influenced the rate of adoption. As discovered by Hall, Hord, and Rogers the decision process had various steps through which an individual must pass from first learning about the innovation to forming an attitude toward the new innovation, to a decision to adopt or reject and finally to the implementation of the new approach and confirmation of this decision.

In the "Stages of Concern," Hall and Hord (2006) discussed the stages involved in making a personal decision on a new task or issue. The stages were grouped into three categories; (1) self, (2) task, and (3) impact. To effectively communicate to an individual concerning this new approach or implementation it is critical to know where the individual resides within the stages. If the person was more concerned about how the change would affect them, it would not help the process by discussing the management of the work or collaboration with co-workers around the new approach. In the "Levels of Use," Hall and Hord identified the individual as fitting within different categories such as; (1) knowledge-a cognitive level of understanding the innovation, (2) acquiring information-solicit information in a variety of ways, (3) sharing-communicating with others about the innovation, (4) assessing-examining the potential or use of the innovation, (5) planning-adoption of the innovation by designing steps to be taken, (6) status reporting-describe personal stand on the innovation, and (7) performing-operationalizing the innovation.

Hall and Hord's Concerns-based Adoption Model (2006) illustrated the change agent or change facilitator team as actively assessing the individuals' concerns and levels of use throughout the innovation process and communicating within the appropriate stages. A change agent facilitated the flow of innovations from the source to the client. They possessed a high degree of expertise in their field and developed rapport with the client. The client perceived them as being credible, trustworthy, and competent. Without the involvement of the individual or client in the change or innovation, progress will slow or stop. Systems or organizations may adopt change, but people implement change (Hall & Hord, 2006). The following descriptions of the healthcare knowledge translation

models incorporate some of the features discussed in Rogers' Innovation-decision Process Model (2003), Hall and Hord's Concerns-based Adoption Model (2006), and other organizational change research.

Integration of Knowledge Translation in Healthcare

The definition of knowledge translation is complicated by the fact that multiple terms are used to identify the process. In a study by Graham, Tetroe, Robinson, and Grimshaw (2005) 33 applied research-funding agencies in nine countries identified 29 terms used to describe the transfer of knowledge to practice. In some articles, knowledge translation was identified as knowledge transfer, knowledge exchange, implementation, diffusion, and research utilization (Estabrooks, Thompson, Lovely, & Hofmeyer, 2006). The term, knowledge translation, more accurately identified the complex process and multiple layers needed to be identified when working within healthcare organizations. It described the movement of "knowledge to action" (Graham, Logan, Harrison, Straus, Tetroe, Caswell & Robinson, 2006, p. 14) or "what is known and what is currently done" (Davis et al., 2003, p. 33). Identifying the most inclusive term leads to the next step in defining what the term means in the healthcare community.

Healthcare organizations' definitions of knowledge translation

Knowledge translation as defined by the Canadian Institutes for Health Research (CIHR) is "the iterative, timely, and effective process of integrating best evidence into the routine practices of patients, practitioners, health care teams, and systems, in order to effect optimal healthcare outcomes and to optimize health care and health care systems" (Canadian Institute for Health Research, 2008). The National Center for the Dissemination of Disability Research views knowledge translation as a multi-

dimensional and encompassing process. It should reflect the context in which the end-users make decisions, solve problems, or use knowledge. It is an interactive and engaged process between the researchers and the systems of care (i.e., teams, policymakers, health institutions, and consumers) (NCDDR Technical Brief #10, 2005). The World Health Organization describes knowledge translation as "the synthesis, exchange, and application of knowledge by relevant stakeholders to strengthen health systems and improve people's health" (2005, p. 2). In comparing the definitions, the common thread surrounds the identification of the process that moves research knowledge into implementation by all relevant stakeholders thus improving healthcare for all patients. Knowledge translation is a "systematic approach" as well as an "interactive process" between what is known from research, and the implementation of this knowledge by healthcare practitioners to improve health outcomes (Graham et al., 2006). It is not the one-way process that is often the logical positivist approach applied in scientific circles (Rycroft-Malone, 2007).

The rapid advancement in technology and testing has created volumes of scientific research, but the translation from scientific data to clinical practice is not keeping pace. As identified in the previous discussion on change, communication across healthcare disciplines can produce a more useful implementation of the research. In the past, the development of research and practice silos has created the gap between high-quality evidence and practice (Davis, 2006). It has been estimated that it takes one or two decades for original research to be translated into practice (Sussman, Valente, Rohrbach, Skara, & Pentz, 2006). The presence of the professional elitism has added to the

delay,since various academic and healthcare professionals have limited communication with each other (Davis, 2006).

In 1980, the U.S government became involved in the translation of science into practice. The Stevenson-Wyndler Technology Innovation Act involved the government in the transfer of technology to public or private agencies. The Bayh-Dole Patent and Trademark Act focused on universities, not-for-profit organizations, and small businesses to produce incentives for new products and services (Sussman et al. 2006). Sussman et al. described the difference in translational research and basic research. The translational research outcome is a product, process or service from conceptualization to dissemination whereas basic research does not embrace the entire process but only focuses on the pure research objectives. The National Institutes of Health are heavily involved in translational research, and universities partner with businesses to get products marketed. It can be a revenue generator for both universities and practitioners. A discussion on translational research or the creation of new technology will not be included in this study.

Knowledge translation framework

The development of knowledge translation within healthcare has elicited debates on the theoretical framework that best defines it. Estabrooks, Thompson, Lovely, and Hofmeyer, (2006) did not support the one theory fits all approach. The critical step was finding a fit between context and theory. Theory should be the guiding force behind the design of interventional strategies and implementation guidelines. Even though Estabrooks et al. stated that multiple theoretical perspectives were more powerful than an overarching theory in knowledge translation, there has been no rigorous evaluation on the use of other discipline specific theories into the healthcare sector. Diffusion of

innovation theory developed by Rogers discussed earlier in this chapter focused on social systems and norms but not within a scientific research context (Rogers, 2003). The diffusion was a process that placed an innovation within a social system via a series of stages. Estabrooks et al. defined the five channels of knowledge translation within the scientific research context as awareness, persuasion, decision, implementation, and adoption. Another framework developed by McCormack, Kitson, Harvey, Rycroft-Malone, Tichen, and Seers (2002) was based on rational decision-making and accounted for the important influences of context in knowledge translation. The Promoting Action on Research in Health Services (PARiHS) program emphasized the need for skilled internal and external facilitators and a context supportive of change (Kitson, Harvey & McCormack, 1998; Rycroft-Malone, 2004; Rycroft-Malone, Kitson, Harvey, McCormack, Seers, Titchen & Estabrooks, 2002). The knowledge translation models will be discussed in detail later in this chapter.

Organizational theories such as change theory focused on the process of individuals making a change within a social activity (Eisenhardt, 1989; Fenwick, 2003). The institutional theory examined how institutions make changes or change from one institutional form to another (Estabrooks, Thompson, Lovely, & Hofmeyer, 2006). The social capital theory looked at how change occurs within social relationships identifying networks, linkage, and associations (Ewert & Grace, 2000). People were united in a common purpose within a defined network. As far as this literature review has extended, there is limited research on the transferability of theory-driven interventions across professional groups or settings and patient groups (Estabrooks et al., 2006). Most current knowledge translation studies focused on a single clinical issue or a single practitioner's

change of behavior (Rycroft-Malone, 2007). The success of knowledge translation will depend on active collaboration within the social context of the healthcare community. There is a need for a road map to navigate the complexity of knowledge translation and a multi-disciplinary process to break through the professional silos that are keeping healthcare professionals from working as teams to improve patient outcomes (Graham, Logan, Harrison, Straus, Tetroe, Caswell & Robinson, 2006).

Knowledge translation models

In comparing the knowledge translation definitions discussed earlier there is a consistent view that knowledge translation involves more than the researcher and the practitioner. Some stakeholders are often not included in research as noted in studies directed exclusively to specific practitioners (Henderson & Winch, 2008; Herschel, Nemati, & Seiger, 2001; Lang, Wyer, & Haynes, 2007; Scales & Adhikari, 2008). It is a new process within healthcare, and the creation of various models identifies different pathways for healthcare professionals to become engaged in the process. In a database created by Improved Clinical Effectiveness through Behavioral Research Group (ICEBeRG) 31 models of knowledge translation were identified. The CIHR grant, *Identification, Concept and Bibliometric Analyses of Knowledge Translation Theories/Frameworks,* was established to:

a) conduct a focused search for conceptual models, frameworks, and theories of knowledge transfer
b) create a theory analysis of these models/theories
c) discuss the extent to which the models/theories had been used/tested

d) provide a User's Guide to the models/theories (Improved Clinical Effectiveness Through Behavioral Research Group, 2008).

From this research, CIHR developed a global model that encompasses the overall knowledge translation process. It began with the knowledge-to-action (KTA) process described by Graham, Logan, Harrison, Straus, Tetroe, Caswell, and Robinson (2006). The Graham et al. model encompassed the creation of new knowledge and through its application to yield benefits and improve health outcomes. There were two components of this model; (a) knowledge creation and (b) action. The two components had no definite boundaries, and intersected with each other throughout the entire process. The Knowledge-to-Action Model was conceptually an empirically based approach to knowledge translation. The knowledge creation funnel established the research priorities by raising certain questions. The decision of what knowledge should be translated and how the knowledge will be used is a crucial factor. The knowledge creation funnel included the synthesis of knowledge to contextualization and the integration of findings within a larger body of knowledge. The synthesis process created knowledge tools thus providing best practice guidelines and the evidence base for the knowledge translation. The release of the knowledge in an accessible format and placing the research into the context of sociocultural norms was a critical step leading to the action phase.

The knowledge funnel poured into the action cycle, which was derived from a theory analysis of planned action theories (Graham et al., 2006). The action cycle allowed for dialogue thus bringing about change. Graham excluded the classical implementation theories from the action model because he felt they were passive and retrospectively used to understand change. All phases of the action cycle could influence

one another. The knowledge creation process influenced the action cycle. The action phase identified the problem and how the knowledge can be used to establish interventions. There was a continuous evaluation of the process and assessment of barriers arising from the knowledge usage (Graham, et al.).

From fifteen action theories identified by ICEBeRG twelve categories were synthesized into the CIHR model (Tetroe, 2007). The categories include:

- Identify the problem
- Identify the need for change
- Identify change agents
- Identify target audience
- Assess barriers
- Review evidence/literature or develop innovation
- Tailor/develop intervention
- Link(age)
- Implement
- Evaluate
    - Develop evaluation plan
    - Pilot-test
    - Evaluate the process
    - Evaluate outcomes
- Maintain change
- Disseminate

The CIHR's knowledge translation model incorporated these twelve action categories. A question raised about this model is at what point does the target audience participate in the process? Another critical piece is the amount of stakeholder's involvement in the process. The model is illustrated in figure 2.

The Ottawa Model of Research Use (OMRU) was a logic model based on planned action theory (Logan & Graham, 1998). It was also classified as a context-focused model because it looked at the contextual factors used to move research findings/knowledge into practice (Sudsawad, 2007). It called for continuous monitoring of the process. The model focused on six primary elements. The first phase (assess) examined the barriers and supports of the knowledge (the practice environment, potential adopters, and evidence-based innovation). The practice environment identified the patients, culture/social, structural framework, economic situation, and uncontrolled events. The next phase was a monitoring of the intervention strategies and degree of usage indicating the adoption of the knowledge translation (implementation, intervention strategies, and adoption). The final phase was the evaluation of outcomes (patient, practitioner, and system). The Ottawa Model has also had some revisions (Graham & Logan, 2004) to incorporate similar categories identified in the ICEBeRG research. It relied on the process of assessing, monitoring, and evaluating each element before, during, and after the decision to implement. This model showed more emphasis on inclusion of the stakeholders at the beginning of the process as well as an investigation into the barriers and environment in which this implementation will occur. The process monitored and evaluated the

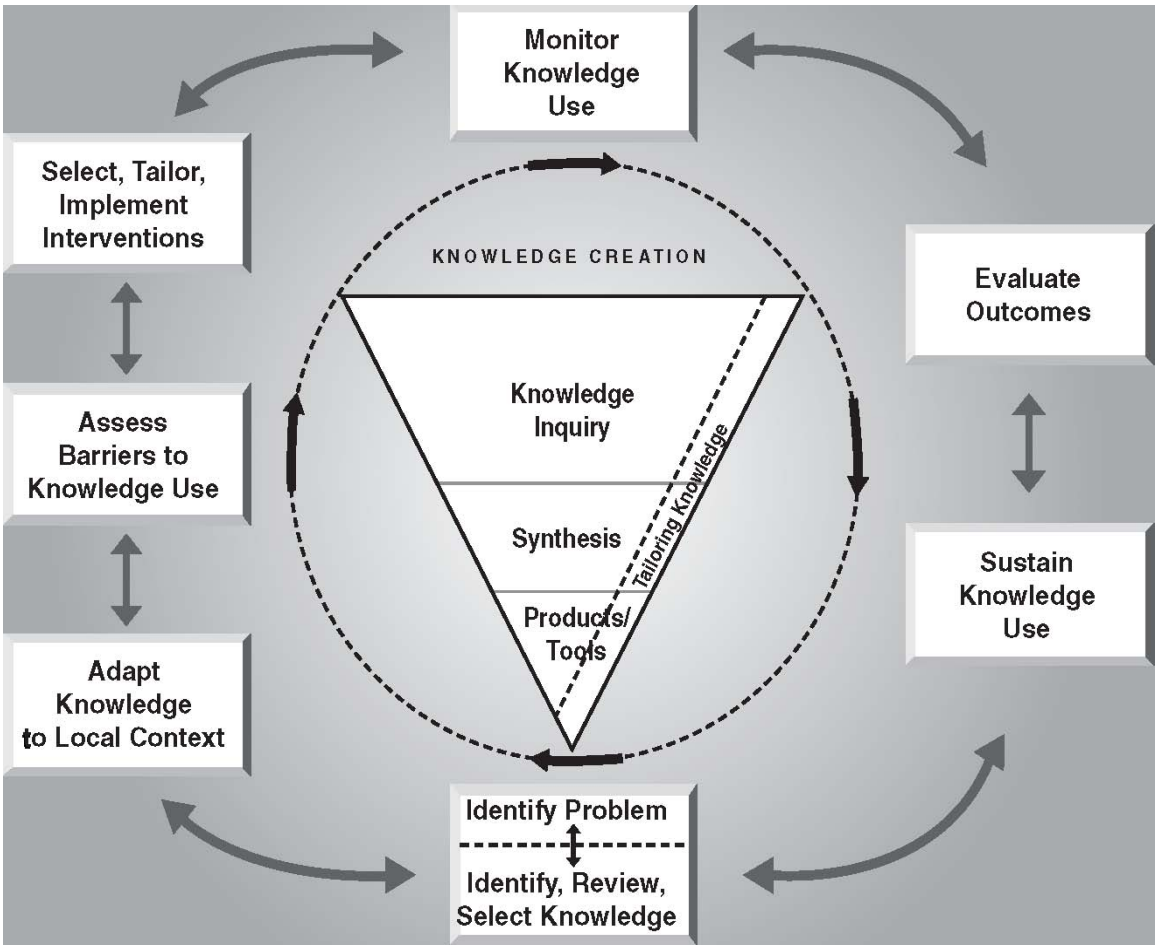

Figure 2 Knowledge-to-Action Model[2]

[2]From "Lost in knowledge translation: Time for a map?" by Graham, Logan, Harrison, Straus, Tetroe, Caswell, and Robinson (2006). *The Journal of Continuing Education in theHealth Professions,* 26, p. 24. Copyright 2006 by John Wiley & Sons, Inc. Reprinted with permission of the author.

implementation until it reached the patient and practitioner, which is the ultimate goal of knowledge translation. It was not clear who was involved in the initial knowledge creation prior to assessing barriers and support stage. The Ottawa model is illustrated in figure 3.

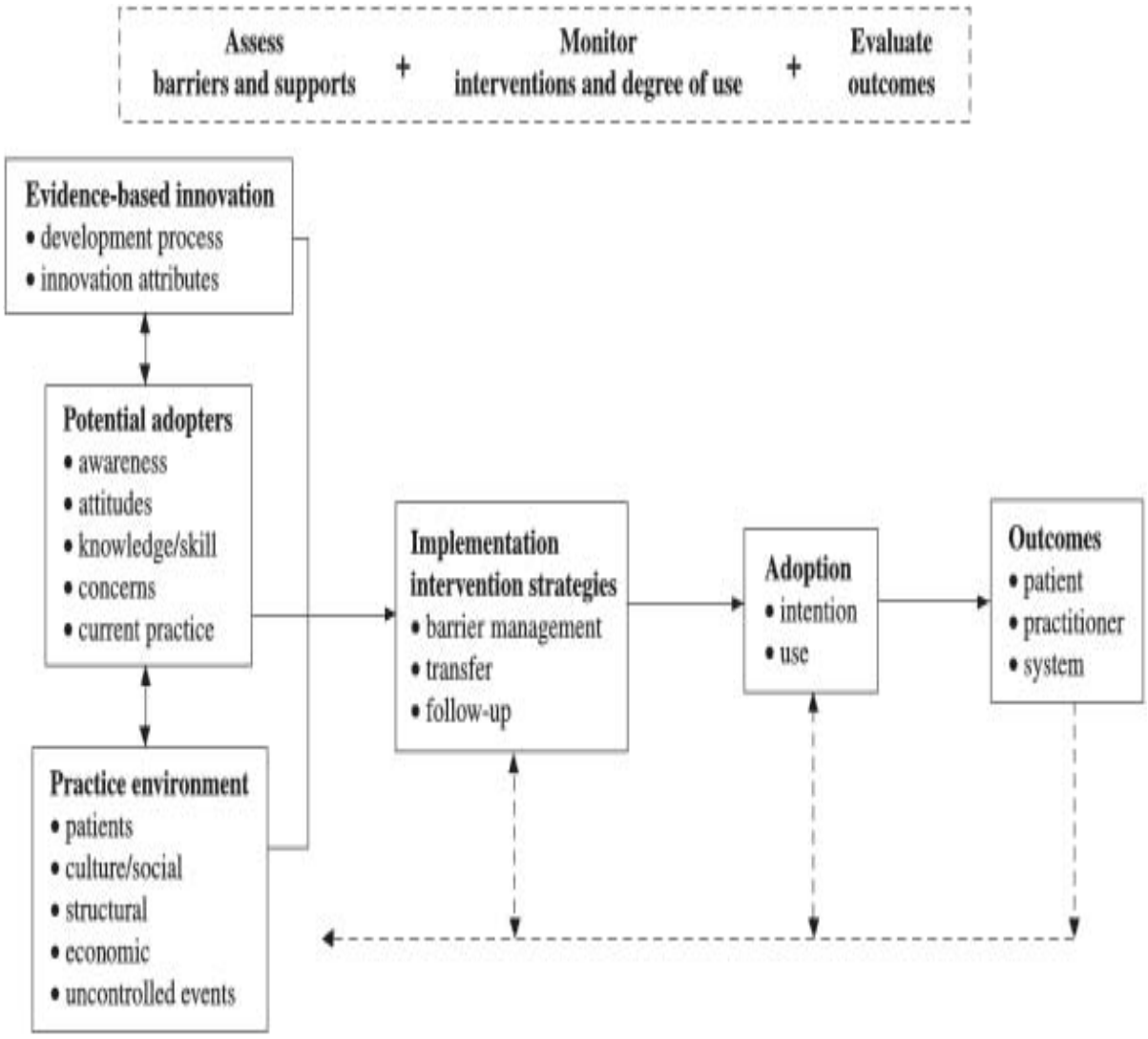

Figure 3. Ottawa model of research[3]

[3]From " Innovations in knowledge transfer and continuity of care," by Graham, I.D. & Logan, J., 2004, *Canadian Journal of Nursing Research*, 36, p. 103. Copyright 2004. Reprinted with permission of the author.

Jacobson, Butterill, and Goering (2003) developed an interaction-focused model. The knowledge translation model involved three key processes: awareness, communication and interaction. The authors suggested several strategies that researchers could use in implementing knowledge translation. Researchers should draw from their

own experiences or build experiences by working with the user group. Some research organizations used a knowledge broker. They mediated between researchers and user communities. Researchers must increase their understanding of the user group by means of focus groups or case studies. The framework consisted of five domains discussed earlier to be included in establishing interaction with users: a) user group, b) issue, c) research, d) researcher-user relationship, and e) dissemination strategies. Jacobson et al. provided a series of questions for researchers and planners to consider. The questions raised awareness about the user group and implementation of the knowledge translation process. This model focused on interaction between the users and researchers occurring after the knowledge exist. The Jacobson's process was labeled as a knowledge translation model, but it is mainly a framework that could be used in addition to the initial steps in the knowledge translation process (Sudsawad, 2007).

The Promoting Action on Research Implementation in Health Services (PARiHS) was a conceptual model that described implementation of research into practice (Kitson, Rycroft-Malone, Harvey, McCormack, Seers, & Titchen, 2008). The conceptual model identified the interplay of three core elements a) the level and nature of the evidence, b) the context or environment, c) the method in which the process is facilitated. It was a contrast to models that placed the level and rigor of the evidence as being more important than the implementation. Together with Kitson, the Royal College of Nursing Institute (1998) worked to develop a model with more interplay and interdependence with factors that influenced the movement of research to practice than other current models. The multi-dimensional framework for this model was expressed in the following equation: SI=f (E, C, F) with SI=successful implementation, E=evidence, C=context, F=facilitation

and f=function of (Kitson et al., 1998). Evidence was defined as a combination of research, clinical experience, and patient preference. Evidence could not solely rest on the success of only one of these factors. For each type of evidence, there was a range of conditions from "low evidence" to "high evidence." Even if a randomized controlled trial revealed a highly effective intervention, practitioners and patients could reject it thus no implementation would occur. However, if clinical experience and patient preference was high for a particular intervention, even though the research evidence was low, the adoption of the intervention was higher. The danger in this formula is played out yearly with new treatments or drugs that are pushed out early and find wide acceptance from the practitioner and patient, but the randomized clinical trials show negative consequences for the patient.

Context was defined in the equation as the environment or setting in which the particular implementation takes place. The context could include physical environment in which the practice occurred. PARIHS identified three themes under context as: a) culture, b) leadership, and c) evaluation. Under the culture domain the high scale consisted of: a) learning organization, b) patient centered, c) valuing people, and d) continuing education. Facilitation was defined as techniques that the facilitator used to make things easier for others. The three domains of facilitation were: a) characteristic, b) role, and c) style. The characteristic of a high level facilitation would be respectful, empathetic, authentic, and credible. The PARiHS model consisted of complex factors involved in the implementation of new knowledge. It did not discuss the elements related to knowledge creation. Rycroft-Malone (2004) updated the PARiHS model using

concept analysis of each sector, but there was still a need to link it to a knowledge creation model and evaluate its actual use within the healthcare community.

Another implementation model introduced by Lomas (1993) was The Coordinated Implementation Model. It captured the competing factors that influence the implementation process. It demonstrated some of the largely unexploited routes through which research information influences practice. Four potential groups influenced the implementation process; a) community interest groups, b) administrators, c) public policymakers, and d) clinical policymakers. Within the overall practice environment, the administrative, economic, personal, educational, and community factors form a system exerting pressure on the implementation process. The model provided awareness of the factors that should be considered within the knowledge translation process. It defined stakeholders outside the healthcare practice thus providing linkage to the success of knowledge translation. This model was not a knowledge translation model because its focus was on the implementation portion without the initial communication between the researcher and stakeholders.

The Stetler Model of Research Utilization (2001) provided an individual-focused model. It was a practitioner-oriented model that provided a procedural and conceptual guide to the application of research to practice. It was first presented in 1976, but has gone through several revisions (Stetler, 1994, 2001). It had two parts. The first part was a graphic model containing the five phases of research utilization including a) preparation, b) validation, c) comparative evaluation/decision making, d) translation/application, and e) evaluation. The second part offered clarifying information and options for each phase. Stetler established six basic assumptions that presented a

prescriptive approach designed to facilitate an effective use of research in practice. The assumptions are:

1. The formal organization may or may not be involved in an individual's utilization of research.
2. Utilization may be instrumental, conceptual, and/or symbolic.
3. Other types of evidence and/or non-research related information are likely to be combined with research findings to facilitate decision-making or problem solving.
4. Internal and external factors can influence an individual's or groups' view and use of evidence.
5. Research and evaluation provide us with probabilistic information, not absolutes.
6. Lack of knowledge and skills pertaining to research utilization and evidence-based practice can inhibit appropriate and effective use. (Stetler, 2001, p. 274)

In reviewing the various models of knowledge translation, it is clear that all stakeholders are not involved in the knowledge translation process. Some of the models identify with the context-focused process of knowledge translation placing more emphasis on the research stage. Jacobson et al. (2003) were more concerned about understanding the user group and engaging the user in the process. Under "the user group" domain, the focus was on the decision-making practices, access to the information, and experiences with knowledge translation. Jacobson et al. also asked about the political climate surrounding the user group and the kinds of decisions the user group made. The "dissemination strategies" domain asked very specific questions. What

level of detail will the user group want to see? How much information can the group assimilate per session? In the other domains, the focus was on the amount of conflict surrounding the issue, and the relevancy of the research to the user group. The Coordinated Implementation Model (Lomas, 1993) addressed all the stakeholders in the process including administration and policy makers.

All of the models offer complex, integrated stages that help achieve knowledge translation, but unless there is more concentration on the stakeholders' involvement in the initial development of the innovation, the implementation process will not move forward. The stakeholders can play a vital role in moving knowledge to action. As demonstrated in the PARiHS model the most effective intervention will fail if the practitioner and patient do not favorably accept it. It is this phase of the process that the clinical laboratory scientist can be helpful in working with the healthcare community to adopt and implement the new, advanced testing. This study will focus more on the utilization of the knowledge translation process by the clinical laboratory scientist collaborating with other healthcare professionals. As the models demonstrate, without active communication with all the stakeholders during all phases of the process, a new test will not be embraced by the healthcare professionals and thus remain on the shelf.

Pathman's approach to successful knowledge translation

In chapter one, a discussion of the awareness-to-adherence model developed by Pathman, Konrad, Freed, Freeman, and Koch (1996) identified the significance of the model to this study. It focused on the individual practitioner's steps from awareness through adherence of a new practice. The physicians surveyed in the study moved through a sequence of behavioral steps; (1) awareness, (2) agreement (acceptance), (3)

adoption, and (4) adherence. In the review of current literature these cognitive activities are mentioned in describing various knowledge translation models. The effectiveness of knowledge translation must be seen as an on-going process involving a shared understanding of the knowledge being translated with a blending of these four steps within a culturally and socially constructed community using an experiential knowledge base (McWilliam, 2007). A brief review of the literature around these steps will aid in establishing the contextualized definitions described in chapter three.

Awareness

Awareness is to become aware that there is a need to understand how new knowledge will fit into the context of the workplace, and the first step is experiential learning and reflection by the individual healthcare professional. If healthcare is viewed as a mechanical/technical system rather than a viable organism, then the translation of knowledge into the system will not occur (Kitson, 2008). Awareness is the way in which participants in the system understand the nature and characteristics of the new knowledge either as individuals or teams. Dirkx (2007) indicated that the interaction of the practitioner with others plus the institutional demands help in the construction of new knowledge to address a problem. Awareness is not simply an individual's interest around new knowledge but a much more complex interactive learning system. The use of passive continuing professional education platforms to achieve awareness of new innovations or knowledge has not been effective in advancing the knowledge translation process (McWilliam, 2007). Moore, Cervero and Fox (2007) described three learning activities that enhance the incorporation of new knowledge into practice. In the predisposing activity the learner is given information about current performance and contrasting

information on evidence-based guidelines. In this learning event the healthcare professional becomes aware of the need to explore the new information.

Acceptance

The acceptance stage includes the activity of acquiring and processing new knowledge that leads to the recognition of its importance within clinical practice. Stetler (2001) defined the nature of acceptance as a gestalt process made on the basis of the strength of the evidence and other applicability criteria. If the individual or group perceived new knowledge as relevant to their current concerns, then there will be greater acceptance of the knowledge, but if they viewed it as politically unfeasible, then they will not become engaged in the knowledge translation process. As Huberman (1990) noted in earlier research, linkage of the researcher with the individual or user group was key in developing an interactive model of knowledge translation. The use of enabling activities described by Moore, Cervero, and Fox (2007) allowed the healthcare professional to actually use the new knowledge in the work environment. This activity allowed the individual or group to determine the benefit of this innovation to their needs and to learn if the innovation could improve patient care.

Adoption

Adoption is translating the new knowledge into a format that is easy to understand and is tailored to the workplace (Tugwell, 2007). As often seen in adopting new practices, if the users can adapt, refine, or modify the innovation to suit their needs, it will be adopted more readily (Greenhalgh, MacFarlane, Bate, & Kyriakidou, 2004). An interesting event in Pathman et al. (1996) research found 11% of the physicians adopted the practice without agreeing with it. The absence of the acceptance stage but moving

into adoption was addressed as a fear of malpractice, patient demand, or peer pressure. As noted by Kitson (2008) the new practice did not follow a logical flow from generation to implementation. The deviation from a logical framework was a significant factor in this study. Whether the healthcare professional accepted an innovation or simply adopted it to their work practice would possibly identify problems within the adherence stage. Adoption of new knowledge or practice requires the incorporation of both tacit and explicit experience to develop an action plan that translates knowledge into practice (Baumbusch, Kirkham, Khan, McDonald, Semeniuk, Tan, & Anderson, 2008). It also requires teamwork and collaboration within the institution to facilitate the implementation. In healthcare as well as in academe the social distance between disciplines often creates problems within the adoption and adherence stages.

Adherence

Adherence is the active, voluntary, collaborative involvement of relevant stakeholders in a mutually acceptable course of action to provide the desired outcome. In the discussion of the four components in bringing new knowledge to practice the adherence phase is problematic. Pathman et al. (1996) discovered the reasons for non-adherence among the physicians was not lack of information or entrenchment in old practice, but a concern about the long-term efficacy of the practice and the inappropriateness of the practice for their particular patients. Consistent adherence to innovations was difficult if it required changes in routine, daily practices. A case in point was the consistent use of hand hygiene by healthcare practitioners. In a UK study it was found between 15% and 30% of nosocomial infections can be prevented by improved hand hygiene. Nevertheless, compliance was poor and the reasons varied from individual

obstacles to unit or organizational reasons (Grol & Grimshaw, 2003). The importance of identifying barriers will be discussed in the next section, but adherence is a multifaceted activity that requires the involvement of all stakeholders.

Barriers and Strategies

The final discussion is concerning the barriers and strategies to implement knowledge translation within the healthcare community. The translation of knowledge to practice implies a need for change in the providers' behavior to guide implementation. According to Grol and Grimshaw (2003) over 10,000 new randomized trials are submitted to MEDLINE every year and 350,000 trials have been identified by the Cochrane Collaboration. In 76 studies reviewing obstacles to change within physicians' practices, researchers found that obstacles occurred in different stages in the healthcare system (Grol and Grimshaw). It occurred at the level of the professional, the healthcare team, the patient, or the organization. If the implementation of evidence in healthcare is examined, the emphasis is on developing a good understanding of the obstacles to produce an effective intervention. A cognitive theory of learning shows the lack of knowledge concerning the results is the reason for poor compliance. Following an experiential learning theory, the physician must experience the problem when not following the protocol first before there is motivation to change (teachable moment). In reflective practice theory, the physician will need to reflect on the solution and discuss it with colleagues before implementing the action. The behavioral theories suggest that performance is influenced by external stimuli such as incentives, feedback, modeling, and external reinforcement. Social influence theories propose group interactive educational sessions and local consensus, while marketing theories emphasize the importance of a

clear message to target audiences about the importance of the action. The barriers to change can occur at different levels, so the strategies must be directed to the correct level (individual, team, or organization). In a study of 54 interventions, Grol and Grimshaw (2003) found most interventions had some effect but none of the interventions were successful for all the changes.

The barriers to knowledge translation occur under the following domains:

1. Practice environment (organizational context)
    - Financial disincentives
    - Organizational constraints
    - Perception of liability
    - Patient's expectations
2. Social Context
    - Standards of practice
    - Opinion leaders-key person not agreeing with evidence
    - Medical training-obsolete knowledge
    - Advocacy-pharmaceutical companies
3. Knowledge and attitudes (professional context)
    - Clinical uncertainty
    - Sense of competence
    - Compulsion to act
    - Information overload (Grol & Grimshaw, 2003, p. 1227)

In a meta-analysis conducted by Bero, Grilli, Grimshaw, Harvey, Oxman, and Thomson (1998) that focused on interventions to improve professional performance and

measured changes in performance or outcome, they identified three levels of interventions for healthcare professionals. Under the consistently effective intervention level they listed manual or computerized reminders, multifaceted interventions (two or more audits and feedback), local census processing, and interactive educational meetings. The interventions with variable effectiveness included audit and feedback, use of local opinion leaders, local consensus processes, and patient-mediated interventions. The final level of interventions with little or no effect included educational materials and didactic educational meetings. Grimshaw, Shirran, Thomas, Mowatt, Fraser, Bero, Grilli, Harvey, and O'Brien (2001) noted that multifaceted interventions that targeted several barriers to change were more effective than single interventions. According to Grimshaw et al. and Bero et al., it was difficult to select which components of the multifaceted interventions led to success. Grimshaw, Thomas, MacLennan, Fraser, Ramsey, Vale, Whitty, Eccles, Matowe, Shirran, Wensing, Dijkstia, and Donaldson (2004) suggested that further studies need to be conducted on which implementation strategies are likely to be effective under different circumstances. To advance patient care the health educators focused on informing patients and their families about the appropriate care plus consultation with the healthcare provider (Wensing, Bosch, & Grol, 2008).

This chapter began with a brief historical sketch of clinical laboratory science plus a discussion of proposed advanced levels of practice and new approaches for continuing professional education. The next section described the development of knowledge translation as well as several concurrent research studies followed by possible conceptual frameworks supporting knowledge translation in the healthcare environment. The discussion on knowledge translation models portrayed a variety of conceptual,

contextual, interaction-focused, and individual-focused models. The models were evaluated on the common characteristics and differences. This study identified one specific conceptual model defining the user's actions in moving knowledge to practice. Pathman's model was pivotal in evaluating the cognitive stages of the individual's actions within the implementation of new knowledge. In the final section, a review of barriers and strategies to implementation of knowledge translation covered current implementation research.

CHAPTER III

METHODOLOGY

The purpose of this study was to understand clinical laboratory scientists' participation in the knowledge translation process. The questions central to this study were:

1. To what extent do clinical laboratory scientists participate in the four major components of knowledge translation (awareness, acceptance, adoption, and adherence)?
2. To what extent do personal characteristics (demographics) and situational factors (location of laboratory) of the clinical laboratory scientist predict the level of participation in each of the knowledge translation components?

This chapter is divided into six sections to describe the strategies and methodology utilized in answering the questions directed to the clinical laboratory scientist's participation in knowledge translation listed above. The first section describes the conceptual framework guiding this study. Section two focuses on the construction of the instrument including the description of the pilot study. Section three discusses the selection of the sample population. Section four describes the data collection procedure while section five covers data preparation. The final section discusses the data analysis and the limitations of the study.

Logical Framework

The purpose of this study was to understand the level of participation of clinical laboratory scientists in the knowledge translation process. The overarching theoretical perspective for this study described the translation of new knowledge to practice. Even though this process has been studied in the social sciences since the 1950s, the healthcare community only in the last decade has started to research the process of moving new medical research into practice. The term knowledge translation was selected for this study to describe the movement of medical research to practice, although knowledge transfer, implementation, utilization and over 33 additional terms are seen in the literature. A review of medical research literature did identify more than 15 knowledge translation models that were described as interdisciplinary studies (Davis, 2006; Graham, Logan, Harrison, Straus, Tetroe, et al., 2006; Graham & Tetroe, 2007; Grimshaw, Santesso, Cumpston, Mayhew, & McGowan, 2006; Zwarenstein & Reeves, 2006), but a single conceptual theory has not been identified (Estabrooks, Thompson, Lovely, & Hofmeyer, 2006; Kitson, Harvey, & McCormack, 1998; Rycroft-Malone, 2007). Since knowledge translation is a complex process involving multidirectional and multidimensional communications, interactive work and collaboration within a community of practitioners, different epistemological approaches contribute to the knowledge translation process.

The discussion on knowledge translation as the conceptual framework must include the organizational, educational, and social theories that are embedded within knowledge translation (Estabrooks et al., 2006). Chapter II covered this relationship between the embedded theories and knowledge translation. The interplay of these

theories can be observed as the clinical laboratory scientist passes through the complex stages in placing new knowledge into practice, but knowledge translation was identified as the overarching conceptual framework.

Prior to constructing a framework, one must understand the purpose of a conceptual framework. Ostrom (1999) defined a conceptual framework as a set of variables and relationships explaining the phenomena. The framework does not specify a certain direction of relationships or identify critical hypotheses. In knowledge translation the set of variables and relationships are identified and support an analysis of organizations and their ability to absorb and adopt new knowledge (Kitson, Rycroft-Malone, Harvey, McCormack, Seers & Titchen, 2008). Ostrom used the following questions to test the usefulness of a conceptual framework:

1. Does the framework help organize the empirical research where there are no well-specified theories?
2. Does empirical research drawing from the framework lead to new discoveries or better explanation of important phenomena?
3. Can the framework be applied to multiple levels of analysis? (Kitson et al., p. 5)

Ostrom's questions guided the development of the conceptual framework for this study. The framework helped to organize the empirical research due to the lack of well-specified theories and the multi-layered dimensions of knowledge translation.

Concept Clarification

In this study, a rigorous literature review was conducted to construct a conceptual framework that guided the instrument's development and provided an understanding of

the clinical laboratory scientist's participation in knowledge translation. In the model of innovation-decision process Rogers (2003) described an individual going through various stages prior to making a decision. From the first awareness of the knowledge, an attitude toward the new knowledge was formed, and then a decision to adopt or reject the innovation was made. Finally, the implementation of the new information into the individual's activities was the confirmation of the decision.

A literature review conducted by Graham and Tetroe (2007) identified 31 documents directed to practitioners, administrators and managers using terms meaning "knowledge to practice." The list of terms selected for the review included adoption, integration, implementation, assimilation, and dissemination. In describing knowledge translation within a user group, Jacobson, Butterill and Goering (2003) identified three key processes as awareness, communication and interaction. One study identified a framework based on best-evidence practice that included awareness, agreement, adoption, and adherence (Pathman, Konrad, Freed, Freeman, & Koch, 1996). Pathman's framework was identified as a cognitive and behavioral model used to integrate clinical practice guidelines into actual practice. The social and interactive activities that are integral in collaborative work are missing from the model but were included as predictor variables in this study. Pathman's model did place more emphasis on the end user and less on the research development making it more appropriate for the discussion of an individual's participation in knowledge translation, which was the focus of this study. A thorough discussion of Pathman's research findings is included in Chapter II.

Knowledge translation was defined using the World Health Organization's (WHO) definition as, "the synthesis, exchange, and application of knowledge by relevant

stakeholders to strengthen health systems and improve people's health" (2005, p. 2). The components of this study's framework were taken from a composite of knowledge translation models, literature review, and the WHO definition. As reflected in the research questions, the participation of the clinical laboratory scientist in knowledge translation was the focus of the study. The four components used as the framework in this research study were taken from the Pathman, Konrad, Freed, Freedman, and Koch (1996) research and other knowledge translation research. They are (a) awareness, (b) acceptance, (c) adoption, and (d) adherence. Table 2 provides conceptual and operational definitions of the four components appropriate for the clinical laboratory profession. The definitions are a composite of knowledge translation research models and literature review directed toward the healthcare environment, which are more fully described in Chapters I and II. A list of knowledge translation literature resources used to develop operational definitions can be found in Appendix D.

Pathman's four knowledge translation components served as the principal variables of this study. The research questions provided a better understanding of what causes variation in these four components among a sample of clinical laboratory scientists. The four components were not identified as levels or steps because one may be skipped or they may not occur in a certain order within the knowledge translation process (Pathman et al., 1996). The literature review revealed that there are also situational and personal influences that affect the success or failure of knowledge translation. These factors are not included in the four components developed by Pathman, therefore the situational and personal factors used in this study were identified

Table 2

Definitions of Knowledge Translation Components for Clinical Laboratory Science

Theoretical Components*	Conceptual Definitions	Operational Definitions
Awareness	The extent that the participant is actively involved in learning new knowledge. Kitson, 2008	Participation in activities to learn about new tests or instruments.
Acceptance	Acquiring and processing new knowledge that leads to the recognition of its importance. Stetler, 2001	Participation in activities identifying the new test or instrument as beneficial to the laboratory.
Adoption	Translating the new knowledge into a format that is easy to understand and is tailored to the workplace. Tugwell, 2007	Participation in activities that integrate the new test or instrument into the laboratory.
Adherence	A collaborative involvement of participants in a mutually acceptable course of action that supports the new knowledge Pathman, 1996	Participation in activities that continue to support the established protocol for the new test or instrument

*From "The awareness-to-adherence model of the steps to clinical guideline compliance. The case of pediatric vaccine recommendations," by D. Pathman, T. Konrad, G. Freed, V. Freeman, and G. Koch, 1996, *Medical Care,* 34, p. 873.

as predictor variables. The analyses of these variables were measured to predict their effect on knowledge translation participation. The complete analytical model is shown in figure 4. As seen in the model, the situational and personal factors described possible variation in knowledge translation behaviors and are discussed later in this chapter. The purpose of research question 2 was to establish these relationships within the knowledge translation process. Descriptive statistics, t-test, and ANOVA were used to explain the relationship of these factors on the knowledge translation components.

Conceptual Model

To summarize the conceptual approach for this study, the first phase was to determine the clinical laboratory scientist's level of participation in knowledge translation

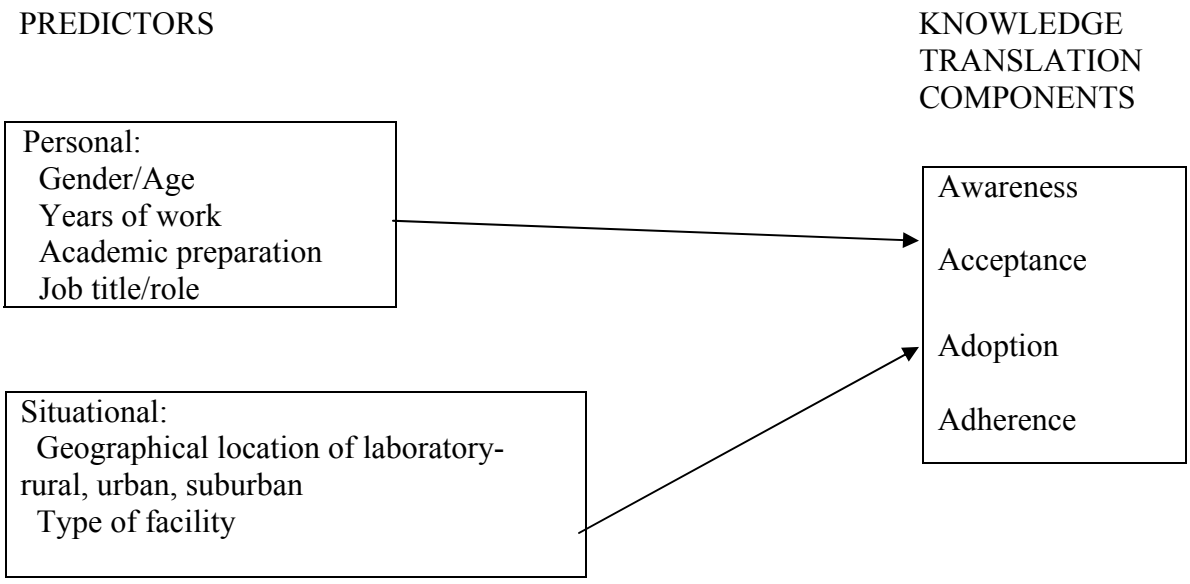

Figure 4. Knowledge translation analytical model for Clinical Laboratory Science

using the four components (awareness, acceptance, adoption, and adherence). The selection and development of these four components was discussed in Chapter II. The second phase was to determine if there are variations in knowledge translation participation. The final phase was to demonstrate if any of the predictors affected the level of participation in the knowledge translation components.

Instrumentation

In the literature review, a suitable instrument to measure the clinical laboratory scientist's participation in knowledge translation was not located. Since the nature of the professional's work environment is not generalizable to other healthcare professionals and because this was a self-report instrument the clinical laboratory scientists needed to participate in the development of the instrument.

With the help of an expert panel of clinical laboratory scientists, the researcher-designed a questionnaire used in this study to measure the level of participation in knowledge translation and to determine what factors influenced the participation. The

final questionnaire can be found in Appendix A. The four knowledge translation components were the central constructs of the instrument. The four operational definitions in Table 2 were used in developing the item pool for research question 1. The personal and situational predictors listed in Figure 4 were guiding the development of the item pool for research question 2. According to Spector (1992), if the constructs are more clearly defined, it will be easier to write items to measure those constructs. The expert panel was given the operational definitions to help identify items for the questionnaire. Instrument administration was an on-line, self-administered questionnaire. The development of the instrument was a five-step process including (a) development and refinement of the item pool, (b) selecting predictor variables, (c) response scale development, d) expert review of prototype instrument, (e) pilot survey instrument construction and (f) item pool's reliability and validity assessment (Table 3).

Development and refinement of item pool

The first phase of the item pool development was a rigorous review of the literature to identify potential items that reflected the four components of this research. Table 4 lists the number of items developed from the literature review, a brainstorming session with laboratory professionals, and discussions with a methodologist. The literature review in Chapter II included articles that identified the four knowledge translation components (awareness, acceptance, adoption, and adherence). The items developed from the literature review are listed in Appendix D with the associated literature source. Since this study was situated in the healthcare community, the research articles selected are from that area, but there have been other contributors in the field of implementation science, human resource development, sociology, and adult education.

Table 3

Study Survey Instrument Development Process

Developing a Measure of Knowledge Translation Components
Concept Clarification
Building Items to Measure Components
Construction of Response Scale
Selecting Predictor Variables
Identifying Personal Predictor Variables
Identifying Situational Descriptor Variables
Finalizing the Survey Instrument
Expert Review of Survey Instrument
Assessment of Pilot Survey

The second phase was a brainstorming session with clinical laboratory scientists selected from local hospital laboratories (Appendix B). Laboratory administrators and academic faculty were not selected because of their distance from the actual laboratory environment. A final phase was an analysis of the items by the researcher and methodologist using the literature review and items developed by the expert panel to eliminate redundancy. The prototype questionnaire was developed (Appendix C) and selected clinical laboratory professionals were asked to take the questionnaire. They were interviewed after taking the questionnaire about clarity and addition or deletion of some items.

Table 4

Description of Item Development

Knowledge Translation Component	*Number of items*
Awareness	
Literature	18
Brainstorming Session	29
Researcher and methodologist discussion	7
Acceptance	
Literature	26
Brainstorming Session	18
Researcher and methodologist discussion	13
Adoption	
Literature	23
Brainstorming Session	23
Researcher and methodologist discussion	12
Adherence	
Literature	25
Brainstorming Session	15
Researcher and methodologist discussion	10
TOTAL	219

Identifying Items to Measure Knowledge Translation Participation

Developing and refining the item pool was the second stage of instrument development. A brainstorming session was scheduled with five working clinical laboratory scientists. This stage involved utilizing a group of clinical laboratory scientists to identify items for the instrument (Dillman, 2007). The group met at a neutral location away from the healthcare environment. The researcher introduced the purpose of the activity and passed out the worksheets located in Appendix B. Because knowledge translation was not a universally understood term in clinical laboratory science the directions only ask them to recall a recent event, and each component was defined operationally to help them describe their participation in awareness, acceptance, adoption and adherence activities. The researcher reminded everyone that participation was to be anonymous. Each person identified an event when a new test or instrument was introduced into his or her laboratory. After describing the event, the participants were asked to write down short statements that reflect the four components associated with their event (Appendix B). The researcher evaluated the items to make sure items were placed in the correct component pool. The items were also reviewed to eliminate semantic equivalents.

Item Pool Refinement by the Researcher

The next step in item pool refinement was to review the 219 potential items provided by the brainstorming group for saturation and semantic equivalents. The potential items were also reviewed for clarity of wording and logic of classification. Items were grouped according to the four components and then sub- grouped by the commonality of the items. Some items were deleted because the wording was confusing

and relevant to only specific types of laboratories. Another expert panel of five clinical laboratory scientists deleted other items. The 219 potential items were reduced to 60 items for the prototype questionnaire. Tables 5-9 identify the items selected for the prototype questionnaire. After development of the prototype questionnaire it was given to registrants at an ASCLS state conference on March 25, 2010. Interviews were conducted, but no additional items were added or deleted to the item pool. Some suggestions were used to clarify the wording of the statements.

Constructing a Response Scale

The initial response scale was developed using the Likert-like style scale. However, after the items were identified that type of scale would have posed validity problems. The items were discreet actions that the clinical laboratory scientist did or did not do. It was desirable from a measurement view to capture additional variance, but it would not be possible with a dichotomous response scale. Due to the structure of the items a yes/no response scale was the most obvious choice. The suggestion of adding a NA (not applicable) option to the response scale was not adopted because it would be difficult to define this response.

Since this was a research-designed instrument, previous questionnaires were not useful in selection of the response scale. Krosnick (1999) discussed the problems associated with this type of scale (yes/no, true/false) in regards to bias due to acquiescence. People tend to agree more often than disagree. His review focused on a personality trait where people with a high agreeableness are inclined to acquiesce in answering all questionnaires. The knowledge translation questionnaire was less likely to reflect this type of bias since the respondents were asked to reflect on an actual event

Table 5

Survey Items Measuring Participation in Awareness

Component	Item Language
Awareness	1. I became aware of the new test/instrument by attending a vendor presentation.
	2. I became aware of the new test/instrument by having a conversation with another laboratory professional.
	3. I became aware of the new test/instrument by reviewing the current test methodologies in professional literature.
	4. I became aware of the new test/instrument by attending a continuing education presentation.
	5. I became aware of the new test/instrument by conducting a web-based review.
	6. I became aware of the new test/instrument by having a private conversation with a vendor.
	7. I became aware of the new test/instrument by visiting other clinical laboratories.
	8. I became aware of the new test/instrument by discussing it on a professional listserv.
	9. I became aware of the new test/instrument by discussing it with my supervisor.
	10. I became aware of the new test/instrument by comparing it with a similar test or instrument.
	11. I became aware of the new test/instrument by comparing it with quality indicators in my lab.
	12. I became aware of the new test/instrument by talking to a physician would is interested in having it available.

Table 6

Survey Items Measuring Participation in Acceptance

Component	Item Language
Acceptance	1. Before adopting this test/instrument, I believed there was a good correlation between the new test/instrument and existing test/instrument.
	2. Before adopting this test/instrument, I believed there was evidence to indicate the durability of this test/instrument.
	3. Before adopting this test/instrument, I believed it would improve the lab's turn-around-time.
	4. Before adopting this test/instrument, I believed it would offer ease of use for the testing personnel.
	5. Before adopting this test/instrument, I believed it met the needs of our patient population.
	6. Before adopting this test/instrument, I believed it met the needs of the physicians in my community.
	7. Before adopting this test/instrument, I believed it would be easy to interface with our laboratory information system.
	8. Before adopting this test/instrument, I believed it met the laboratory's long term goals.
	9. Before adopting this test/instrument, I believed it would be more cost effective to perform it in-house rather than sending it to a reference lab.
	10. Before adopting this test/instrument, I believed it would be easy to set up.
	11. Before adopting this test/instrument, I believed it offered flexibility in entering interpretative text within the result field.
	12. Before adopting this test/instrument, I believed it would reduce cost for the laboratory.
	13. Before adopting this test/instrument, I believed enough tests would be requested to avoid throwing out expired reagents before being used.

Table 7

Survey Items Measuring Participation in Adoption

Component	Item Language
Adoption	1. As the test/instrument was adopted into the laboratory, I played a role in developing a timeline to get it ready for patient testing.
	2. As the test/instrument was adopted into the laboratory, I played a role in requesting vendor support during the start-up period.
	3. As the test/instrument was adopted into the laboratory, I played a role in performing a validation program to measure accuracy and sensitivity.
	4. As the test/instrument was adopted into the laboratory, I played a role in providing hands-on training sessions for the clinical laboratory staff.
	5. As the test/instrument was adopted into the laboratory, I played a role in providing in-service classes for collection, preparation, and processing of the patient specimens if new criteria were required.
	6. As the test/instrument was adopted into the laboratory , I played a role in writing a procedure using standard formatting guidelines established by the Clinical Laboratory Standards Institute (CLSI).
	7. As the test/instrument was adopted into the laboratory, I played a role in providing support to the LIS staff in data base integration.
	8. As the test/instrument was adopted into the laboratory, I played a role in providing system-wide in-service programs to introduce the new test/instrument.
	9. As the test/instrument was adopted into the laboratory, I played a role in setting up a notification protocol of test results.
	10. As the test/instrument was adopted into the laboratory, I played a role in providing a workflow redesign to include the new test/instrument.
	11. As the test/instrument was adopted into the laboratory, I played a role in creating a troubleshooting guide for testing personnel.

Component	Item Language
Adoption	12. As the test/instrument was adopted into the laboratory, I played a role in communicating with the company that developed it.
	13. As the test/instrument was adopted into the laboratory, I played a role in requesting that the manufacturer's project leader be on the site during the start-up period.
	14. As the test/instrument was adopted into the laboratory, I played a role in conducting a system wide in-service program to introduce it to the healthcare practitioners.
	15. As the test/instrument was adopted into the laboratory, I played a role in creating a written back-up procedure.
	16. As the test/instrument was adopted into the laboratory, I played a role in conducting a training session on the back-up procedure.
	17. As the test/instrument was adopted into the laboratory, I played a role in developing an interpretative narrative to accompany the patient's test result.
	18. As the test/instrument was adopted into the laboratory, I played a role in constructing a test algorithm.
	19. As the test/instrument was adopted into the laboratory, I played a role on a collaborative, interdepartmental team during the adoption period.
	20. As the test/instrument was adopted into the laboratory, I played a role in identifying possible barriers in the adoption process.
	21. As the test/instrument was adopted into the laboratory, I played a role in helping the nursing staff understand how to order the new test.

Table 8
Survey Items Measuring Participation in Adherence

Component	Item Language
Adherence	1. Since adopting the test/instrument, I have been involved in interactive communication with the accessioners and other staff members concerning errors to avoid and how to streamline the process.
	2. Since adopting the test/instrument, I have been involved in monitoring problems associated with the new test/instrument.
	3. Since adopting the test/instrument, I have been involved in providing on-going sessions for laboratory personnel when problems are found.
	4. Since adopting the test/instrument, I have been involved in scheduling competency evaluations of all testing personnel on the new test/instrument.
	5. Since adopting the test/instrument, I have been involved in providing 24-hour assistance for nursing units and physicians concerning the new test/instrument.
	6. Since adopting the test/instrument, I have been involved in creating solutions to problems arising from the new test/instrument.
	7. Since adopting the test/instrument, I have been involved in making changes to the testing protocol if necessary.
	8. Since adopting the test/instrument, I have been involved in providing re-education sessions when pre-analytical, analytical, or post-analytical problems arise.
	9. Since adopting the test/instrument, I have been involved in correlating the new test or instrument with evidence-base laboratory practice guidelines.
	10. Since adopting the test/instrument, I have been involved in making changes in the reporting format to provide ease of understanding for the healthcare practitioners.

Component	Item Language
Adherence	11. Since adopting the test/instrument, I have been involved in a presentation for the community physicians.
	12. Since adopting the test/instrument, I have been involved in providing evidence of improved patient care.
	13. Since adopting the test/instrument, I have been involved in working collaboratively with the nursing staff.
	14. Since adopting the test/instrument, I have been involved in getting input from all the departments involved in the new test or instrument.

while responding to the items. Black addressed the dichotomously scored instruments as being restricted to truly binary situations (1999). The respondents only indicated if they were involved or not involved in these activities as reflected in the one event. Kuder Richardson's logic stated that a dichotomous scale could be used to evaluate reliability (1999). A pilot study was conducted to reveal limited variation in responses.

Validity and Reliability

In developing an instrument the researcher examined the content and construct validity. The content validity means that the items are measuring what the research constructs. A test of validity is to ask an expert panel to review the items, sort them into the constructs, delete items that are redundant or do not fit into the constructs, and make any suggestions for additional items (Merriam & Simpson, 2000). The second test is to perform a pilot survey to provide correlational evidence that the construct has a strong relationship with certain variables and a weak relationship with other variables (Huck, 2004).

Reliability is a numerical indicator of measurement stability (Valentine, 2008). It is based on the level of covariation among the items or scales. If there is a lack of reliability, the validity cannot be established. The reliability of this instrument was done by conducting the pilot survey and using a coefficient alpha (Cronbach's alpha) measurement to express reliability. Alpha coefficient ranges in value from 0 to 1 describe the reliability of factors extracted from dichotomous scales (Santos, 1999). The validity and reliability of the survey are discussed in the pilot survey section.

Selecting Predictor Variables

The research question 2 required the researcher to identify personal and situational predictor variables that would possibly show variation in participation.

Identifying Predictor Variables

The final development phase of the questionnaire first required a discussion on the rationale directing the selection of specific predictor variables influencing clinical laboratory scientists' participation in knowledge translation. The predictor variables were introduced in items located at the end of the survey instrument. They consisted of two sets: personal characteristics and situational factors. Each predictor variable and its rationale are summarized in Tables 9.

Personal characteristic variables

Personal predictor variables were selected based on a literature review, actual job experiences and discussion with other laboratory professionals. The personal predictors selected are gender, age, academic preparation, certification, years of experience, and job title. These personal variables were used to measure the predictive value of personal variables on the individual's awareness, acceptance, adoption, and adherence in an actual

event involving a new test or instrument introduced in her laboratory. In past research, males were in higher supervisory or administrative roles than females in the laboratory (Blau & Tatum, 2000). Gender influences knowledge translation, if the decision-making process mainly occurs at the administrative level. Age and years of experience predicts the possible opportunity clinical laboratory scientists have had in participating in knowledge translation activities. In recent statistics, forty percent of current clinical laboratory scientists will retire in the next ten years (Critical Values, 2008). If age and years of experience do predict a higher involvement in knowledge translation, then there may be a larger gap in decision-making activity at the clinical laboratory scientist's entry-level position within the next ten years. The level of professional involvement and the higher level of certification may be significant predictors because the person's interest in professional development would indicate a desire to advance in the profession and increased activity in improving the laboratory's status. The participant's job title may indicate the level of participation in the laboratory. If the managerial participants score higher in the four components than the entry level individuals it may indicate little involvement by the laboratory professionals actually doing the test.

Situational characteristic variable

The situational variables were selected also based on the literature review, discussion with laboratory professionals, and job experience. The location of the laboratory may affect the amount and the level of participation. The large metropolitan hospitals often ask the clinical laboratory to provide testing services for current on-going research grant projects. Clinical laboratory scientists may be asked to participate in research earlier in their career than other professionals at small rural hospital laboratories,

but larger laboratories have begun to hire PhDs to be the lead on new projects (Epner, 2007). The large urban laboratories may give the laboratory professionals opportunity to participate in the adoption of new tests or instruments, but not have any active participation in awareness or acceptance. The number of clinical laboratory scientists employed by the laboratory could also determine the level of participation. If the laboratory employs more technicians and fewer clinical laboratory scientists because of budget restraints, there may be higher participation by clinical laboratory scientists in introducing a new test or instrument. The researcher was not sure if these predictor variables would make a difference in knowledge translation participation.

Finalizing the Survey Instrument

After the survey items and predictor variables were selected there was one last evaluation by independent experts who could provide a clearer picture of any additional discrepancies.

Expert Review of Survey Instrument

Prior to sending out a pilot survey two expert panels reviewed the pilot instrument (Appendix C). The first panel included active graduate students in the University of Georgia, Adult Education Program who determined if all necessary questions were contained in the questionnaire, if the questions were clear, and if there were superfluous or poorly worded questions. The second panel was the clinical laboratory scientists who participated in the initial brainstorming session to create items. The expert content reviewers (clinical laboratory scientists) evaluated the instrument to determine if the respondents would understand the questions. Also, the content experts were asked if there were any characteristics of the questionnaire that would deter participants

Table 9

Listing and Rationale of Demographic and Situational Predictor Variables

Type	Predictor Variable	Rationale
Personal	Gender	Three fourths of certified practitioners are women, men move up faster into the management jobs, participation in knowledge translation could vary by gender.
Personal	Age	Maturity may indicate either a willingness or unwillingness to participate.
Personal	Academic	Higher level of education may place greater emphasis on participation because of insight into the importance of knowledge translation.
Personal	Certification	Advanced certification beyond the initial generalist exam shows the importance of education and pride in profession.
Personal	Years of work	Years working in the laboratory may show level of interest in taking on more responsibility.
Personal	Professional involvement	Membership in a professional organization may increase interest in more challenging jobs.
Personal	Job title/role	Supervisory position or above in the laboratory involves more participation in new testing or instrument.
Situational	Size of lab	Larger testing volume may reflect more decisions about new testing are made at the management level.
Situational	Type of facility Urban Laboratory Rural hospital lab Suburban lab	May indicate CLS level of participation in knowledge translation with rural laboratories. placing the responsibility on the CLS while larger laboratories hire PhDs for higher level activities.

from completing it. Audiotapes of the meetings were summarized and analyzed for significant changes in the questionnaire.

Revision of the pilot survey

The researcher reviewed the comments from the two expert panels. It was decided not to label the sections of the survey with the four constructs (awareness, acceptance, adoption, or adherence). The first part of the survey asked the respondent to recall a new test or instrument that they participated in introducing to their laboratory. This was a critical part of the survey because the subsequent statements would ask the respondent to reflect back to the event. Each section of the survey had a brief description of the situation in which the respondent would have participated in knowledge translation activities. The description represented the construct's definition discussed earlier in this chapter. An example was "Prior to the laboratory adopting the new test or instrument, did you learn about it from….". The response was "Yes" or "No." As mentioned earlier in this chapter the expert panel suggested a Likert-like scale, but the researcher could not measure participation based on this type of scale. The respondents either participated in the activity or did not participate. They would not be able to select a degree of participation (often, sometimes). Open-ended responses for the predictor variables concerning age, gender, and ethnicity were used due to the sensitive nature of the questions.

Pilot Study

After the revisions were made from the work completed by the expert panels, the dissertation committee, the study methodologist, and the researcher, the pilot survey was ready to send out. IRB approval was received prior to activating the survey. There were several questions that must be answered by the pilot survey. First, did the data collection procedure work? Secondly, did the survey have the desirable measurement properties?

Reliability and validity of the four components would be measured. Thirdly, did the instrument exhibit enough variance (sensitivity)?

The pilot survey instrument was administered through the on-line survey company, Survey Monkey®. Approximately 100 randomly selected participants were first selected from the American Society for Clinical Laboratory Science's (ASCLS) mailing list for the pilot study. The questionnaire included an implied consent form (Appendix F). An invitation to participate was sent from the researcher's personal email account instead of the survey's website (Appendix E). The email invitation had a link to the survey on the Survey Monkey® website. Two follow-up email letters were sent one week apart (Appendix G). An electronic thank you was also attached to the survey at the completion of the survey.

The response rate was low, so a second pilot survey was sent out to an additional 300 randomly selected ASCLS members. No changes were made to the survey prior to sending it out. The two pilot surveys resulted in 60 usable responses. It was obvious several improvements had to be made to the survey. At a meeting with the researcher and several members of the dissertation committee a decision was made to make several changes.

1. Rewrite the introductory letter to elicit higher response rate. (Appendix H)
2. Review of the second and third letters to encourage participation. (Appendix G)
3. The researcher discussed activities to increase the response rate with the ASCLS office. Their past response rates were usually 10%.

4. A screener question would have to be added to eliminate those members who are not actively working in the clinical laboratory. (Appendix A)

5. Because the first component (awareness) did not meet reliability (Cronbach's Alpha=.55), the components will have to be analyzed as additive indices.

6. To clarify the first component it was decided to reword the initial statement. "Prior to the lab adopting the new test or instrument described in the previous section from how many sources did you hear about it (select all that apply)."

A letter was sent out to the dissertation committee to discuss these changes with ample time for member responses. An IRB amendment was submitted and approval granted to make the changes (Appendix L).

Study Population

The population of interest was clinical laboratory scientists in the United States. The research population for this study was members of the American Society for Clinical Laboratory Science (ASCLS). The members of the professional organization include clinical laboratory scientists (CLS, MLS, or MT) and clinical laboratory technicians (CLT or MLT). To request a mailing list for only clinical laboratory scientists was not possible because ASCLS could not sort by certification. Since membership is not a requirement for employment, the mailing list did not include clinical laboratory scientists or technicians that choose not to join a professional organization. There are also several

representative organizations (ASCP, ASCLS, American Medical Technologists, and American Bioanalysts), who have professional memberships.

Clinical laboratory scientists can have a specialist certification in a specific discipline of clinical laboratory medicine such as: Hematology (SH), Immunohematology (SBB), Chemistry (SC), and Microbiology (SM). There are also professional organizations representing these laboratory specialists, so the ability to capture all certified clinical laboratory scientists was very unlikely. The sample was from the membership list of a major professional organization (ASCLS) with clinical laboratory professionals identified as the recipients of the questionnaire. Students were excluded.

Of the 4600 surveys sent out using the ASCLS mailing list 77 members had blocks on their email addresses blocking the first letter, 152 emails were not current, and 2997 did not open the survey. Table 10 indicates the raw response rate based on the total responses and the total surveys sent out was 35%. The recipients whose emails were not active were subtracted from the total sent out raising the response rate to 36%. The usable percentage (16%) was based on the respondents who answered yes to the screener question and completed the survey. The screener question asked if the respondent had participated in introducting a new test or instrument into a laboratory within the last five years. A "no" response took them out of the survey. Because of the low response rate, there are no claims of statistical inference for the data. Since there were a large number of usable responses (n = 726), it does allow for logical inference.

Description of Respondents

The personal characteristics of the respondents are listed in Table 11. A large percentage of clinical laboratory professionals are female (79%) with 24 years of

experience, 60% had a BS as a terminal degree and 28% had a Master's degree. A majority are Caucasians (88%) working in urban hospitals (43%).

Data Collection

The self-administered survey was sent to the participants using the Survey Monkey®. The Tailored Design Method was followed to encourage the clinical laboratory scientists' responses to the survey (Dillman, 2007). Dillman's method focused on creating an atmosphere of trust, and expressing the importance of the study for the profession. The survey should be presented as a linkage of social exchange between the researcher and the participant. To increase responses the request for participation should ask for advice, make the questionnaire interesting, thank the participants, and express social validation. To reduce social cost the questionnaire should limit the request for personal information, make the survey short and easy, avoid embarrassment, and inconvenience. The researcher identified with the study population because of her professional association and years of work experience in the laboratory. According to Dillman these factors will help to reduce the overall survey error.

Since the email addresses were the major route of communication for the professional organization, an invitational cover letter was sent to the members using the researcher's academic address. An example of the letter is found in Appendix H. A hyperlink was provided to the Survey Monkey® website. The opportunity to create the survey as a pdf file, print it, answer the survey, and fax or mail it back to the researcher was offered as an option to the participants. The number of returns on the email invitational letter determined if alternate email addresses could be located or additional listserv professional addresses.

Table 10

Response to Final Survey (n =4601)

Response Rate		*N*	**%**
Raw Response Percentage	Total Responses/Total Sent	1593/4601	35%
Adjusted Response Percentage	Total Responses/Total Sent-(bounced)	1593/4450	36%
Usable Response Percentage	Total Completed/Total Responses	1593-867/4450	16%

Table 11

Personal and Situational Variables of Respondents (n =727)

Variable			Value
Age (in years)	Max=80	Mean=49	Min=23
Gender			
Female		n=524	78.6%
Male		n=143	21.4%
Race			
Caucasian		n=517	87.5%
Asian		n=31	5.2%
African American		n=24	4.1%
Hispanic		n=13	1.8%
Years of Experience	Max=51	Mean=24	Min=1
Highest Degree			
Bachelor's		n=405	60.2%
Master's		n=189	28.1%
Doctorate		n=33	4.9%
Associate		n=26	3.9%
Type of Certification			
MLS/MT		n=467	70.3%
Specialist (SBB, SM)		n=112	16.9%
MLT		n=77	11.6%

Personal and Situational Variables of Respondents (n =727)

Variable	Value	
Type of Job		
Mostly Bench/some adm.	n=209	31.5%
Mostly Adm/some bench	n=197	29.7%
Administrative	n=140	21.1%
All Bench	n=117	16.1%
Geographical Location		
Urban	n=281	43.6%
Suburban	n=199	30.9%
Rural	n=165	25.6%

Using Dillman's Tailored Design Method (2007) the revised cover letter developed a professional acquaintance with the participant in an open and friendly manner. The salutation was directed to the specific respondent. It was short and directed to the purpose of the survey. The letter explained why it was important to respond and how it would help the profession. Confidentiality was addressed, and the fact that this was a voluntary survey. It also explained the length of the survey and how long it would take to respond to the questionnaire (Appendix H).

The implied consent form (Appendix F) was included in the Survey Monkey®, and the hyperlink in the cover letter sent the recipient directly to the form. The multiple contact strategy endorsed by Dillman was used by sending a second follow-up email letter to those recipients who did not respond (Appendix G) with the hyperlink to Survey Monkey® within two weeks of the first letter. A final request (Appendix G) was sent a week after the second request including only the respondents who did not complete the

survey. The Survey Monkey® hyperlink was included in the final request. The bounced requests were investigated using additional contact information provided by the professional organizations, but it was decided not to mail out questionnaires. Seventy-seven recipients had blocks on their email address to avoid unknown mail, so they did not even open the introductory letter.

A copy of the questionnaire is included in Appendix A. It was largely a forced-choice questionnaire that meets the criteria suggested by Dillman (2007) for internet surveys. In most cases the line length was short (about 70 characters) to avoid wrap-around problems. The first section required an open-ended response describing a recent event that was used in responding to the rest of the questionnaire. The next sections were answered by placing an X in the Yes or No column. The final section requesting demographic information consisted of forced- choice, fill-in-the-blank, or check-all-that-apply responses.

Data Preparation

The responses from the Survey Monkey® survey were exported into an Excel spreadsheet for data cleaning. The first step in data preparation was to separate out the surveys that are unusable. If the questionnaire was left blank or the participant was not identified as a clinical laboratory professional, the survey was unusable. Using the Survey Monkey® filter the questionnaires that did not have responses to the first block of questions were not included in the downloaded Excel spreadsheet. The next step was to code the personal and situational variables that required a free text response and assign a numerical value; such as certification, highest degree, gender, and race/ethnicity. The age was calculated by subtracting the respondent's year of birth from the current year. A

separate code book was prepared to code the open-ended text used to describe the current new test or instrument. A code was assigned if the description concerned a test or an instrument plus a code identifying the specific department. The code books used to translate the responses can be found in Appendix I.

The cleaned data set was imported from the Excel spreadsheet into version 18 of PASU Statistics® formerly SPSS for further preparation. Each variable was labeled as nominal, ordinal, or categorical. The researcher assigned the scales for the four components and the predictor variables. The frequencies for each knowledge translation component were calculated using version 18 of PASU Statistics® formerly SPSS. If the results indicated a range of responses appropriate for the intended responses, a coefficient alpha for each knowledge translation component was calculated to measure reliability. Although research question 1 will be discussed on an item level, certain analyses require the creation of an additive index for the four components. All of the items in each component were added together to create an additive index. Cronbach's alpha used to measure internal reliability within the four components demonstrated a low score for awareness ($\alpha = .48$). Even though acceptance, adoption, and adherence had a high score for reliability the awareness component did not reach reliability (Table 12). The mean and standard deviation are not of significance in this study because the response scale was limited to two responses (yes/no) as opposed to a Likert-like scale. The low alpha score for the awareness component caused the reassignment of the knowledge translation components into additive indices. Reliability is not an issue when analyzing additive indices because an index is a behavioral measure. All of the knowledge translation

Table 12

Distribution and Reliability of the Knowledge Translation Components

Component	Number of Items	M	SD	Alpha
Awareness	11	16.83	2.05	.48
Acceptance	13	16.11	3.50	.89
Adoption	16	22.61	4.46	.88
Adherence	8	11.28	2.59	.83

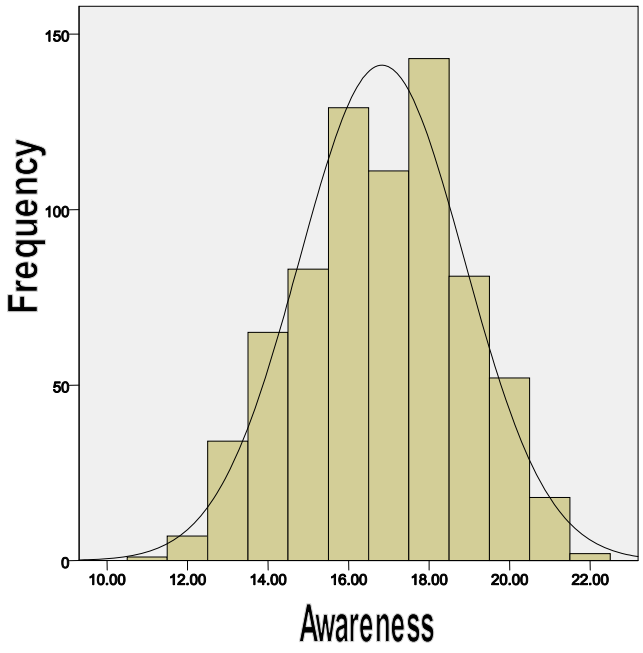

Figure 5. Distribution of awareness component

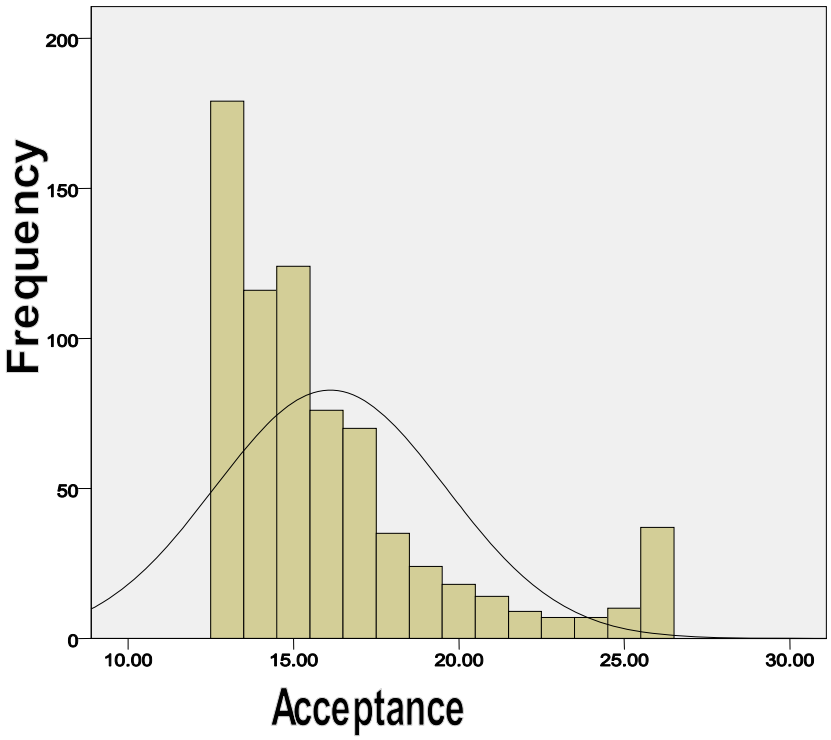

Figure 6. Distribution of acceptance component

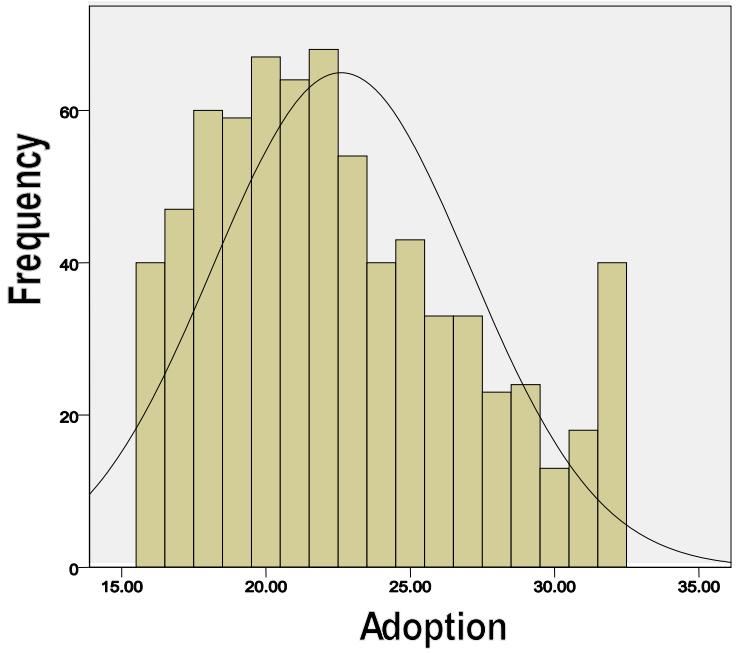

Figure 7. Distribution of the adoption component

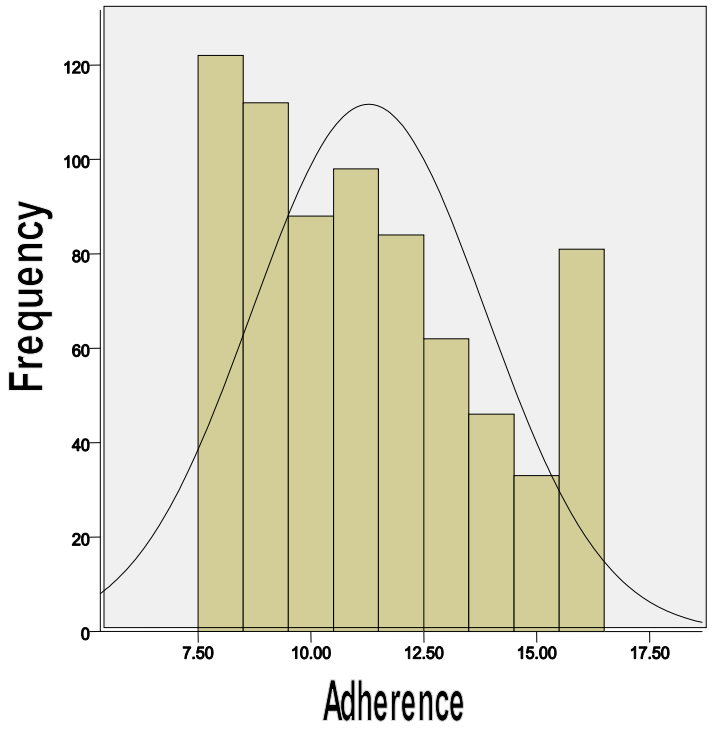

Figure 8. Distribution of the adherence component

Table 13

Intercorrelation of Knowledge Translation Components

	Awareness	Acceptance	Adoption	Adherence
Awareness	-	.30	.34	.31
Acceptance	.30	-	.57*	.55*
Adoption	.34	.57*	-	.78*
Adherence	.31	.55*	.78*	-

Note. *The correlation showed a positive significance at the level of $p < .001$.

components measure a behavioral activity. Histograms of each component showed a fairly normal distribution (Figures 5-8).

The final analysis in data preparation was to determine the intercorrelation between the four component scales. The correlation coefficient between every component showed the strength of the relationship. A summary of the relationships is shown in Table 13. The correlation between acceptance and adoption was significant, r =.57, p <.001. The correlation between adherence and adoption met statistical significance, r =.78, p <.001. Adherence and acceptance showed significance correlation. r =.55, p <.001. Awareness showed no significance with acceptance, adoption, or adherence. The statistical intercorrelation between acceptance, adoption, and adherence was a key factor in the final analysis of the data and will be discussed in Chapter IV.

Data Analysis

The data analysis was conducted using version 18 of PASU Statistics® formerly SPSS. Appropriate statistical analyses were conducted to evaluate the two research questions. Data analysis was described for each research question in the following discussion.

Research question 1; To what extent do clinical laboratory scientists participate in the four major components of knowledge translation; awareness, acceptance, adoption, and adherence was analyzed by calculating the ranks of each item for the four components. The items were ranked from highest to lowest using frequencies. The ranking was to establish which specific behaviors are common versus uncommon in respect to all four components. The items were also grouped by component to provide a

rank order listing. A mean percent was calculated to demonstrate a clearer picture of the rank order between the components.

Research question 2; To what extent do personal characteristics and situational factors of clinical laboratory scientists predict the level of participation in the knowledge translation process was used to determine what predicts the observed variance in the level of knowledge translation activities for each component. By using the bivariate correlation each predictor was paired with each component to see if there was a systematic relationship.

When predictor variables were continuous or interval (age, years of experience) simple correlation analyses along with coefficients of determination were calculated using Pearson Product-Moment Correlation Coefficient to determine relationship between the predictor variables and the components. With the predictor variables that were ordinal (nonparametric-type of job, education, and certification levels), Spearman Correlation Analysis was conducted to show the relationship with the components. T-tests for equality of means were employed to determine relationships between the nominal (dichotomous-gender) and the knowledge translation components. A one-way ANOVA was used to determine the best multivariate explanation of the observed variance on each of the components.

Limitations

The major limitation to this study was related to the study population. The clinical laboratory scientists who are certified, but do not have membership in the professional organization that was selected for this study, were not included in the survey. The second population absent from the study was clinical laboratory scientists

that chose not to be certified and are not members of a professional organization. Neither national nor state individual licensure is a requirement for employment in most states. With those two populations missing from the study responses, it restricted the ability to generalize the findings beyond the actual respondents.

Another limitation was the low useable response rate (16%) from the survey. It was addressed during the analysis of the pilot survey and decided to revise the introductory letter and discuss the response rate with the ASCLS staff. On surveys sent out from ASCLS, a 10% response rate is the expected rate. The researcher expected the large professional member pool (4600) would offer enough data for statistical analysis. The response rate received does not warrant statistical generalization. It should be noted that this is a large, diverse, national sample of laboratory professionals. In making a generalization about the study population two factors should be considered, the population of clinical laboratory scientists who belong to a professional organization are a representation of elite professionals interested in their profession or the sampling may indicate a systematic response bias. Any generalization should be made with caution. Only logical inference is utilized with this study.

Summary

This chapter described the development of an instrument to measure participation in knowledge translation. Extensive literature review, identification of knowledge translation components, development of items, and numerous meetings with clinical laboratory professionals were required in the development of a forced field pilot questionnaire. After the prospectus defense and IRB approval, a pilot questionnaire was sent out to approximately 400 laboratory professionals. There are some limitations to the

study, based on the limited sample population and the low response rate, but the 726 responses were adequate for a statistical analysis.

CHAPTER IV

RESEARCH FINDINGS

The purpose of this study was to understand clinical laboratory scientists' participation in the knowledge translation process, and if situational factors and personal characteristics predict the level of participation. This chapter will review the results of the statistical analysis described in chapter three of this document. The chapter is divided into sections that address the two research questions guiding this research.

Findings Related to Research Question 1

The first research question asked to what extent do clinical laboratory scientists participate in the four major components of knowledge translation (awareness, acceptance, adoption, and adherence). To help the respondents focus on specific knowledge translation activities, the first section of the questionnaire requested a brief description of a new test or instrument that the respondent would use to reflect on the knowledge translation activities. Table 14 list departments involved and frequencies of introducing new tests or instruments. Since laboratory professionals are constantly involved in establishing new tests or instruments, the total number of events represents more than one per respondent. Some respondents gave very lengthy descriptions of all tests in which they participated during the last five years. The responses are not mutually exclusive because some events include both a new tests and instruments, so they could not be included in the statistically analysis of this study. A listing of the new tests or instruments described by the respondents is listed in Appendix J.

Table 14

Listing of Departments Introducing New Tests or Instruments

Department	Frequency	
	N	%
Blood Bank	70	9.6
Hematology (including UA & Flow Cytometry testing)	139	19.1
Chemistry/Automated Immunology	307	42.3
Coagulation	94	12.9
Molecular Diagnostic	68	9.4
Microbiology	96	13.2
Point-of-Care	32	4.4
TOTAL	806	

The four major knowledge translation indices are presented separately in Table 15 by mean percent. The table clearly represents the highest participation by the laboratory professionals was acceptance. A larger table listing each item included in the survey ranked from the most used activity to the least used activity along with the knowledge translation index associated with the activity is found in Appendix K. The top knowledge translation component identified by the participants was acceptance (75.6%). The second component was the adherence at 64.4 % while the third was adoption (58.7%). As discussed in Chapter II, the top three knowledge translation components were those integral to the early laboratory worker's job description. The laboratory worker in the early 1930's performed laboratory testing with limited communication with other healthcare professionals. Acceptance of the testing protocol, adoption of the test

Table 15

Mean Percent by Knowledge Translation Component

Knowledge Translation Indices	Mean %
Awareness	47%
Acceptance	75.6%
Adoption	58.7%
Adherence	64.4%

into the existing laboratory environment, and consistent adherence to the detailed test procedures were very important issues in providing accurate test results to the physician. These components are still important in the delivery of quality patient care by the laboratory professionals. An in-depth analysis of each knowledge translation component with a focus on specific activities provided a clearer understanding of the current role of laboratory professionals in the healthcare community. Tables 16-19 show the specific activities that the clinical laboratory professionals selected as important in the awareness, acceptance, adoption, and adherence of a new test or instrument.

Awareness

The operational definition of awareness used in this study was participation in activities to learn about new tests or instruments. In Table 16 the awareness activities are listed by rank order indicating the percentage of respondents who selected specific items included in the survey. Eighty percent of the respondents selected a vendor's representative as the source of information concerning the new test or instrument. Sixty-three percent attended a presentation paid for by commercial laboratory vendors. These selected activities raised the question of the quality of information provided by the companies whose sales quotas are the main focus. The frequent involvement by large

companies is not new to the healthcare community. An earlier study by Smith (2006) stated that 70% of the academic continuing education programs for colleges and schools of medicine are supported by the commercial industry. She illustrated the promotional and educational activities of these companies develop a financial dependency on the companies by healthcare professionals. The needs of the stakeholders (patients) are not considered when the requirement of CEU is provided by commercial support. ProPublica (2010) published a database listing physicians and the money they received from drug companies that totaled $320 million for speaking engagements and other activities. Awareness of a new test or instrument received from vendors is an activity of convenience and profit not related to patient care.

The lowest awareness activities involved acquiring information from CE programs or reaching out to other healthcare professionals. Only 31% of the respondents used a professional listserv or website to find out about a new test or instrument. The awareness item identifying discussions with practitioners or another institutional department that might have requested the test ranked in the lowest percentage (29% to 16%). It should be mentioned that awareness showed very slight correlation with the other three knowledge translation components.

Acceptance

The operational definition of acceptance for the study was participation in activities identifying the new test or instrument as beneficial to the laboratory. In the rank order listing, the selection of activities was equally spread over most of the items listed in the survey. Out of 13 activities eight ranked over 80%. The respondents felt it

Table 16

Percentage of Respondents Indicating Participation in Awareness Activities (n =726)

ITEM	FREQUENCY	
Prior to the lab adopting the new test or instrument described in the previous section from how many sources did you hear about it (select all that apply):	Rank	Percent
3. Vendor's representative	1	80.0
2. Lab professionals in other labs	2	67.6
8. Vendor's presentation	3	62.9
4. Your supervisors or manager	4	58.3
1. Other lab professionals in your lab	5	52.6
10. A professional journal/magazine	6	48.3
11. Visiting another lab	7	38.3
9. A continuing education presentation	8	33.6
7. A professional listserv or website	9	30.6
5. Practitioners that would request the test	10	29.1
6. Another department in your organization	11	15.7

was important to know if the test or instrument was easy to use and met the needs of the institution and practitioners before it was adopted into the laboratory. They analyzed the turn-around-time, ease of set-up, and the comparison to similar tests or instruments. Sixty-seven percent of the respondents used evidence-based lab practice guidelines to evaluate the new test. The lowest percent (45%) of the activities was evaluating the

Table 17

Percentage of Respondents Indicating Participation in Acceptance Activities (n =726)

ITEM	FREQUENCY	
Before the new test or instrument described earlier was adopted did you:	Rank	Percent
23. Evaluate the ease of use for the lab professionals	1	86.1
19. Identify that it meets the lab's long term goals	2	85.3
18. Identify that it meets the needs of the practitioner	3	85.0
12. Compare it to a similar test or instrument	4	83.7
21. Evaluate the ease of set-up	5	81.7
17. Identify it as meeting your lab's standard of care	6	80.6
16. Compare the test's or instrument's turn-around time parameters to your lab's standard requirements	7	80.2
13. Evaluate it using lab quality indicators	8	80.0
24. Evaluate the new test's or instrument's cost per test with other comparable tests or instruments	9	77.4
20. Identify that it is more cost effective to perform the test in-house that sending it out	10	70.9
14. Evaluate it using lab evidence-based practice guideline	11	67.4
15. Evaluate its durability	12	60.1
22. Identify flexibility in adding interpretative text	13	45.3

flexibility of adding interpretative text to the test results. The low percentage may indicate the use of a mainframe computer interfaced with an instrument that allows for

interpretative text, so the individual test or instrument would not need this added feature. It may also indicate the lack of participating in collaboration with the practitioner who may not completely understand the test results. If the practitioners ordered the test, they must understand what the test results indicate for the patient. From the literature review discussed in Chapter II that is not always true.

Adoption

From the operational definition of adoption used in this study the respondent participated in activities that integrated the new test or instrument into the laboratory. The adoption activities were more widely spread through the items listed in the survey than the acceptance activities. It should be noted that 78% of the respondents used the vendor to assist in integrating the new test or instrument. These activities involving the vendor are based on the financial arrangements included in the contract. The lower ranking activities are collaborative actions that reach out to the healthcare community. Less than 45% of the respondents spend time introducing the new test to the individuals who will be getting the test results. These respondents possibly would not present vital information about the new test in the form of a presentation, announcement on an institutional website, or an article on the interpretation of the results. The lowest ranked activity in the adoption component (31%) was the laboratory professional designing a testing algorithm for the new test. The testing algorithm could help practitioners select the series of tests which fit into the diagnostic flowchart providing an accurate patient care profile and possibly reducing costs/hospital stay.

Table 18

Percentage of Respondents Indicating Participation in Adoption Activities (n =726)

ITEM	FREQUENCY	
As your lab adopted the new test or instrument did you:	Rank	Percent
28. Participate in communicating with vendor	1	78.1
27. Request vendor support during the start-up period	2	77.7
34. Participate in performing a method validation study	3	77.5
31. Participate in presenting training sessions for the lab professionals performing the test	4	70.4
30. Attend a training session for the new test or instrument	5	67.2
25. Participate in creating a time line in preparation for patient testing	6	65.3
29. Request the vendor's technical representative be on site during the start-up period	7	64.3
35. Write the testing procedure using the Clinical Laboratory Standards Institute (CLSI) guidelines	8	63.2
37. Participate in developing a workflow design	9	60.6
26. Participate in developing a troubleshooting guide	10	55.9
33. Write a down-time or back-up procedure	11	47.9
32. Participating in presenting in-service classes introducing the new test or instrument to other lab staff (phlebotomists, accessioners…)	12	47.4
36. Participate in establishing the notification procedure for getting (STAT) test results to the practitioner	13	45.7
40. Participate in introducing the new test or instrument to health care practitioners (nurses, physicians, other clients…)	14	45.5
38. Participate in creating an interpretative narrative to accompany the test results	15	41.7

ITEM	FREQUENCY	
As your lab adopted the new test or instrument did you:	Rank	Percent
39. Participate in developing a test algorithm	16	30.6

Adherence

The final knowledge translation component is adherence but it was the second highest percentage in the rank order listing. The study's definition of adherence was participation in activities that continue to support the established protocol for the new test or instrument. Laboratory professionals are trained to maintain strict adherence to the testing protocol. In the rank order table the first two activities were dealing with analytical and post-analytical problems as well as designing solutions to these problems. Developing problem solving skills is an established objective in every CLS program curriculum. Laboratory professionals must have the ability to discover problems before test results are released to the nursing unit or practitioner. Quality management has established guidelines to identify the root cause of a problem and take corrective action. It is often difficult for clinical laboratory scientists to communicate the importance of this process to other healthcare professionals. The wrong name on a blood specimen, an incorrect tube drawn for a test, or not following national guidelines on starting a unit of blood for a patient are essential to quality patient care.

The lowest ranked activities again were related to the limited conversation laboratory professionals have with their fellow healthcare professionals. Only 48% of the respondents were involved in providing evidence that the new test or instrument had improved patient care. The measurement of improved patient care is certainly a vital

Table 19

Percentage of Respondents Indicating Participation in Adherence Activities (n =726)

ITEM	FREQUENCY	
Since your lab adopted the new test or instrument have you:	Rank	Percent
42. Monitored analytical and post-analytical problems related to the new test or instrument	1	77.5
43. Participated in designing solutions to those problems associated with the new test or instrument	2	71.1
44. Participated in establishing competency evaluations for the lab professionals performing the new test or instrument	3	67.8
48. Participated in improving the testing efficiency of the new test or instrument since it has been adopted	4	58.5
41. Communicated with accessioners and phlebotomists on pre-analytical problems associated with the new test or instrument	5	57.3
46. Participated in evaluating the new test or instrument with evidence-based lab guidelines	6	54.3
47. Participated in providing evidence of improved patient care with the new test or instrument	7	48.3
45. Participated in providing consultation services for healthcare practitioners about the new test or instrument	8	37.2

statistic for healthcare institutions, so someone does evaluate the impact of a new test on patient care as well as the financial benefit or loss. If this analysis could be done by

laboratory professionals, it would not only provide a more accurate picture due to the depth of knowledge available, but it could expand the lab professionals' role in healthcare. Providing a consultative service to the practitioner was selected by only 37% of the respondents. Even if the practitioner has read about the new test and feels it would be a major diagnostic tool, there would be additional research available on this test to enhance the utilization of the test. These two activities would open up a new community of practice for laboratory professionals and begin a conversation for everyone concerning improved patient care.

Findings Related to Research Question 2

The second question of the study asked to what extent personal and situational characteristics of clinical laboratory scientists predict the level of participation in each of the knowledge translation components. The personal characteristics selected were age, gender, ethnicity, years in the profession, academic preparation, job title, and professional involvement. Under situational predictors the study asked to what extent situational characteristics of clinical laboratory scientists predict the level of participation in the knowledge translation components. The situational predictor variable chosen was location of the facilities. A series of bivariate analyses were conducted. Using version 18 of PASU Statistics ® formerly SPSS, Pearson and Spearman's rho correlation were used to measure correlation between the predictor variables and the total score for each knowledge translation component.

Personal Predictor Variables

The correlation coefficients were computed using selected personal predictors; age, work experience, academic preparation and level of certification. Race showed no

statistical significance in the computation because Caucasian respondents (88%) limited variance in the study population. The standard deviations showed normal distribution in male and female respondents. Table 20 demonstrates that male versus female responses in knowledge translation participation were very similar. The Independent-Samples t test was run on gender and the four knowledge translation components. Awareness shows a negative correlation while the other three components have positive correlation. Only the adherence and adoption components showed a slight statistical significance with $p < .05$. Gender is not of statistical significance as a personal predictor. The descriptive statistics of all the personal predictor variables on the knowledge translation components can be found in Table 21. Using the Bonferroni approach to control for Type I error across the eight correlations, a *p* value of less than .05 was required for significance. The results of the correlation analyses demonstrated slight statistical significance. The personal predictor variables showed a weak correlation with the knowledge translation components as discussed below.

- Age demonstrated negative correlation with awareness, adoption, and adherence which indicate the older clinical laboratory scientists are less likely to participate in awareness, adoption, and adherence activities Acceptance showed no statistical significance ($p > .05$). The mean age of participants was 49, and the correlation showed only slight statistical significance.
- Work experience reflected a negative correlation with awareness, acceptance, adoption, and adherence at $p < 0.01$ indicating the younger laboratory professionals show slightly more knowledge translation activities. The survey indicated the mean years of experience was 24 years.

Table 20

Influence of gender on knowledge translation components (n =667)

Component	*N*	Mean	Std. Deviation	*t*	df	*p*
Awareness				-.27	665	.79
Male	143	16.8	2.2			
Female	524	16.7	2.0			
Acceptance				.39	665	.70
Male	143	15.6	3.0			
Female	524	15.7	2.9			
Adoption				2.10	665	.04
Male	143	21.4	4.0			
Female	524	22.2	4.0			
Adherence				2.66	665	.01
Male	143	10.5	2.3			
Female	524	11.0	2.3			

- Academic preparation showed a negative correlation with adoption, but it showed a slight statistically significance ($p < .05$). This may indicate individuals with higher education are not as involved in the adoption activities. The selections for academic preparation showed 60% of the respondents had a Bachelor's degree and 28% possessed a Master's degree.
- Level of certification showed a slight negative correlation with awareness, adoption, and adherence, which indicated those with lower certification showed slightly more participation in some knowledge translation activities as opposed to the higher certified respondents, but it may indicate they are more involved in those activities on a daily level. The respondents selected MLT (12%), MLS (70%), or specialist certification, which is higher than MLS (17%).

Table 21

Correlations between the continuous predictor variables and the four knowledge translation components (n-726)

Predictor Variable	Awareness	Acceptance	Adoption	Adherence
Age	-.118**	.022	-.154**	-.148**
Work experience	-.144**	-.015	-.174**	-.162**
Academic preparation	-.039	.013	-.079*	-.065
Level of certification	-.094**	.047	-.103**	-.092*
Type of Job	.198**	.119**	.237**	.226**

*$p < .05$, **$p < .01$ (2-tailed)

- Type of job showed a slight positive correlation ($p < .01$) with all four knowledge translation components. The survey indicated that 32% of the respondents performed mostly lab testing and some administrative duties, and 30% had mostly administrative responsibilities with some lab testing. Only 21% of the respondents had just administrative duties and 16% had only bench work. It would indicate that most laboratory professionals have involvement in the four knowledge translation activities because their jobs encompass administrative as well as lab testing responsibilities.

The personal predictors showed very slight statistical correlation with the four knowledge translation components. It demonstrated the homogeneity within the laboratory profession regardless of age, level of education, academic preparation or type of job.

Situational Predictor Variables

The only situational predictor variable that could be analyzed for its predictive value on the knowledge translation components was location. One-way ANOVA was used to assess the effect location had on the four components and there was no statistical significance. This analysis indicated that knowledge translation participation did not vary from rural (25%), suburban (31%), or urban (44%) laboratories.

Significance of Predictor Variables

When assessing the predictive value of personal and situational predictors on knowledge translation participation there was no statistically significant difference. The homogeneity of laboratory professionals and hierarchical structure of laboratory medicine would support the lack of variance in the predictors. The slight negative correlation in some knowledge translation components occurred with the younger less experienced individuals that may indicate generational diversity. These issues are discussed in Chapter V under 'Implications for Practice'.

CHAPTER V

DISCUSSION OF FINDINGS

The purpose of this chapter is to provide a summary of the research study, implications for practice, and future research. The first section of the chapter will include the purpose of the research, the conceptual framework, a summary of the construction of the questionnaire, and the research findings. The conclusions and discussion section will provide three concluding statements that were drawn from the research study, and the significance of these conclusions for the clinical laboratory science profession. The next sections will cover implications for practice as well as for theory and research. A discussion about future research initiatives will complete the chapter.

Overview of the Study

The purpose of this study was to understand clinical laboratory scientists' participation in the knowledge translation process. To establish a framework for the study, it was important to define knowledge translation as it related to this study and describe the role of clinical laboratory scientists in healthcare. The study adopted the definition of knowledge translation established by the World Health Organization as "the synthesis, exchange, and application of knowledge by relevant stakeholders to strengthen health systems and improve people's health" (2005, p. 2). The clinical laboratory scientist, as a relevant stakeholder, has the skills to bridge the gap between current advances in testing and the interpretation of these tests to improve patient's health. The research questions guiding this study were:

1. To what extent do clinical laboratory scientists participate in the four major components of knowledge translation (awareness, acceptance, adoption, and adherence)?
2. To what extent do personal characteristics (demographics) and situational factors (location of laboratory) of the clinical laboratory scientist predict the level of participation in each of the knowledge translation components?

In a database developed by the Improved Clinical Effectiveness through Behavioral Research Group (ICEBeRG) 31 models of knowledge translation have been identified. The ICEBeRG was tasked with finding conceptual models, frameworks and theories of knowledge translation (Improved Clinical Effectiveness Through Behavioral Research Group, 2008). Several models were discussed in this study that demonstrated how new research could be moved into practice. The models offered complex, integrated stages that would help advance knowledge translation but none of the models included the clinical laboratory scientist as a relevant stakeholder. A study conducted by Pathman et al. (1996) identified a sequence of behavioral steps used to measure a practitioner's participation in a new test. The four components (awareness, acceptance, adoption, and adherence) were cognitive activities that would indicate the on-going process involved in understanding and implementing the use of new knowledge into practice. From the Pathman study a conceptual framework was developed for this study. The literature review revealed that Pathman's four components were used in other knowledge translation studies in conjunction with the addition of culturally and socially constructed

Table 22

Definitions of Knowledge Translation Components for Clinical Laboratory Science

Theoretical Components*	Conceptual Definitions	Operational Definitions
Awareness	The extent that the participant is actively Involved in learning new knowledge Kitson, 2008.	Participation in activities to learn about new tests or instruments.
Acceptance	Acquiring and processing new knowledge that leads to the recognition of its importance, Stetler, 2001	Participation in activities identifying the new test or instrument as beneficial to the laboratory.
Adoption	Translating the new knowledge into a format that is easy to understand and is tailored to the workplace Tugwell, 2007	Participation in activities that integrate the new test or instrument into the laboratory.
Adherence	A collaborative involvement of participants in a mutually acceptable course of action that supports the new knowledge, Pathman, 1996	Participation in activities that continue to support the established protocol for the new test or instrument

*From "The awareness-to-adherence model of the steps to clinical guideline compliance. The case of pediatric vaccine recommendations", by D. Pathman, T. Konrad, G. Freed, V. Freeman, and G. Koch, 1996, *Medical Care,* 34, p. 873.

tacit and experiential knowledge base (McWilliam, 2007). Using the four conceptual definitions the researcher developed operational definitions listed in Table 22.

These four knowledge translation operational definitions served as a framework for the development of items for the questionnaire. The four components were not identified as levels or steps because they are not all required and do not occur in a certain order within the knowledge translation process described by Pathman (1996). Since the literature review did not reveal any research on clinical laboratory professionals' participation in knowledge translation, the researcher used studies from other healthcare professions to formulate the personal and situational influences that might affect the type

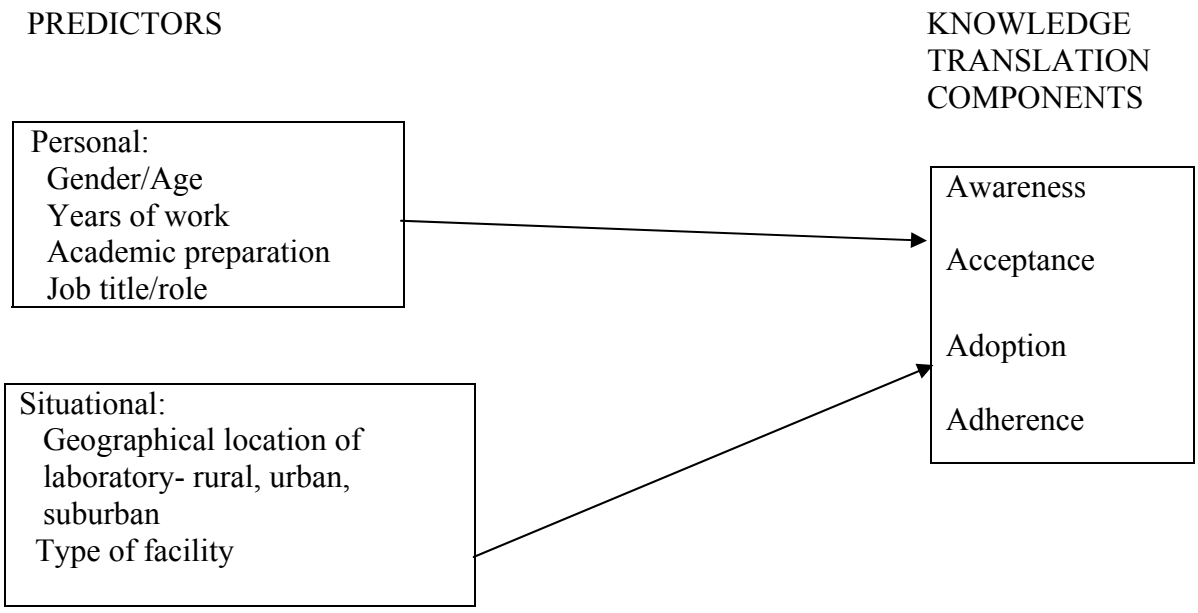

Figure 9. Knowledge translation analytical model for Clinical Laboratory Science

of participation. The final analytical model for this study was created from Pathman's model (Figure 9).

With the help of an expert panel of clinical laboratory scientists, a researcher-designed questionnaire was developed to measure the level of participation and to determine if the predictors listed above influenced the amount of participation. The central constructs of the questionnaire are the four components discussed earlier. The expert panel was asked to describe an event in which they introduced a new test or instrument into their laboratory, then given the operational definitions listed in Table 22 to guide them they created an item pool. From the brainstorming session, literature review, and discussion with clinical laboratory educators 219 potential items were developed. After refinement of the item pool, 62 items were used to create a prototype questionnaire that was given to some clinical laboratory scientists at a state meeting. A dichotomous response scale was selected for the prototype questionnaire because a

Likert-like style scale would not give an accurate measurement of the respondent's participation. The final questionnaire is found in Appendix A.

After the responses to the prototype questionnaire were returned a panel of Adult Education graduate students gathered to determine if all necessary questions were contained in the questionnaire, if the questions were clear, and if there were superfluous or poorly worded questions. A second panel was the clinical laboratory scientists who participated in the initial brainstorming session to create items. The expert content reviewers (clinical laboratory scientists) evaluated the instrument to determine if the respondents would understand the questions. Also, the content experts were asked if there are any characteristics of the questionnaire that would deter participants from completing it. At that time the item pool was reduced from 62 to 48 items.

A pilot survey was sent out using Survey Monkey® to 400 clinical laboratory professionals using a professional organization's member list. The result of the pilot survey gave a low response rate, reliability on the awareness component was low, and a screener question needed to be added to avoid getting respondents who currently did not work in the profession. The final decisions were made:

1. Rewrote the introductory letter to elicit higher response rate. (Appendix H)
2. Reviewed the second and third letters to encourage participation.
3. A screener question was added to eliminate those members who are not actively working in the clinical laboratory. (Appendix A)

4. Because the first component (awareness) did not meet reliability (Cronbach's Alpha = .55), the components would be analyzed as additive indices.

5. To clarify the first component the initial statement was reworded. "Prior to the lab adopting the new test or instrument described in the previous section from how many sources did you hear about it (select all that apply)."

After revisions were made and the IRB accepted the revisions, the final questionnaire went out to 4601 clinical laboratory professionals resulting in 726 useable responses.

Summary of Principal Findings

The clinical laboratory scientists who responded to the questionnaire demonstrated higher participation in acceptance (75.6%), adherence (64.4%), and adoption (58.7%) activities than in awareness activities (47%). The awareness activities mostly revolved around interaction with a sales representative who provided the new test or instrument. Eighty percent of the respondents chose talking to a vendor's representative as an awareness activity as opposed to getting information from a professional listserv (30.6%) or discussing it with a department or practitioner that has requested the test (15.7%). For the acceptance activities the highest percentage of respondents evaluated the new test's or instrument's ease of use (86%) and identified if it met the laboratory's standard of care (86%). The highest adherence activities selected by the respondents were monitoring analytical and post-analytical problems related to the new test or instrument (77.5%) and designing solutions to those problems associated with the new test or instrument (71.1%). In the adoption activities, 78% of the participants

communicated with the vendor and conducted a method evaluation study on the new test or instrument.

The predictive values of personal and situational characteristics showed very slight statistical significance. Gender showed a slight difference ($p < .05$) for adoption and adherence. Age of the respondents did demonstrate a negative correlation with awareness, adoption, and adherence indicating that older clinical laboratory scientists are less likely to participate in awareness, adoption, and adherence ($p < 0.1$). Acceptance showed no statistical significance ($p > .05$). Work experience demonstrated a negative correlation for all four components at $p < .01$ indicating that younger professionals show more activity in the four components, but it was only a slight statistical significance. The mean years of work experience of the respondents was 24 years. Academic preparation showed negative correlation for awareness, adoption, and adherence, but there was no statistical significance except in adoption. It may indicate that the higher degreed respondents are more involved in management responsibilities not related to knowledge translation. Level of certification also showed a negative correlation for all four components with a slight statistical significance on awareness, adoption, and adherence ($p < .05$).

With the situational predictor variables location of the laboratory (rural, suburban, and urban) was measured with a one-way analysis-of-variance (one-way ANOVA). This analysis did not indicate the location caused variation in knowledge translation activities. A Pearson Product Moment Correlation t-test on the size of the hospital (number of beds) showed no statistical correlation. Statistical analyses of other situational factors were not

statistically significant or analysis could not be conducted due to the wide variation in open-ended responses.

The personal and situation predictor variables showed only slight statistical significance in the knowledge translation activities. The homogeneity of the clinical laboratory scientists would support these results. A review of the predictor variables from the respondents defines a work force of predominantly white, females who are 49 years old with a mean work experience of 24 years. As reported by the Executive Summary of Lab Medicine (2008), the U.S. in the next five years will experience a workforce shortage of laboratory professionals (4% to 7%). The turnover rate in clinical laboratory scientist positions in hospitals as reported by the ASCP survey (2011) has increased. The "Baby Boomer" generation will be retiring. As indicated in other healthcare professions there are four generations in the workplace (Kramer, 2010). All of these factors may influence the negative correlations demonstrated in the predictor variables.

Conclusions and Discussion

The conclusions of this study are a result of a thorough review of relevant literature, communication with clinical laboratory scientists, and evaluation of the survey results. The following three statements will be discussed in this section.

1. Clinical laboratory scientists are substantially involved in the knowledge translation process in their work settings.
2. Clinical laboratory scientists are differentially involved in the four stages of the knowledge translation process.

3. Although clinical laboratory scientists employ a variety of learning activities in the knowledge translation process, these are adhoc rather than intentional and systematic.

Conclusion 1

Clinical laboratory scientists are substantially involved in the knowledge translation process in their work settings.

Clinical laboratory scientists in this study demonstrated an integration of the knowledge translation process into their daily activities. Before undertaking the introduction of a new test or instrument they wanted to learn about this test or instrument. They reached out to others to make sure they knew if this test or instrument fit the needs of their institution. In Appendix J the listing of new tests or instruments identified by the respondents, showed the awareness and acceptance activities clinical laboratory professionals take when introducing most new tests. In the descriptions they not only listed the test or instrument but also described the purpose of the test or rationale for changing to a different test. In one discussion the respondent indicated they selected a specific test measuring anti-rejection drug levels for their transplant program because it gave reportable ranges on the lower end of the measurement scale required by their surgeons. Some other respondents listed the reason they became aware of a new instrument was the ability to provide advanced testing that would improve patient care. One respondent was making a selection of a new instrument to be used by laboratory professionals in another country, so they wanted to make sure it would be easy to use and compatible with the institution's needs. It clearly showed that the awareness and

acceptance components are an integral part of laboratory scientists' role in bringing new research to practice.

Adoption and adherence were identified as essential activities for successful introduction of a new test. As mentioned in Chapter II the educational essentials established by the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS, 2008) have emphasized the analytical phase of laboratory testing. Clinical laboratory science educators have included quality control measurements, method evaluations, and troubleshooting skills as part of all course objectives. With the rapidly increasing number of testing platforms being approved by FDA (2011), it is imperative that these adoption and adherence protocols have been firmly established in clinical laboratories. Clinical laboratory scientists in the survey indicated they performed method validation on new test or instruments (78%) prior to including them on the laboratory's test menu. They attended training sessions (67%), wrote test procedures using the CLSI guidelines (63%), and developed troubleshooting guides (56%) to make sure appropriate preparation had been made to adopt the new test or instrument. In adherence activities, the respondents participated in monitoring analytical and post-analytical problems (78%) and designed solutions to specific problems related to the new test or instrument (71%). Since the respondents are assigned different tasks they may not have been involved in the total adoption process as indicated on the survey, but they were involved in segments of the adoption process which must be completed with satisfactory results before a new test can be released to the practitioner. During laboratory inspections by authorized organizations (CAP, FDA or CLIA-certified agencies) documentation on new test evaluations by the laboratory as well as ongoing evaluations after adoption to ensure

adherence to quality improvement standards are required. National laboratory laws (CLIA, 2004) mandate that specific records must be maintained and guidelines followed are a laboratory's license can be withdrawn. Clearly specific adoption and adherence activities are an integral part of clinical laboratory scientists' daily activities.

As described in this section, clinical laboratory scientists focus on the quality outcomes of laboratory tests and benefits to the patient. The reduction in gaps, redundancies, and errors are intertwined throughout all four knowledge translation components. Bringing the knowledge translation process to the table supplies valuable new knowledge to the healthcare team. Working in teams involves sharing one's expertise and relinquishing some professional autonomy to work closely in achieving better outcomes. This point will be discussed further in "Implications for Practice."

Conclusion 2

Clinical laboratory scientists are differentially involved in the four stages of the knowledge translation process.

Awareness

Even though the respondents indicated participation in all four knowledge translation components, there was differential involvement in certain aspects of the knowledge translation process. Upon review of the survey in Chapter IV, the method respondents selected most often to become aware of a new test or instrument was through conversation with a vendor's representative (80%) while the lowest activities selected were conversations with other healthcare professionals or practitioners who may be interested in the test. Although acquiring new knowledge may come from various sources, if the majority of learning occurs with a vendor's sales representative the

learning goal may be narrowed down to financial gain and not about improvement of patient care, but if the communication is between the laboratory professional and a vendor's technical representative, some valuable technical knowledge could be acquired. Becoming aware of a new test or instrument from a vendor's representative can be helpful initially, but other learning sources should be utilized to develop in depth knowledge of the subject.

Acceptance

Another result found in the survey responses that showed differential involvement was found in acceptance activities. Out of 13 survey items in the acceptance section eight showed at least 80% of the respondents selected them. Most of the eight activities were centered on the impact the new test would have on the laboratory. The ease of use, meeting laboratory's long-term goals, and ease of set-up outweighed identifying flexibility in adding interpretative text or evaluation using evidence-based laboratory practice guidelines. The respondents were more involved in the laboratory's acceptance needs and not furthering collaborative activities. Providing interpretative text and identifying evidence-based testing would improve laboratory support to the practitioner and improvement of patient care.

Adoption and Adherence

The acceptance component had a higher mean percentage than adoption and adherence. The first observation was the respondents selected more acceptance activities than the adoption and adherence activities because they were more inter-laboratory activities. Only four out of 16 adoption activities were selected by 70% to 78% of the

respondents. Those adoption activities selected by less than 50% of the respondents were:

- presenting in-service classes to introduce the new test or instrument to other laboratory employees and other healthcare professionals.
- establishing a notification procedure for getting (STAT) test results to practitioners.
- creating an interpretative narrative to accompany the test results.
- developing a test algorithm for the practitioner.

Even though the survey had fewer adherence activities (8 items) it had a higher mean percentage than adoption. The two items selected by less than 50% of the respondents were:

- providing evidence of improved patient care with the new test or instrument.
- providing consultation services for healthcare practitioners about the new test or instrument.

The differential involvement in knowledge translation components was identified by the survey responses. It was revealing that the respondents did not select the knowledge translation activities requiring involvement with other healthcare professionals or activities outside of the routine daily activities as often. Dupree and Kemp (2005) suggested that narrative interpretation translates laboratory test data into knowledge and educates the practitioner at the point of practice. With the advent of IPODS and smart phones the test results and narrative would be available at the patient's

bedside. Moving new testing to the practitioner is the value of the knowledge translation process. The increase in new tests has made it difficult for practitioners to keep up with new advances (Roth & Garrott, 2011). The development of test algorithms based on evidence-base laboratory guidelines could reduce the number of laboratory tests ordered on a patient and provide a more rapid diagnosis, thus improving patient care as well as possibly reducing healthcare cost. The consultative service also had a low response rate. A family practice practitioner questionnaire indicated 92% would benefit if there was a mechanism for simple and effective consultation on the selection of laboratory tests (Clinical Laboratory Improvement Act, 2009). If clinical laboratory scientists become more involved within an interprofessional team, there will be a more complete involvement in the knowledge translation process and a more patient centered healthcare environment.

Conclusion 3

Although clinical laboratory scientists employ a variety of learning activities in the knowledge translation process, these are adhoc rather than intentional and systematic.

As a total view of the knowledge process utilized by clinical laboratory scientists, this study revealed the learning activities were randomly selected and not based on a systematic approach. Kitson (2003) stated the involvement of knowledge translation includes education and personal development. In review of the questionnaire, it was significant that clinical laboratory scientists learned about new tests or instruments the majority of the time from an individual whose main objective was to push a specific product. The vendor's representative visited the clinical laboratory regularly, so the information was readily available but not based on a planned learning process. In

Chapter II, the development of the knowledge translation process was identified as a "systematic approach" as well as "interactive process" (Graham et al., 2006). The need to establish an interrelationship between educational objectives and the knowledge translation process is vital in providing significant progress. The extensive development of knowledge translation models discussed in Chapter II emphasized the systematic movement of research to practice. The Knowledge-to-Action Model (Graham, et al., 2006) was an example of how important a systematic process enhances the process. The knowledge creation funnel pushed the new research out to the healthcare community, but the next phase, action cycle, included the synthesis of the knowledge to contextualization, assessing barriers to knowledge use, and the integration of findings within a larger body of knowledge to sustain knowledge use. The Ottawa Model (Logan & Graham, 1998) placed emphasis on assessing, monitoring, and evaluating each element of the new knowledge before, during, and after the decision to implement. These models could not be described as a haphazard movement of learning to practice and especially not one based on financial gains.

As discussed in the first two discussion points clinical laboratory scientists were involved in the knowledge translation process, but more precise and directed learning activities would establish engagement in the process. If the educational competencies established by the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS, 2009) were used as an educational framework with increased interactivity and engagement with other healthcare professionals, clinical laboratory scientists would have a more total immersion in the process. Epner (2008) emphasis on moving from the pre-analytical, analytical, and post analytical activities to more patient-centric activities

such as interpretation and consultation of patient test results would begin the interprofessional communication. The development of test algorithms would also create professional education opportunities with other healthcare professionals, and learning more about the total healthcare environment. The use of pre-service and continuing professional education could assist in defining a clinical laboratory science model of knowledge translation.

Implications for Practice

The future role of clinical laboratory scientists in healthcare is unclear at this moment. The current picture consists of an invisible clinical laboratory scientist providing vital clinical and interpretive laboratory information to practitioners. In a recent article a professional colleague mentioned an experience he had with a caricaturist who was creating his portrait (Kaplan & Burgess, 2010). The caricaturist asked his profession and as the colleague described the role of the clinical laboratory professional, the caricaturist had a blank look. The final portrait revealed a man in a white lab coat and a stethoscope in his pocket, which is not a tool of the profession. The interesting feature of this sketch was it did not have a face. No eyes, nose, or mouth. The laboratory professional asked him why his sketch did not include a face. The caricaturist said, "Because I have no idea who you are."

The purpose of this study was to understand clinical laboratory scientists' participation in the knowledge translation process. Knowledge translation provided the portal for the direction of this study. If the future of healthcare is to include clinical laboratory scientists, knowledge translation should be investigated as a model for strengthening the collaborative skills. With the many new advanced tests available, the

translation of these tests for use in healthcare is an opportunity for collaborative teamwork.

Education's Interrelationship with Knowledge Translation

One of the implications for practice involves learning how to integrate knowledge translation into the total healthcare environment. An expert panel of healthcare educators (nursing, medicine, pharmacy, dentistry) developed core competencies for interprofessional collaborative practice because they felt that being able to work effectively as members of clinical teams while students would engage them in interactive learning and possibly follow into professional practice (Core Competencies for Interprofessional Collaborative Practice, 2011). If academic healthcare institutions could develop an interactive collaborative community, and clinical laboratory professionals could be a part of this process, it would help them form relationships with other healthcare students. WHO (2010) defined interprofessional collaborative practice as multiple health workers from different professional backgrounds working together with patients, families, and communities to deliver the highest quality of care.

D. Davis and N. Davis (2010) described educational interventions in a CPE (Continuing Professional Education) format to include interactivity and engagement in the learning process thereby introducing knowledge translation to all healthcare professionals. By incorporating large group sessions including various healthcare professionals, knowledge translation needs and objectives could be established for the group. The use of various multicomponent interventions would be used to address reflection and interaction in small groups or individual simulation-based techniques to emphasize relevance with increased potential for learning.

For collaborative teamwork the emphasis should be on understanding how the four knowledge translation components can aid the clinical laboratory profession by improving the profession's strengths in each component. By using interprofessional CPE, some of the barriers could be dissolved and allow collaboration including clinical laboratory professionals. The students can become actively engaged in communicating new knowledge to their healthcare partners, and developing teamwork skills while in school. From the survey results the awareness component should be a central focus. In the operational awareness definition (Table 22), participation in activities to learn about new tests or instruments would be an area to develop communication with other professionals, thus becoming a vital part of the interprofessional collaborative team. The awareness of new tests would include reaching out to the healthcare community to understand the current critical issues and how the clinical laboratory profession can offer a solution.

The use of problem-base e-learning has been used at the University of Alberta in interprofessional health science education courses (King, et al., 2010). The ePBL is a new approach that uses technological tools to support various learning delivery formats. The educational objective was based on meaning-making and not fact-collecting. The study focus was the understanding that learning occurs as a process of constructing knowledge within a social and environmental context. Each team consisted of no more than one student of each discipline. The implication of this study was to provide health practitioners with an opportunity for team-based collaborative professional development.

If the clinical laboratory scientist is to evolve out of the faceless portrait, more emphasis must be placed on collaborative work. In competency domains, roles and

responsibilities, the expert panel of educators stated that there should be a diverse group of healthcare professionals who complement each other's professional expertise to develop strategies to meet specific patient care needs (Core Competencies for Interprofessional Collaborative Practice, 2011). In reflecting on the responses to the knowledge translation survey, acceptance, adherence, and adoption activities represented high participation among the respondents. Awareness was the component that represented less participation. It is at least a beginning point for the profession to identify awareness activities that will involve other healthcare professionals. Communication outside of the clinical laboratory will give more visibility and develop professional relationships. Clinical laboratory professionals should volunteer to participate on institutional committees including infection control, TQM, and safety. There is much that can be done to place the clinical laboratory professional in a collaborative interprofessional team, but it will take educational experiences to begin the process. The clinical laboratory science educational curriculum should include professional development involving more interactive learning courses with medical, nursing and other healthcare professionals.

Implications for Research

Since this is the first research study for clinical laboratory science in the area of knowledge translation, the opportunities for future research are extensive. For the future of the profession additional research will provide insight into the direction clinical laboratory scientists should take to support quality collaborative healthcare. This section will discuss the implication for future research.

Knowledge translation focuses on the movement of research to practice. Clinical laboratory science is the pivotal point of this process. The survey respondents represented a wide diversity of clinical laboratory professionals. Even though a screener question eliminated those respondents who had not participated in introducing a new test or instrument within the last five years, it may give a deeper view of current participation by focusing on specific segments of the profession. This survey was evenly distributed among mostly bench work with some administrative responsibilities (32%), all bench work (16%), mostly administrative responsibilities and some bench work (30%), and all administrative responsibilities (21%). If the managers and directors are interviewed concerning their types of knowledge translation activities and compare their responses to those performing the tests, it may identify the reasons for the lack of participation in awareness activities. Should a laboratory professional performing the test not be allowed to participate in knowledge translation activities? Why is the bench testing limited to psychomotor skills and not cognitive abilities? The research may show a block in the development of knowledge translation within the profession.

A second research area would be the degree of knowledge translation involvement with younger clinical laboratory scientists. In understanding generational diversity, the millennial generation (1980-2000) prefers to communicate within teams instead of reading lengthy policies and procedure manuals. They like instant feedback and learn best by doing, collaborating on case studies and simulations (Kramer, 2010). If the laboratory leadership consists of baby boomer age individuals, the communication styles are different. In a discussion with laboratory leaders of 18 not-for-profit integrated delivery network healthcare systems, the talent shortage for the immediate and long-term

future of the laboratory was discussed. One issue was the needs of the younger laboratory professionals. The Gen-Xers and millennial generations do not view the laboratory as being a place in which they can contribute to patient care (CAP Compass Group, 2008). In this research survey, it was noted that age showed negative correlation with knowledge translation participation. Do younger laboratory professionals enter the career with more interest in knowledge translation participation and leave the profession because these interests are not supported by laboratory administration? An opportunity to establish working relationships with a healthcare team will give the younger professionals a sense of contributing to patient care in tangible activities.

Another research area would be working with the laboratory educators to identify interprofessional core competencies that would be incorporated into national education accreditation guidelines. An educators' survey on current interprofessional core competencies would be a starting point. More emphasis should be placed on problem solving skills that involve patient-centered care and awareness of other healthcare professionals in the process. This research should involve conversations with medical and nursing programs to establish the interprofessional links. What would be significant conversations in improving patient care from the practitioner's viewpoint? What type of communication could be used to provide fast and efficient support in patient care?

Summary

This research study is just the beginning of further studies that should be conducted to inform the clinical laboratory science profession. As our country redefines healthcare, it is time to align this critical laboratory profession with other healthcare professions improving patient care. Patient-centered care mentioned by Epner (2008)

included the mining of clinical data to support improved evidence-based healthcare processes and reduce practitioner variability. The clinical laboratory profession should assert ownership for the total testing process. Without knowledge translation skills it will be difficult to translate simply testing patient samples to asserting ownership of the testing process. The younger laboratory professionals could lead the transformation of the profession to a more expanded scope of practice. If given the tools during their educational experience, the clinical laboratory science students could learn how to discuss the appropriate testing platform based on evidence-based laboratory guidelines using interprofessional teamwork. The older professionals should embrace the change and allow the young professionals the opportunity to move toward a future with involvement in patient-centered care.

Knowledge translation requires awareness, acceptance, adoption, and adherence for all laboratory activities. Moving from what is currently happening in the laboratory requires not only advanced testing methodologies but also active participation in improving healthcare. This research study indicated that activities involving acceptance, adherence and adoption are embedded in the clinical laboratory profession, but awareness of new tests or instruments is based on what information is received from limited sources. This source of information is not unique just for laboratory professionals, other healthcare professionals receive information from financially invested sources (Smith, 2006), but changing participation in the type of awareness activities could begin the ownership for patient testing.

Finally, a collaborative healthcare community could advance an improvement in how healthcare is delivered to patients. The insular department focused only on its own

silo will not change healthcare to become a more positive source for improving everyone's health. The movement from a disease-centered healthcare system to a prevention-centered system is a new approach that clinical laboratory science should support. The future of healthcare is squarely on the shoulders of all healthcare professions.

References

Acker, J. (2006). *Class questions: Feminist answers*. New York: Rowman & Littlefield Publishers, Inc.

Agency for Healthcare Research and Quality. *Morbidity and mortality rounds.* Retrieved November 9, 2008, from http://www.webmm.ahrq.gov/search.aspx?searchStr=laboratory%20medicine

Agency for Healthcare Research and Quality. *Patient safety net.* Retrieved November 9, 2008, from http://www.psnet.ahrq.gov/collectionBrowse.aspx?taxonomyID=334

American Society for Clinical Laboratory Science (2001). Scope of practice. Retrieved April 18, 2007 from http://www.ascls.org/?page=Pos_Pap_18

American Society for Clinical Laboratory Science (2007). Practice levels and educational needs for clinical laboratory personnel. Retrieved February 3, 2008 from http://www.ascls.org/?page=Pos_Pap_2

American Society for Clinical Laboratory Science State Licensure (2008). Retrieved October, 12, 2008 from http://www.ascls.org/?page=Grad_PL&hhSearchTerms=state+and+licensure

American Society for Clinical Laboratory Science (2009). Current events. Retrieved February 8, 2010 from http://www.ascls.org/?page=Grad_PL

American Society for Clinical Pathology History. Retrieved July 17, 2007 from http://www.ascp.org/MainMenu/AboutASCP/History.aspx

American Society for Clinical Pathology Certification Maintenance. Retrieved July 17, 2006 from http://www.ascp.org/functionalnavigation/certification/certificationmaintenanceprogramcmp.aspx

American Society for Clinical Pathology (2008). The future of pathology and laboratory medicine. *Critical Values,* 1, 26-33.

American Society for Clinical Pathology. (2011). ASCP vacancy survey results pay, education, and retirement as laboratory staffing challenges. Retrieved May 30, 2011 from http://www.ascp.org/MainMenu/AboutASCP/Newsroom/NewsReleases/ASCP-Vacancy-Survey-Reveals-Pay-Education-and-Retirement-as-Laboratory-Staffing-Challenges.aspx

Baumbusch, J.L., Kirkham, S. R., Khan, K.B., McDonald, H., Semeniuk, P., Tan, E. & Anderson, J.M. (2008). Pursuing common agendas: A collaborative model for knowledge translation between research and practice in clinical settings. *Research in Nursing & Health,* 31, 130-140.

Bennett, A., Thompson, N., Holladay, B., Bugbee, A. & Steward, C (2009). ASCP wage and vacancy survey of U.S. medical laboratories. *Laboratory Medicine,* 40, 133-141.

Bero, L.A., Grilli, R., Grimshaw, J.M., Harvey, E., Oxman, A.D., & Thomson, M.A. (1998). Closing the gap between research and practice: An overview of systematic reviews of interventions to promote the implementation of research findings. *British Medical Journal,* 317, 465-468.

Black, T. (1999). *Doing quantitative research in the social sciences,* London, SAGE.

Blau, G. & Tatum, D. (2000). Correlates of perceived gender discrimination for female versus male medical technologists. *Sex Roles*. 43(1/2), 105-118.

Blau, G., Tatum, D.& Ward-Cook, K.(2003). Correlates of professional versus organizational withdrawal cognition. *Journal of Vocational Behavior.* 63, 72-85.

Bugbee, Jr., A., Jones, G., Doyle, K.M., Holladay, E.B., & Blau, G. J. (2007). ASCP board of registry research 1993-2007: An annotated bibliography. *Laboratory Medicine,* 38 (10), 587-593.

Canadian Institute for Health Research. Knowledge translation. Retrieved July 5, 2008 from http://ktclearinghouse.ca/knowledgebase/glossary

Centers for Disease Control and Prevention. (2008). Laboratory best practices: Developing an evidenced-based practice review and evaluation process: Final technical report 2007. Phase 1. Atlanta, GA, U.S. Department of Health and Human Services.

Chapman, S., Lindler, V., & Ward-Cook, K. (2005). An assessment of critical issues facing the clinical laboratory workforce. *Clinical Leadership & Management Review,* 19(1), E4.

Clinical laboratory improvement amendments (2004). Retrieved October 18, 2008 from http://www.fda.gov/CDRH/clia/

Clinical Laboratory Improvement Act, (2009). Retrieved April 3, 2009 from http://wwwn.cdc.gov/clia/default.aspx

College of American Pathologists Compass Group (June 2008). Labs coming up short in finding new talent. Retrieved November 1, 2009

from http://www.cap.org/apps/cap.portal?_nfpb=true&cntvwrPtlt_actionOverride=%2Fportlets%2FcontentViewer%2Fshow&_windowLabel=cntvwrPtlt&cntvwrPtlt{actionForm.contentReference}=cap_today%2Ffeature_stories%2F0608_Labs_coming_up.html&_state=maximized&_pageLabel=cntvwr

Coordinating council on the clinical laboratory workforce report (2008), Retrieved April 18, 2008, from http://www.ascp.org/pdf/ccclw.aspx

Davies, H, Nutley, S., & Walter, I. (2008). Why 'knowledge transfer' is misconceived for applied social research. *Journal of Health Service Research Policy,* 13(3), 188-190.

Davis, D. (2006). Continuing education, guideline implementation, and the emerging transdisciplinary field of knowledge translation. *The Journal of Continuing Education in the Health Professions,* 26, 5-12.

Davis, D & Davis, N. (2010). Selecting educational interventions for knowledge translation. *Canadian Medical Association Journal,* 182(2), 89-93.

Davis, D. Evans, M, Jadad, A., Perrier, L., Rath, D., Ryan, D., Sibbald, G., Straus, S., Rappolt, S., Wowk, M. & Zwarenstein, M. (2003). The case for knowledge translation: Shortening the journey from evidence to effect. *British Medical Journal,* 327, 33-35.

Davis, D., O'Brien, M.A., Freemantle, N., Wolf, F.M., Mazmanian, P. & Taylor-Vaisey, A. (1999). Impact of formal continuing medical education: Do conferences, workshops, rounds, and other traditional continuing education activities change physician behavior or health care outcomes? *The Journal of the American Medical Association,* 282(9), 867-874.

Day, L. (2008). Commercialism and the professional practice of healthcare providers. *American Journal of Critical Care,* 17 (2), 164-167.

Dillman, D. A. (2007). *Mail and Internet Surveys The tailored Design Method* (2nd ed.) New Jersey: John Wiley & Sons, Inc.

Dirkx, J., (2006). Studying the complicated matter of what works: Evidence-based research and the problem of practice. *Adult Education Quarterly,* 56, 273-290.

Dupree, W. & Kemp, K. (2005). A one-stop shopping center which transforms data into information and knowledge. *Lab Medicine,* 36 (2), 78-80.

Eisenhardt, K. (1989). Agency theory: An assessment and review. *Academy of Management Review,* 14 (1), 57-74.

England, P. (2005). Emerging theories of care work. *Annual Review of Sociology,* 31, 381-399.

Epner, P.L. (2007). Laboratory workforce shortage: Implications for the future. *Clinical Leadership and Management Review,* 21, 1-7.

Epner, P. (2008). Owning the total testing process. *Advance for Administrators of the Laboratory,* 65.

Estabrooks, C.A., Floyd, J.A., Scott-Findlay, S, O'Leary, K.A., & Gushta, M. (2003). Individual determinants of research utilization: A systematic review. *Journal of Advanced Nursing,* 43(5), 506-520.

Estabrooks, C.A., Thompson, D.S., Lovely, J.E., & Hofmeyer, Anne. (2006). A guide to knowledge translation theory. *The Journal of Continuing Education in the Health Professions,* 26, 25-36.

Ewert, D.M. & Grace, K.A. (2000). Adult education for community action. In A.L. Wilson & E. R. Hayes (Eds.), *Handbook of adult and continuing education* (pp. 327-343). San Francisco, CA: Jossey-Bass.

Fenwick, T. (2003). *Learning through experience: Troubling orthodoxies and intersecting questions.* Malabar, FL.: Krieger Publishing Company.

Ferlie, E. & Shortell, S.M. (2001) Improving the quality of health care in the United Kingdom and the United States: A framework for change. *The Milbank Quarterly,* 79 (2), 281-315.

Forsman, Rodney S. (2002, November/December). The value of the laboratory professional in the continuum of care. *Clinical leadership and management review*, 370-373.

Fraenkel, J. & Wallen, N.E. (2003). *How to design and evaluate research in education* (5th ed.), New York: McGraw Hill.

Georgia Health Sciences University, CLS Masters Curriculum, Retrieved May 30, 2011 from http://catalog.georgiahealth.acalog.com/preview_program.php?catoid=7&poid=379#curriculum

Georgia House Bill 944 (2009) Retrieved March 12, 2010 from http://www.legis.ga.gov/legis/2009_10/fulltext/hb994.htm

Graham, I. & Logan, J. (2004). Innovations in knowledge transfer and continuity of care. *Canadian Journal of Nursing Research,* 36, 89-103.

Graham, I., Tetroe, J., Robinson, N. Grimshaw, J., & The International Funders Study Research Group (2005). *An international study of health research funding*

agencies' support and promotion of knowledge translation. Paper presented at the Academy Health Annual Research Meeting, Boston, MA.

Graham, I., Logan, J., Harrison, M.B., Straus, S.E., Tetroe, J., Caswell, W., & Robinson, N. (2006). Lost in knowledge translation: Time for a map? *The Journal of Continuing Education in the Health Professions,* 26, 13-24.

Graham, I. & Tetroe, J. (2007). Some theoretical underpinnings of knowledge translation. *Academic Emergency Medicine,* 14(11), 936-941.

Greenhalgh, T. Robert, G, McFarlane, F., Bate, P., & Kyriakiou, O. (2004). Diffusion of innovations in service organizations: Systematic review and recommendations. *The Milbank Quarterly,* 82(4), 581-629.

Grimshaw, J., Shirran, L., Thomas, R., Mowatt, G., Fraser, C., Bero, L.A., Grilli, R., Harvey, E., Oxman, A., & O'Brien, M. A.(2001). Changing provider behavior: An overview of systematic reviews of interventions. *Medical Care,* 39(Suppl. 2), II-2-11-25.

Grimshaw, J., Thomas, R.E., MacLennan, G., Fraser, C., Ramsey, C.R., Vale, L., Whitty, P., Eccles, M.P., Matowe, L., Shirran, L., Wensing, M., Dijkstra, R. & Donaldson, C.. (2004). Effectiveness and efficiency of guideline dissemination and implementation strategies. *Health Technology Assessment,* 8(6), 1-355.

Grimshaw, J., Santesso, Nancy, Cumpston, M. Mayhew, A.I. & McGowan, J. (2006). Knowledge for knowledge translation: The role of the Cochrane collaboration. *Journal of Continuing Education in the Health Professions*, 26, 55-62.

Grol, R. & Grimshaw, J. (2003). From best evidence to best practice: Effective implementation of change in patients' care. *The Lancet,* 362, 1225-1230.

Hall, G. & Hord, S. (2006). *Implementing change: Patterns, principles, and potholes* (2nd ed.). Boston: Pearson.

Havelock, R. (1969). Planning for innovation through dissemination and utilization of knowledge. *Center for Research on Utilization of Scientific Knowledge,* University of Michigan, Ann Arbor

Havelock, R. & Havelock, M. (1973). Training for change agents: A guide to the design of training programs in education and other fields. *Center for Research on Utilization of Scientific Knowledge,* University of Michigan, Ann Arbor.

Henderson, A. & Winch, S. (2008). Staff development in the Australian context: Engaging with clinical contexts for successful knowledge transfer and utilization. *Nurse Education in Practice,* 8, 165-169.

Herschel, R., Nemati, H.,& Seiger, D. (2001). Tacit to explicit knowledge conversion: Knowledge exchange protocols. *Journal of Knowledge Management,* 5(1), 107-116.

Hord, S. (1997). *Professional learning communities*. Washington, D.C.: U.S. Department of Education, Office of Educational Research and Improvement.

Huberman, M., (1990, Summer). Linkage between researchers and practitioners: A qualitative study. *American Educational Research Journal,* 27, 363-391.

Huck, S.W. (2004). *Reading statistics and research* (4th ed.) Boston: Pearson

Improved Clinical Effectiveness through Behavioral Research Group. Retrieved October 18, 2008 from http://www.iceberg-grebeci.ohri.ca/research/kt_theories_db.html

Institute of Medicine (2011, March). *Clinical practice guidelines we can trust*, Washington, D.C.: The National Academies Press.

Interprofessional Education Collaborative Expert Panel (2011, May). *Core competencies for interprofessional collaborative practice: Report of an expert panel*. Washington, DC: Interprofessional Education Collaborative.

Jacobson, N. Butterill, D., & Goering, P. (2003). Development of a framework for knowledge translation: Understanding user context. *Journal of Health Services Research & Policy,* 8, 94-99.

Kaplan, R. & Burgess, T. (2010). The impending crisis. *Journal of Microbiology & Biology Education,* 11(2), 1-3.

King, S. Greidanus, E., Carbonaro, M., Drummond, J. Boechler, P., & Kahlke, R. (2010). Synchronous problem-based e-learning (ePBL) in interprofessional health science education. *Journal of Interactive Online Learning,* 9(2), 133-150.

Kitson, A.L. (2008). The need for systems change: Reflections on knowledge translation and organizational change. *Journal of Advanced Nursing,* 65(1), 217-228.

Kitson, A. Harvey, G, & McCormack, B. (1998). Enabling the implementation of evidence based practice: A conceptual framework. *Quality of Health Care,* 7, 149-158.

Kitson, A., Rycroft-Malone, J., Harvey, G., McCormack, B., Seers, & Titchen (2008). Evaluating the successful implementation of evidence into practice using the PARiHS framework: Theoretical and practical challenges. *Implementation Science,* 3(1), 1-19.

Kramer, L. (2010). Generational diversity. *Dimensions of Critical Care Nursing,* 29(3), 125-128.

Krosnick, J. (1999). Survey research. *Annual Reviews,* 50, 536-567.

Lab Test on Line. Retrieved September 2007 from www.labtestonline.org/understanding/news/index/html

Lang, E.S., Wyer, P.C., & Haynes, R.B. (2007). Knowledge translation: Closing the evidence-to-practice gap. *Annals of Emergency Medicine,* 49, 355-363.

Laposata, M., Van Cott, E., Buchner, D., Kashalo, M., & Dighe, A. (2004). Physician survey of a laboratory medicine interpretive service and evaluation of the influence of interpretations on laboratory test ordering. *Archives of Pathology Laboratory Medicine,* 128, 1424-1427.

Leibach, E. (2008). The doctorate in clinical laboratory science: The keystone practitioner for the profession. *Clinical laboratory science,* 20(1), 4-6.

Logan, J. & Graham, I.D. (1998). Toward a comprehensive interdisciplinary model of health care research use. *Science Communication,* 20, 227-246.

Lomas, J. (1993). Retailing research: Increasing the role of evidence in clinical services for childbirth. *The Milbank Quarterly,* 71, 439-475.

Malone, B. (2009). Comparative effectiveness: Where do labs fit in? *Clinical laboratory News,* 35(5), 1-7.

Martini, L. (Oct. 2009). Merger between NCA and ASCP: What does it mean for students? *ASCLS Today,* 6.

McCormack, B., Kitson, A., Harvey, G. Rycroft-Malone J., Tichen, A.., and Seers, K. (2002). Getting evidence into practice: The meaning of "context". *Journal of Advanced Nursing,* 38, 94-104.

McGlynn, E., Asch, S., Adams, J., Keesey, J. Hicks, J., & DeCristofaro, A. (2003). The quality of health care delivered to adults in the United States. *New England Journal of Medicine*, 348, 2635-2645.

McLane, M. (2009, November/December). Reflections on the NCA-BOR merger. *ASCLS Today,* 2-3.

McWilliam, C. (2006). Implementing organizational change in health and social services. *Journal of Organizational Change Management, 19(2), 119-135.*

McWilliam, C. (2007). Continuing education at the cutting edge: Promoting transformative knowledge translation. *The Journal of Continuing Education in the Health Professions,* 27, 72-79.

McWilliam, C. Kothair, W., Ward-Griffin, C., Forbes, D., Leipert, B. (2009). Evolving the theory and praxis of knowledge translation through social interaction: A social phenomenological study. *Implementation Science,* 4(26), 1-41.

Merriam, S. & Simpson, E. (2000). *A guide to research for educators and trainers of adults* (2nd Ed.), Malabar, FL: Krieger Publishing Company.

Mills, A.J., Kelley, E., & Cooke, B. (2002). Management theory in context: Exploring the influence of the cold war. *Administrative Sciences Association of Canada,* 23(24), 11-20, Winnipeg, Canada.

Michel, R.L. (2002). Clinical decision support system improves lab test ordering. Retrieved April 3, 2009 from http://www.darkdaily.com

Michel, R.L. (2010) Merger of Spectrum Laboratory Network and Carilion Laboratory creates clinical laboratory company. Retrieved March 4, 2010 from http://www.darkdaily.com/merger-of-spectrum-laboratory-network-and-carilion-labs-creates-big-clinical-laboratory-company-128

Moore, D.E., Jr., Cervero, R.M., & Fox, R. (2007). A conceptual model of cme to address disparities in depression care, *Journal of Continuing Education in the Health Professions.* 27(S1), S40-S54.

National Accrediting Agency for Clinical Laboratory Sciences (NAACLS). Clinical laboratory science doctorate competencies. Retrieved on October 13, 2008 from http://www.naacls.org/docs/guide_dcls.pdf

National Center for Dissemination of Disability Research. What is knowledge translation? Technical brief number 10.2005. Retrieved October 13, 2008 from National Certification Agency. Recertification guidelines. Retrieved October 13, 2008 from http://www.ncddr.org/kt/products/focus/focus10/Focus10.pdf

Nguyen, D., Ornstein, C., & Weber, T. (2010). Dollars for docs: What drug companies are paying your health professionals. Retrieved May 30, 2011 from http://projects.propublica.org/docdollars/

Ostrom,E.(1999). Institutional rational choice: An assessment of the institutional analysis and development framework. In P.A. Sabatier (Ed.), *Theories of the policy process* (pp. 35-65). Colorado: Westview Press.

Pathman, D.E., Konrad, T.R., Freed, G.L., Freeman, V.A. & Koch, G.G. (1996). The awareness-to-adherence model of the steps to clinical guideline compliance. The case of pediatric vaccine recommendations. *Medical Care,* 34(9), 873-89.

Patient-Centered Care and Laboratory Medicine. (2009). *Laboratory medicine: A national status report 2008-2009 Update*, 1-49, Retrieved October 13, 2009 from https://www.futurelabmedicine.org/pdfs/2007%20status%20report%20laboratory_medicine_-_a_national_status_report_from_the_lewin_group_updated_2008-9.pdf

Rodriquez, R. (March, 2006). ASCP president's message. *Pathology Today*, 2.

Rogers, E.M. (2003). *Diffusion of innovations, 5th Edition,* New York, Free Press.

Ross, L. & Collins, L. (2009). A practical approach to master's level clinical laboratory science education. *Clinical Laboratory Science*, 22(3), 146-150.

Roth, E. & Garrott, P. (May, 2011). The evolving new role of laboratory professionals. *CAP Today, 54-56.*

Rycroft-Malone,J, Kitson, A. Harvey, G., McCormack, B. Seers, K., Titchen, A., & Estabrooks, C. (2002). Ingredients for change: Revisiting a conceptual framework. *Quality and Safety in Health Care,* 11, 174-180.

Rycroft-Malone, J. (2004). The PARIHS framework: A framework for guiding the implementation of evidence-based practice. *Journal of Nursing Care Quality*, 19, 297-304.

Rycroft-Malone, J. (2007, July/August). Theory and knowledge translation: Setting some coordinates. *Nursing Research,* 56 (Suppl. 4S), S78-S85.

Santos, J. (1999). Cronbach's Alpha: A tool for assessing the reliability of scales. *Journal of Extension,* 37(2), 1-4.

Scales, D.C. & Adhikari, N.K. (2008). Lost in (knowledge) translation: "All breakthrough, no follow through"? *Critical Care Medicine,* 36(5), 1654-1655.

Smith, J., Cervero, R., & Valentine,T. (2006). Impact of commercial support on continuing pharmacy education. *Journal of Continuing Education in the Health Professions,* 26(4), 302-312.

Spector, P.E. (1992). *Summated rating scale construction an introduction,* London: Sage Publications.

Standards of accredited educational programs for the clinical laboratory scientist. Retrieved May 2, 2008, from http://www.naacls.org/docs/Section2.pdf

Stetler, C. (1994). Refinement of the Stetler/Marram model for application of research findings to practice. *Nursing Outlook,* 42, 15-25.

Stetler, C. (2001). Updating the Stetler model of research utilization to facilitate evidence-based practice. *Nursing Outlook,* 49, 272-278.

Stetler, C. & Marraam, G. (1976). Evaluating research findings for applicability in practice. *Nursing Outlook,* 24, 559-563.

Sudsawad, P. (2007). Knowledge translation: Introduction to models, strategies, and measures (pp.1-39). *The National Center for the Dissemination of Disability Research*, University of Wisconsin-Madison.

Survey Monkey, Retrieved December 12, 2008 from http://www.surveymonkey.com/

Sussman, S., Valente, T. W., Rohrbach, L. A., Skara, S., & Pentz, M.A. (2006). Translation in the health professions. *Evaluation & The Health Professions*, 29, 7-32.

Szulanski, G. (2000). The process of knowledge transfer: A diachronic analysis of stickiness. *Organizational Behavior and Human Decision Processes.* 82, 9-27.

Tetroe, J., (2007) Knowledge translation at the Canadian Institutes of Health Research: A primer. *Focus, A publicaton of the national center for the dissemination of disablility research,* Technical Brief No. 18, 1-8.

Tugwell, P. Santesso, N., O'Connor, A., & Wilson, A. (2007). Knowledge translation for effective consumers. *Physical Therapy,* 87, 1728-1738.

U.S. Food and Drug Administration (February, 2011). Medical device innovation initiative white paper: CDRH innovation initiative. Retrieved May 30, 2011 from http://www.fda.gov/AboutFDA/CentersOffices/CDRH/CDRHInnovation/ucm242067.htm

Valentine, T. (2007). Understanding quantitative research about adult literacy. Retrieved on September 2, 2007 from http://www.ncsall.net/?id=771&pid=470.

The value of laboratory medicine (2008). *Laboratory medicine: A national status report,* Retrieved October 13, 2008 from https://www.futurelabmedicine.org/pdfs/2007%20status%20report%20laboratory_medicine_-_a_national_status_report_from_the_lewin_group_updated_2008-9.pdf

Wensing, M., Bosch, M. & Grol, R. (2008). Developing and selecting interventions for translating knowledge to action. *Canadian Medical Association Journal*, E85-E-88.

World Health Organization (2005). *Bridging the "Know-Do" gap: Meeting on knowledge translation in global health*. Retrieved December 11, 2008 from http://www.who.int/kms/WHO_EIP_KMS_2006_2.pdf

Zwarenstein, M. & Reeves, S. (2006). Knowledge translation and interprofessional collaboration: Where the rubber of evidence-based care hits the road of teamwork. *The Journal of Continuing Education in Health Professions,* 26, 46-54.

APPENDICES

Appendix A

Final Questionnaire

This is notification of informed consent for the research study titled An Assessment of Knowledge Translation Participation in Clinical Laboratory Science. The purpose of this research is to understand the clinical laboratory professional's role in advancing new research within the health care community. Please know that this research activity is being conducted by Anne Ranne, under the supervision of Dr. Ron Cervero, and the results may be published. Your identity will not be associated with your responses in any published format.

Dr. Ron Cervero
College of Education
G 10-Y
Aderhold Hall
110 Carlton Street
Athens, GA 30602
Telephone: 706-542-2221
Fax:706-542-8125
E-mail: rcervero@uga.edu
aranne@uga.edu

As a participant in this study, you will be asked to complete this online survey about your participation in introducing a new test or instrument into your laboratory. Your participation is voluntary. You may refuse to participate or withdraw at any time without penalty,or loss of benefits to which you are otherwise entitled or skip any questions that you feel uncomfortable answering. The online questionnaire should take approximately 15 minutes. There will be no risks or discomforts associated with taking this questionnaire. Your contribution to this research will expand the knowledge of clinical laboratory science practice, and the contribution we can make to improving patient care.

Your responses will be confidential and will not be associated with your name or email address; however a unique number will be assigned to each respondent through the use of a "cookie" that has no meaning outside of the survey website. If necessary, this will allow each respondent to return to an incomplete survey and be taken directly to their initial point of exit. As a courtesy to you, if you have not participated in the introduction of a new test or instrument within the last five years,you may answer "No" to the second question and you will be taken out of the survey.

Please note the following:
Internet communications are insecure and there is a limit to the confidentiality that can be guaranteed due to the technology itself. However, once the completed survey is received by the researcher, standard confidentiality procedures will be followed. Only summary data will be reported. If you prefer, you can print the survey instrument, complete by hand, and then submit a fax or US mail to the address above.

If you have any questions, do not hesitate to contact Anne Ranne, Study Director, at aranne@uga.edu.

Additional questions or problems regarding your rights as a research participant should be addressed to IRB Chairperson, Institutional Review Board, University of Georgia, 612 Boyd Graduate Studies Research Center, Athens, Georgia 30602; Telephone (706) 542-3199; Email Address IRB@uga.edu.

A

Are you willing to complete this questionnaire? Please select yes or no below and click 'next'. If you select yes, you will continue with the survey. If you select no, you will be taken immediately to the last page of the survey. Yes No

*

Think of a new test or instrument that you were recently involved in introducing to your lab. Please give a brief description of the test or instrument in the space below.

Prior to the lab adopting the new test or instrument described in the previous section, from how many sources did you hear about it (select all that apply):

	YES	NO
1. other lab professionals in your lab?	◯	◯
2. lab professionals in other labs?	◯	◯
3. vendor's representative?	◯	◯
4. your supervisor or manager?	◯	◯
5. physicians that would request the test?	◯	◯
6. another department in your organization that would request the test?	◯	◯
7. a professional listserv or web site?	◯	◯
8. a vendor's presentation?	◯	◯
9. a continuing education presentation?	◯	◯
10. a professional journal/magazine?	◯	◯
11. another lab when visiting it?	◯	◯

Before the new test or instrument described earlier was adopted did you:

	YES	NO
12. compare it to a similar test or instrument?	◯	◯
13. evaluate it using lab quality indicators?	◯	◯
14. evaluate it using lab evidence-based practice guidelines?	◯	◯
15. evaluate its durability?	◯	◯
16. compare the test's or instrument's turn-around time parameters to your lab's standard requirements?	◯	◯
17. identify it as meeting your lab's standard of care for your clients?	◯	◯
18. identify that it meets the needs of the practitioners?	◯	◯
19. identify that it meets the lab's long term goals?	◯	◯
20. identify that it is more cost effective to perform the test in-house than sending it out?	◯	◯
21. evaluate the ease of set-up?	◯	◯
22. identify flexibility in adding interpretative text?	◯	◯
23. evaluate the ease of use for the lab professionals?	◯	◯
24. evaluate the new test's or instrument's cost per test with other comparable tests or instruments?	◯	◯

As your lab adopted the new test or instrument did you:

	YES	NO
25. participate in creating a time line in preparation for patient testing?	◯	◯
26. participate in developing a troubleshooting guide?	◯	◯
27. request vendor support during the start-up period?	◯	◯
28. participate in communicating with the vendor?	◯	◯
29. request the vendor's technical representative be on site during the start-up period?	◯	◯
30. attend a training session for the new test or instrument?	◯	◯
31. participate in presenting training sessions for the lab professionals performing the test?	◯	◯
32. participate in presenting in-service classes introducing the new test or instrument to other lab staff (phlebotomists, accessioners...)?	◯	◯
33. write a down-time or back-up procedure?	◯	◯
34. participate in performing a method validation study?	◯	◯

As your lab adopted the new test or instrument did you:

	YES	NO
35. write the testing procedure using the Clinical and Laboratory Standards Institute (CLSI) guidelines?	◯	◯
36. participate in establishing the notification procedure for getting (STAT) test results to the practitioner?	◯	◯
37. participate in developing a workflow design?	◯	◯
38. participate in creating an interpretative narrative to accompany the test results?	◯	◯
39. participate in developing a test algorithm?	◯	◯
40. participate in introducing the new test or instrument to health care practitioners (nurses, physicians, other clients...)?	◯	◯

Since you lab adopted the new test or instrument have you:

	YES	NO
41. communicated with accessioners and phlebotomists on pre-analytical problems associated with the test or instrument?	◯	◯
42. monitored analytical and post-analytical problems related to the new test or instrument?	◯	◯
43. participated in designing solutions to those problems associated with the new test or instrument?	◯	◯
44. participated in establishing competency evaluations for the lab professionals performing the new test or instrument?	◯	◯
45. participated in providing consultation services for healthcare practitioners about the new test or instrument?	◯	◯
46. participated in evaluating the new test or instrument with evidence-based lab guidelines?	◯	◯
47. participated in providing evidence of improved patient care with the new test or instrument?	◯	◯
48. participated in improving the testing efficiency of the new test or instrument since it has been adopted?	◯	◯

Please provide the following background information to help us get a clear picture of the laboratory professionals involved in patient care. All analyses will focus on the responses as an aggregate, and no attempt will be made to identify individuals. Remember your responses to this survey will be confidential.

49. What is the highest degree you have earned:

- ◯ Associate's degree
- ◯ Bachelor degree
- ◯ Master's degree
- ◯ Doctorate
- ◯ Other (please specify)

50. What is your gender?

- ◯ Female
- ◯ Male

51. In what year were you born; e.g., 1955, 1977?

52. What is your race/ethnicity?

53. What certification do you have? (check all that apply)

- ☐ Medical Laboratory Technician (MLT)
- ☐ Medical Technologist (MLS)
- ☐ Specialist Certification (SBB,SM...)
- ☐ Other (please specify)

54. How many years of experience do you have in the clinical laboratory?

55. What is your current job title?

56. Which of the following BEST describes your current job?

- All administrative
- Mostly administrative, some bench work
- Mostly bench work, some administrative
- All bench work

57. Which of the following BEST describes your work setting?

- University hospital laboratory
- VA or other federal facility
- Non-profit hospital laboratory
- For-profit hospital laboratory
- Outpatient clinic laboratory
- Physician's office laboratory
- Commercial/Reference laboratory
- Blood Center
- Other (please specify)

58. If your laboratory is located in a hospital, approximately how many beds are in the hospital?

59. Which of the following best describes the location of your laboratory?

- Rural
- Suburban
- Urban

60. Approximately how many medical laboratory technicians (MLT) work in your laboratory?

61. Approximately how many medical technologists (MT/MLS) work in your laboratory?

62. To which of the following professional organizations do you belong? (check all that apply)

- [ ] American Society for Clinical Laboratory Science
- [ ] American Society for Clinical Pathology
- [ ] American Medical Technologists
- [ ] Clinical Laboratory Management Association
- [ ] No membership affiliation
- [ ] Other (please specify)

APPENDIX B

Brainstorming Session

BRAINSTORMING SESSION

AUGUST 10, 2009

5PM

During the brainstorming session, I would like you to recall a recent event that involved the introduction of a new test, instrument, or an update of an existing test system (not an LIS upgrade). In the space below write down a short summary of the event. On the following pages write down key statements that reflect how you and others were involved in each of the stages listed below. A definition is provided to guide your thinking.

Description of events:

1. Select and introduce new POC instrument for creatinine to be used by Radiology Dept.
2. Introducing a new rapid HIV test for blood borne pathogen exposure.
3. Bringing new automated instrument into the lab.
4. Replacing a manual testing procedure with an automated system.
5. Trained to perform a new test (rapid malaria test)

AWARENESS

Awareness- realize a **need** (either external or internal) to understand how the new testing modality will fit into the context of the workplace. Two sample items are listed below.

---

1. discussed the principles of the new test or instrument with other professional colleagues
2. read test-related reference journal articles
3. vendor presentation/ other POC input
4. called as many POC coordinators as possible
5. looked at test methodologies for lab analyzer & POC instruments
6. how well did they correlate
7. durability
8. how many tests were being done/monthly
9. is there a need for this test
10. put in a request for a new testing instrument
11. determine cost, ease of use
12. does it meet all of our needs
13. group consisted of radiology, laboratory, LIS
14. goal: to meet CDC guidelines
15. researched with occupation health dept.
16. goal: same standard of care at both hospitals
17. needed a faster TAT for potential treatment

18. discussed how new test would improve TAT

19. worked with vendor to learn as much as possible

20. visited many hospitals (similar size) where automation was in place to get unbiased answers

21. shared information with all associates in the accessioning and tech area to subdue any anxieties from something so new and different

22. What can this test modality do that we can't do the traditional way?

23. Will we be able to keep up with repairs and biomedical requirements?

24. become familiar with components of test system

25. compare/contrast with previous methods

26. compare/contrast with similar test methods

27. understanding why changes were made

28. discuss other possibilities to achieving the goal

29. How will this benefit the end user

ACCEPTANCE

Acceptance-is the activity of acquiring and processing of information on the new test or instrument that leads to the recognition of its importance within the clinical lab. Two examples are listed below:

---

1. reviewed the reasons for selection of this new test or instrument
2. evaluated the pros and cons of the new test or instrument
3. practicality of new method
4. What were other alternatives, if any, why was it not selected?
5. How does this new test fit into long term goals?
6. Where does this fit into overall work flow
7. Benefits over previous methodologies
8. How will training affect current work processes?
9. With new equipment, discuss implementation process with other users who have already gone "live"
10. improve TAT
11. ease of use
12. projected improvements for turn around time (TAT)
13. looked at the changes from departmentalization to core lab concept
14. weighed the price of doing these in-house against paying stat courier for each test

15. determined that in-house testing would better meet the standard of care
16. evaluated cost of kits plus loss from expiring kits before being used up
17. most instruments were very similar in cost/lock-out features, etc.
18. only instrument that calculated the GFR which was needed by Radiology

ADOPTION

Adoption-translating the new testing procedures into a format that is easy to understand and is tailored to the workplace. Two sample items are listed below:

---

1. developed a timeline for the set-up of the test or instrument
2. direct communication with the developer of this new test or instrument
3. train the trainer sessions with hands-on training

4. in services on specimen collection
5. trouble shooting
6. develop the procedure manual following standard formatting
7. coordinated with LIS for database work
8. system-wide education of complete 'ECODE' process
9. set up paging system for PSCs and Occupational Health RNs
10. training techs to perform test
11. set-up kits and qc on supply ordering templates
12. set up CAP proficiency testing program
13. report to State that we are now performing rapid HIV testing
14. set-up group training sessions with vendor or supervisor for accessioners & techs

15. encouraged communication between techs and accessioners to assure that we have the best process in place

16. recreated job duties to include new equipment

17. performed studies on automated centrifugation and any effect it might have on any test with a very low sensitivity

18. use test result codes that reflected the results/interpretation

19. look at possibility of equipment provider giving some training

20. are procedures clearly written for all users

21. integrate training into current workflow to minimize delays and interruptions

22. ensure testing instrument, reagents, and tools that are necessary to 'roll out' the new procedure are in place when it is time to implement

23. are backup procedures in place and is everyone trained on them

ADHERENCE

adherence-the active, voluntary, collaborative involvement of all employees and clinicians in a mutually acceptable course of action. Two sample items are listed:

---

1. change the protocol to make it easier for the physician/nurse to understand the results.
2. formed a committee of everyone involved in the new test or instrument (lab personnel, physician, and nurses) to discuss strategies to roll out the new test.
3. Monitor all users to see that everyone is performing test according to written procedure.
4. Is there a need to alter ordering procedures to ensure that customer will get desired results.
5. techs and accessioner worked together to streamline the process and communicate with each other so changes were more benign
6. Competencies were created so everyone could be trained and know what was expected of them.
7. Open mindedness to new challenges and knowledge requirements
8. Invited other departments into the lab so they would understand our new language (i.e. the specimen is on the track) and needs (straight labels are essential).
9. Had to go back and add to many HIS menus so they could order
10. Reverted to downtime orders in many areas due to poor cooperation in HIS ordering/inability to order
11. Re-education on RAVing HVS results

12. initial, 6 months, and 12 months competencies

13. lock-out features for non-compliance of QC or critical value results

14. through some trial and error learned the system and what would it would be like to make changes

15. 24 hour help for assistance for nursing unit and other personnel.

APPENDIX C

Pilot Questionnaire

The University of Georgia
College of Education
School of Leadership and Lifelong Learning
Department of Adult Education

CLINICAL LABORATORY PROFESSIONAL SURVEY

Please take a few minutes to respond to this survey. Your contribution will help expand the knowledge of clinical laboratory science practice, and its contribution to improved patient care.

Section I. Description of an Event

Recall a recent event that involved the introduction of a new laboratory test or instrument that has not been available in your clinical laboratory. In the space below give a brief description of the recalled event you will use to respond to the survey questions. As you remember this event, answer the questions as they reflect your involvement in this new test or instrument.

Section II.

Prior to the adoption of a new test or instrument in your laboratory you realized a need to understand how the new test or instrument will fit into the context of the workplace. Look over the following statements and mark **Yes** or **No** as they apply to you within the recalled event.

Please circle Yes or No

1. Prior to the laboratory adopting the new test or instrument, did you hear about it *from other lab professionals in your lab*?	YES	NO
2. Prior to the laboratory adopting the new test or instrument, did you hear about it *from lab professionals in other labs*?	YES	NO
3. Prior to the laboratory adopting the new test or instrument, did you hear about it *from the company's representative*?	YES	NO
4. Prior to the laboratory adopting the new test/instrument, did you hear about it *from your supervisor or manager?*	Yes	No
5. Prior to the laboratory adopting the new test or instrument, did you hear about it *from the physicians who would be requesting the test?*	YES	NO
6. Prior to the laboratory adopting the new test or instrument, did you hear about it *on a professional listserv or web site?*	YES	NO
7. Prior to the laboratory adopting the new test or instrument, did you hear about it *from other departments that would request the test?*	YES	NO
8. Prior to the laboratory adopting the new test/instrument, did you *attend a vendor presentation about it?*	YES	NO
9. Prior to the laboratory adopting the new test or instrument, did you *attend a continuing education presentation about it?*	YES	NO
10. Prior to the laboratory adopting the new test or instrument, did you *visit other laboratories to see it?*	YES	NO
11. Prior to the laboratory adopting the new test or instrument, did you *read an article about it in a professional journal?*	YES	NO
12. Prior to the laboratory adopting the new test or instrument, did you *compare it to a similar test or instrument?*	YES	NO
13. Prior to the laboratory adopting the new test or instrument, did you *compare it with quality*	YES	NO

indicators established by your lab?		
14. Prior to the laboratory adopting the new test or instrument, did you *evaluate it with evidence-based laboratory practice guidelines?*	YES	NO

Section III.

Before adopting the new test or instrument you had a personal belief that it should be accepted by your clinical laboratory. Look over the following statements and mark **Yes** or **No** as they apply to you within the recalled event.

Please circle Yes or No

15. Before adopting the new test or instrument, did you believe *there was good correlation between it and a similar test or instrument?*	Yes	No
16. Before adopting the new test or instrument, did you believe *there was evidence indicating it would be durable?*	YES	NO
17. Before adopting the new test or instrument, did you believe *it would improve turn-around time?*	YES	NO
18. Before adopting the new test or instrument, did you believe *it would provide the standard of care for your facility?*	YES	NO
19. Before adopting the new test or instrument, did you believe *it would meet the needs of the physicians in your community?*	YES	NO
20. Before adopting the new test or instrument, did you believe *it would be easy to interface with your laboratory information system?*	YES	NO
21. Before adopting the new test or instrument, did you believe *it would meet the laboratory's long term goals?*	YES	NO
22. Before adopting the new test or instrument, did you believe *it would be more cost effective to perform it in-house rather than sending it to a reference lab?*	YES	NO
23. Before adopting the new test or instrument, did you believe *it would be easy to set-up?*	YES	NO
24. Before adopting the new test or instrument, did you believe *the new test or instrument offered flexibility in entering interpretative text within the result field?*	YES	NO
25. Before adopting the new test or instrument, did you believe *it would reduce cost for the laboratory?*	YES	NO

26. Before adopting the new test or instrument, did you believe *enough tests would be requested to avoid throwing out expired reagents before being used?*	YES	NO
27. Before adopting the new test or instrument, did you believe *it offered ease of use for the testing personnel?*	YES	NO

Section IV.

As your laboratory adopted the new test or instrument you played a role in the adoption process. Look over the following statements and mark **Yes** or **No** as they apply to you within the recalled event.

Please circle Yes or No

28. As your laboratory adopted the new test or instrument, did you play a role in *creating a timeline to prepare it for patient testing?*	YES	NO
29. As your laboratory adopted the new test or instrument, did you play a role in *creating a troubleshooting guide for testing personnel?*	YES	NO
30. As your laboratory adopted the new test or instrument, did you play a role in *requesting vendor support during the start-up period?*	YES	NO
31. As your laboratory adopted the new test or instrument, did you play a role in *communicating with the company that developed it?*	YES	NO
32. As your laboratory adopted the new test or instrument, did you play a role in *requesting that the manufacturer's project leader be on the site during the start-up period?*	YES	NO
33. As your laboratory adopted the new test or instrument, did you play a role in *conducting a hands-on training session for the lab testing staff?*	YES	NO
34. As your laboratory adopted the new test or instrument, did you play a role in *conducting in-service classes for the collection and processing of the patient specimens for the new test or instrument?*	YES	NO
35. As your laboratory adopted the new test or instrument, did you play a role in *conducting a system wide in-service program to introduce it to the healthcare practitioners?*	YES	NO
36. As your laboratory adopted the new test or instrument, did you play a role in *creating a written back-up procedure?*	YES	NO
40. As your laboratory adopted the new test or instrument, did you play a role in *conducting a training session on the back-up procedure?*	YES	NO
41. As your laboratory adopted the new test or instrument, did you play a role in *performing a method validation study to measure accuracy and sensitivity?*	YES	NO

42. As your laboratory adopted the new test or instrument, did you play a role in *writing a procedure using the CLSI (Clinical Laboratory Standard Institute) guidelines?*	YES	NO
43. As your laboratory adopted the new test or instrument, did you play a role in *setting up a notification protocol for getting patient's test results to the physician?*	YES	NO
44. As your laboratory adopted the new test or instrument, did you play a role in *developing a workflow design for it?*	YES	NO
45. As your laboratory adopted the new test or instrument, did you play a role in *developing an interpretative narrative to accompany the patient's test result?*	YES	NO
46. As your laboratory adopted the new test or instrument, did you play role in *constructing a test algorithm?*	YES	NO
47. As your laboratory adopted the new test or instrument, did you play a role on *a collaborative, interdepartmental team during the adoption period?*	YES	NO
48. As your laboratory adopted the new test or instrument, did you play a role in *identifying possible barriers in the adoption process?*	YES	NO
49. As your laboratory adopted the new test or instrument, did you play a role in *helping the nursing staff understand how to order the new test?*	YES	NO

Section V.

Since the adoption of the new test or instrument in your laboratory you have been involved in certain activities. Look over the following statements and mark **Yes** or **No** as they apply to you within the recalled event.

Please circle Yes or No

50. Since your laboratory adopted the new test or instrument, have you been involved in *communicating with accessioners and phlebotomists on pre-analytical problems?*	YES	NO
51. Since your laboratory adopted the new test or instrument, have you been involved in *monitoring problems associated with it?*	YES	NO
52. Since your laboratory adopted the new test or instrument, have you been involved in *designing solutions to problems arising from the new test/instrument?*	YES	NO
53. Since your laboratory adopted the new test or instrument, have you been involved in *scheduled competency evaluations for all testing personnel?*	YES	NO
54. Since your laboratory adopted the new test or instrument, have you been involved in *providing re-education session when pre-analytical, analytical, or post-analytical problems arise?*	YES	NO
55. Since your laboratory adopted the new test or instrument, have you been involved in *correlating the new test or instrument with evidence-based laboratory practice guidelines?*	YES	NO
56. Since your laboratory adopted the new test or instrument, have you been participating in *a consultation service to answer questions for the healthcare practitioners*?	YES	NO
57. Since your laboratory adopted the new test or instrument, have you been involved in *making changes in the reporting format to provide ease of understanding for the healthcare practitioners?*	YES	NO
58. Since your laboratory adopted the new test or instrument, have you been involved in *a presentation for the community physicians.*	YES	NO
59. Since your laboratory adopted the new test or instrument, have you been involved in *providing evidence of improved patient care?*	YES	NO
60. Since your laboratory adopted the new test or instrument, have you been participating in *changes to improve testing efficiency?*	YES	NO
61. Since your laboratory adopted the new test or instrument, have you been involved in *working collaboratively with the nursing staff?*	YES	NO
62. Since your laboratory adopted the new test or instrument, have you been involved in *getting input from all the departments involved in it*?	YES	NO

Section VI.

Please provide the following background information to help us understand the role of laboratory professionals in patient care. All analyses will focus on groups, and no attempt will be
made to identify individuals. Remember your responses to this survey will be confidential.

63. The highest degree you have earned:
    - □ Associate degree
    - □ Bachelor's degree
    - □ Master's degree
    - □ Doctoral degree
    - □ Other, please specify _____
64. What is your gender? _____
65. What is your race/ethnicity? _____
66. Certification (mark all that apply):
    - □ Clinical Laboratory Technician, Medical Laboratory Technician
    - □ Clinical Laboratory Scientist, Medical Technologist, or Medical Laboratory Scientist
    - □ Specialist certification (SBB, SM, HM), please specify _____
    - □ Other, please specify _____
67. Years of experience in the clinical laboratory. ____
68. Current job title _____
69. Professional membership:
    - □ American Society of Clinical Laboratory Science
    - □ American Society of Clinical Pathology
    - □ Clinical Laboratory Management Association
    - □ Other, please specify _____
    - □ No membership affiliation

70. Which of the following best describes your work setting? Select the best choice
    - □ University hospital laboratory
    - □ VA or other federal facility
    - □ Non-profit hospital laboratory
    - □ For-profit hospital laboratory
    - □ Outpatient clinic laboratory
    - □ Doctor's office laboratory
    - □ Commercial/Reference laboratory
    - □ Blood center

    Size of hospital:
    - □ Hospital <100 beds
    - □ Hospital 100-250 beds
    - □ Hospital >500 beds

71. Location of your laboratory:
    - □ Rural
    - □ Suburban
    - □ Urban

72. Number of CLT/MLT in your lab:

- □ < 20
- □ 20-50
- □ >50

73. Number of CLS/MLS in your lab:

- □ < 20
- □ 20-50
- □ >50

APPENDIX D

Items Developed from Literature Review

Acceptance Item Pool

Acceptance-is the activity of acquiring and processing new knowledge that leads to the recognition of its importance within clinical practice. Some questionnaire items are listed below with references:

Both communities of practice theory (Wenger, 1998) and social network theory (West, Barron, Dowsett, & Newton, 1999) are concerned with how networks and groups produce, communicate, and transfer knowledge. Rycroft-Malone, J. 2007. Theory and knowledge translation. *Nursing Research,* 56 (4S), S78-S85.

1. I had the support of my supervisor in learning as much as possible about the new test or instrument.
2. I worked collaboratively with other CLSs in discussing the advantages and disadvantages of this test or instrument .
3. The laboratory manager gave me and staff members time to review information on the new test or instrument.

While most research evidence is factual and technical a portion relies on refining professional craftsmanship such as tacit (‘how to’ knowledge).

Professionals combine research results with tacit knowledge and experiential learning, professional training, and socialization.

Scope of practice, uni-disciplinary social & cognitive boundaries led to prioritization of discipline-specific knowledge.

The inclination to 'push' evidence to practice can be met with professional relationships and boundaries when experiential and tacit knowledge conflict with the evidence being pushed. McWilliam, C.L. Kothari, A., Ward-Griffin, C., Forbes, D. and et al. 2009. Evolving the theory and praxis of knowledge translation through social interaction: A social phenomenological study. *Implementation Science,* 4 (26),

4. From my past laboratory experience I did not feel this new test or instrument would meet the needs of our hospital/laboratory.

5. I knew this new test or instrument would be easy to set up in our laboratory.

6. I knew this new test or instrument would be difficult to use by our staff.

7. The new test or instrument will be used as a point-of-care test, and it requires interpretation of test results not possible by non-laboratory personnel using it.

The level to which the participants can make informed autonomous decisions about how they can use the new knowledge to improve outcomes. Kitson, A.L. 208. The need for systems change: reflections on knowledge translation and organizational change. *Journal of Advanced Nursing,* 65(1), 217-228.

8. I discussed the application of this new test or instrument to the healthcare community with the pathologist and/or physician.

9. I made suggestions about application of this new test or instrument based on prior experience or investigation on the subject.

The process of coming to know is embedded in social, cultural, political, and economic relationships that constitute the contexts of research.

The practitioners perceive and address problems in a situated and contextual manner.

Dirkx, J. 2007. Studying the complicated matter of what works: evidence-based research and the problem of practice. *Adult Education Quarterly,* 56(4), 273-290.

10. I reviewed the reasons for selection of this new test or instrument within our healthcare community.

11. I wanted to make sure this new test or instrument will meet the needs of our physicians and patient population.

Learning is a social activity and people learn by practice plus interacting with others. The acceptance of new knowledge is produced by negotiations with each other in the work environment. It takes time as the group solves problems. Estabrooks, C.A.. Thompson, D.S., Lovely, J.E. & Hofmeyer, A. 2006. A guide to knowledge translation theory. *The Journal of Continuing Education in the Health Professions.* 26, 25-36.

12. I discussed the advantages and disadvantages of the new test or instrument with the staff.

13. I made sure we had done a thorough evaluation of the new test or instrument.

Knowledge translation may be difficult if there is no agreement about the expected outcomes.

Relationship or linkage is a key concept in the interactive model of knowledge translation.

If the change from the knowledge translation is perceived to be politically unfeasible then the user groups will not be engaged.

User group is more likely to use the new knowledge if they perceive that it is relevant to the current environment.

Jacobson, N.; Butterill, D., & Goering, P. 2003. Development of a framework for knowledge translation: understanding user context. *Journal of Health Service Research Policy,* 8(2), 94-99.

A model of cognitive and behavioral steps taken when physicians comply with practice guidelines. They first become **aware** of the guidelines, then intellectually **agree** with them, then decide to **adopt** them, and then regularly **adhere** to them. Pathman, D.E., Konrad, T.R., Freed, G.L., Freeman, V.S., & Koch, G. 1996. The awareness-to-adherence model of the steps to clinical guideline compliance: The case of pediatric vaccine recommendations. *Medical Care,* 34(9), 873-889.

14. I agreed with the use of the new test or instrument.

15. I did not agree with using the new test or instrument.

16. I had strong feelings about this new test or instrument.

17. My supervisor or manager did not listen to my concerns.

18. I had suggestions about how the new test or instrument should be set up.

9. My suggestions were not acknowledged.

20. I feel the laboratory administration receives direction from upper administration on which tests are selected.

21. I found journal articles that support my concerns about the test or instrument.

22. I did not evaluate the appropriateness of the test for our laboratory.

23. I was strongly supportive of the new tests.

24. I evaluated the pros and cons of the new test or instrument to reach my own acceptance of it.

25. I did not have to accept the new test or instrument because I just did whatever the laboratory manager or supervisor wanted me to do.

26. The laboratory manager or supervisor listened to my suggestions and concerns.

Awareness Item Pool

Awareness- the healthcare professional realizes a **need** (either external or internal) to understand how new knowledge will fit into the context of the workplace. It may occur because of cognitive dissonance. Some questionnaire items are listed below with references:

One's knowledge base 'colors' all incoming information, because this information is enriched by and interpreted with the help of the exiting knowledge. Information must align with the user's mental model. Increase awareness of the differences between the developer (researcher) and the user (MT). Tabachneck-Schijf, J.J.M. & Geene, P.L. 2009. Preventing knowledge transfer errors: Probabilistic decision support systems through the user's eyes. *International Journal of Approximate Reasoning,* 50, 461-471.

1. The user's manual that describes the new test or instrument was unclear.
2. I had no prior knowledge about this new test or instrument.
3. There were no journal articles or educational material available to provide some background information of this new test or instrument.
4. The developer of the new test or instrument did not provide a training session.
5. The training sessions for the new test or instrument were very helpful.

The way in which participants in the system understand the nature and characteristics of the new knowledge. Kitson, A.L. 208. The need for systems change: reflections on

knowledge translation and organizational change. *Journal of Advanced Nursing,* 65(1), 217-228.

6. The laboratory manager and supervisor made sure I understood the nature and characteristics of the new test or instrument.

The interaction of the practitioner with others plus the institutional demands can the practitioner construct the knowledge to address the problem. Dirkx, J. 2007. Studying the complicated matter of what works: evidence-based research and the problem of practice. *Adult Education Quarterly,* 56(4), 273-290.

7. I discussed the principles of the new test or instrument with other professional colleagues to understand if it would meet our laboratory's needs.

A model of cognitive and behavioral steps taken when physicians comply with practice guidelines. They first become **aware** of the guidelines, then intellectually **agree** with them, then decide to **adopt** them, and then regularly **adhere** to them. Pathman, D.E., Konrad, T.R., Freed, G.L., Freeman, V.S., & Koch, G. 1996.
The awareness-to-adherence model of the steps to clinical guideline compliance: The case of pediatric vaccine recommendations. *Medical Care,* 34(9), 873-889.

8. I participated in listserv discussions or internet chat groups to get current information on the new test or instrument.

9. I had not read or heard anything about the new test or instrument before it was purchased.

10. I had heard about the new test or instrument before it was purchased.

---

11. I am notified of a new test being added to our department by my supervisor prior to the purchase of the reagents and/or instrument.

12. A meeting was scheduled to introduce the new test and/or instrument prior to arrival.

13. Test-related reference journal articles were available for me to read.

14. I was not aware of the new test or instrument until it arrived.

15. I was asked to give my opinion about the new test or instrument (pros and cons).

16. I was not asked my opinion.

17. I identified the reason for the introduction of a new test or instrument.

Knowledge is a product of human reflection and experience. Dependent on context, knowledge is a resource that is always located in an individual or a collective, or embedded in a routine or process. There are three distinct types of knowledge: human, social, and structured. DeLone, D.W. & Fahey, L. 2000. *Academy of Management Executive,* 14(4), 113-127.

18. I was given some background information on the new test or instrument that helped me understand why it was selected.

Adherence Item Pool

Adherence- the active, voluntary, collaborative involvement of relevant stakeholders in a mutually acceptable course of action. Some questionnaire items are listed below with references:

"Learning environment in which the integration of findings from scientific endeavors can be natural and straightforward." Lyons, J.S. Feb. 2009. Knowledge Creation through Total Clinical Outcomes Management: A Practice-based Evidence Solution to Address some of the Challenges of Knowledge Translation. *J. Can. Acad. Child Adolesc. Psychiatry.* 18 (1), 38-45.

1. I suggested changes to the new test or instrument to meet the needs of our patient population.

2. I suggested changes to the new test or instrument to make it easier for the physician to understand the results.

Shared responsibility and accountability for knowledge translation integration outcomes is challenging to achievement-oriented researchers and organizational decision-makers committed to evidence-base practice, and to practitioners pursuing what they know intuitively and tacitly. McWilliam, C.L. Kothari, A., Ward-Griffin, C., Forbes, D. and et al. 2009. Evolving the theory and praxis of knowledge translation through social interaction: A social phenomenological study. *Implementation Science,* 4 (26), 1-37.

3. I felt laboratory administration pressured me to get the new test or instrument set up and working by administration.

4. Laboratory administration was committed to a successful integration of the new test or instrument.

5. I was not considered part of the decision-making process team in the integration of this new test or instrument.

6. I felt we needed to review the clinical guidelines before making a final decision about the new test or instrument.

7. I was asked to be a part of the integration team in making the decision to release the new test or instrument.

The successful introduction of new knowledge into any system is a function of the level of local autonomy experienced by individuals, teams, and the unit involved in the change. Key stakeholders in personal development, control of immediate physical resources and context Kitson, A.L. 208. The need for systems change: reflections on knowledge translation and organizational change. *Journal of Advanced Nursing,* 65(1), 217-228.

8. All departments impacted by the new instrument or test were involved in the integration process.

Integration of new knowledge is a complex issue that requires skilled facilitation of staff interaction with the new application or test and their experiences. Duncan, C., Langlais, S. Danyluk-Hall, J. and Simonson, K. 2008. Knowledge translation: Empowering health professionals to take the lead. *Journal of Continuing Education in the Health Professions.* 28(4): 282-283.

9. I used my past laboratory experience and constant communication with the staff to integrate this new test or instrument into our workflow.

10. My past laboratory experience helped in the integration of the new test or instrument.

Even with acceptable evidence and some facilitation, neither the high or low providers changed practice. The nature, focus and duration of facilitation can produce successful implementation even with poor contextual conditions. If there was high evidence, and context, the role of facilitator was the key to implementation. The facilitator must be a member of the team and supportive of the change to be successful. It is not clear what elements of the core dimensions are strongest in creating the right conditions for implementation (evidence, context, and facilitation). Kitson, A., Harvey, G., and McCormack, B. 1998. Enabling the implementation of evidence based practice: A conceptual framework. *Quality in Health Care,* 7, 149-158.

11. I facilitated the integration of the new test or instrument by providing current evidence and contextual support to the laboratory staff and other healthcare professionals.

A model of cognitive and behavioral steps taken when physicians comply with practice guidelines. They first become **aware** of the guidelines, then intellectually **agree** with them, then decide to **adopt** them, and then regularly **adhere** to them. Pathman, D.E., Konrad, T.R., Freed, G.L., Freeman, V.S., & Koch, G. 1996.
The awareness-to-adherence model of the steps to clinical guideline compliance: The case of pediatric vaccine recommendations. *Medical Care,* 34(9), 873-889.

12. I did not follow the manufacturer's procedural directions when using the new test or instrument because it would be confusing to the staff.

13. I changed some steps in the manufacturer's procedure because it would be a more efficient testing schema.

---

14. I had worked collaboratively with the nursing units and physicians at our institution to integrate this new test or instrument.

15. I was not involved in the integration of a new test or instrument.

16. I prepared a presentation on this new test or instrument for the medical advisory committee or physicians interested in this new test.

17. I reviewed the problems encountered after the new test or instrument is available.

18. I provided a troubleshooting guide to aid in a smooth integration of this new test or instrument.

19. I evaluated the integration of the new test at intervals during the year.

20. I am actively involved in working with physicians and nurses who are receiving test results from the new test or instrument.

21. I provided the staff training for this new test or instrument.

22. I provided training for the nursing units.

23. I prepared the test information for the nursing unit.

24. The other hospital departments and physicians were not involved in the integration of the new test or instrument.

25. The other hospital departments and physicians were involved in the integration of the new test or instrument.

Adoption Item Pool

Adoption-translating new knowledge into a format that is easy to understand and is tailored to the workplace. Some questionnaire items are listed below with references:

Social and cognitive boundaries between health professionals impeded the adoption of the research.

Resistance to uptake was particularly strong where professional roles and identities were strong and social distance between disciplines were great.

Trans-disciplinarity is increasingly deemed important in knowledge production where the knowledge is to be co-constructed and applied in interdisciplinary service delivery and care.

Important to mobilize the professional workforce to actively implement, monitor the implementation, and provide leadership. Group interaction, teamwork, and collaboration help to facilitate the implementation as well as inter-organizational collaboration.

McWilliam, C.L. Kothari, A., Ward-Griffin, C., Forbes, D. and et al. 2009.

Evolving the theory and praxis of knowledge translation through social interaction: A social phenomenological study. *Implementation Science,* 4 (26),

1. Even though our laboratory was selected as a 'beta site' for this new test or instrument I did not feel we had sufficient input into the process.

2. The support of the company in the adoption of this new test or instrument in our laboratory was excellent.

3. I had direct communication with the developer of this new test or instrument when I had questions.

4. The project leaders from the company came to discuss the adoption of this new test or instrument to the staff.

5. I found it difficult to get in touch with the company's implementation team.

6. The medical director of the laboratory was very supportive of the adoption of this new test or instrument.

7. The physicians pushed for the adoption of this new test or instrument even though we knew they did not understand the significance of the test results.

8. Because this new test or instrument was to be used as a point-of-care test I involved the nursing department in the initial adoption phase.

9. I did not involve the nursing department in the initial adoption phase even though it would be a point-of-care test.

Adoption of new knowledge is contingent upon learning styles and culture, levels of autonomy and support and new ways of defining boundaries around power, groups, communication and action.

Adoption: How they negotiate and renegotiate relations with others (individuals, teams, internal, external relations) in their system. Kitson, A.L. 208. The need for systems change: reflections on knowledge translation and organizational change. *Journal of Advanced Nursing,* 65(1), 217-228.

A model of cognitive and behavioral steps taken when physicians comply with practice guidelines. They first become **aware** of the guidelines, then intellectually **agree** with them, then decide to **adopt** them, and then regularly **adhere** to them. Pathman, D.E., Konrad, T.R., Freed, G.L., Freeman, V.S., & Koch, G. 1996. The awareness-to-adherence model of the steps to clinical guideline compliance: The case of pediatric vaccine recommendations. *Medical Care,* 34(9), 873-889.

10. I consistently used the new test or instrument instead of selecting an older test that was available.

11. I did not feel comfortable using the new test or instrument.

---

12. I was asked to develop a timeline to get the test or instrument ready for use.

13. I was asked to coordinate a team to get the instrument ready for use.

14. I was assigned to do just the initial set up of the new test or instrument.

15. I only participated in the quality control and evaluation of the new test or instrument.

16. I wanted to be more involved in the aspects that need to be considered in adopting the new test or instrument such as; turn-around time studies, cost per test, workflow, and the test result format.

17. I did not feel involved in the adoption of the new test or instrument.

18. I saw barriers that interfered with the adoption of the new test or instrument.

19. I felt my department did not investigate the external factors affecting the successful use of the new test or instrument.

20. I knew this test would be difficult to adopt in our laboratory.

21. I did have the opportunity to receive input from the physicians that will be using the test results on their expectations.

22. I did discuss obstacles the nursing units may face in the adoption of this new test when considering patient preparation, collection, and body fluid requirements.

23. I can reject a new test or procedure if I feel it does not meet our laboratory standards.

APPENDIX E

Initial Request for Participation

University of Georgia
College of Education

May 5, 2010

Dear Clinical Laboratory Professional:

I am an assistant professor in the Department of Biomedical & Radiological Technologies at the Medical College of Georgia, and a doctoral student in the Adult Education Program at the University of Georgia. My research is under the direction of Dr. Ron Cervero, Assistant Dean of the College of Education. We are currently involved in an exciting research study about the clinical laboratory professional's involvement in introducing a new test or instrument into the laboratory. In the challenging field of clinical laboratory science, it is important for us to reflect on the part we play in advancing healthcare. We are aware that we provide vital information used to improve patient care. Precision and accuracy are central in the performance of our practice. With the advent of personalized medicine, testing will become more specialized, and the clinical laboratory professional will be critical in providing these tests.

To understand the clinical laboratory professional's role in the translation of new tests or instruments into practical use, this study will evaluate our current level of participation in this process. The selection of the test or instrument includes research into the best test methodology plus method evaluation of the tests, but these are just a few steps in the complex developmental process. Your participation in this study will provide invaluable assessment into the professional's level of activity in implementation of the new test or instrument. You have been identified as a person who strongly supports the profession and wants to be instrumental in the improvement of patient care.

Your contribution to this research will expand the knowledge of clinical laboratory science practice, and the contribution we can make to improve patient care. Your participation in this questionnaire is voluntary, and the answers will be completely confidential. It will take approximately 20 minutes to complete the questionnaire. There are no right or wrong responses. The results of this study will be published in one of our professional journals. Thank you for your consideration.

Sincerely yours,

Appendix F

Implied Consent Statement

This is notification of informed consent for the research study titled An Assessment of Knowledge Translation Participation in Clinical Laboratory Science. The purpose of this research is to understand the clinical laboratory professional's role in advancing new research within the healthcare community. Please know that this research activity is being conducted by the individual listed below, under the supervision of Dr. Ron Cervero, and the results may be published. Your identity will not be associated with your responses in any published format.

Dr. Ron Cervero
COLLEGE OF EDUCATION
G4-5 ADERHOLD HALL
110 CARLTON STREET
University of Georgia
ATHENS, GEORGIA 30602
Telephone: **706-542-2221**
Fax: **706-542-0360**
E-mail: rcervero@uga.edu
aranne@uga.edu
aranne@mcg.edu

As a participant in this study, you will be asked to complete this online survey about your participation in introducing a new test or instrument into your laboratory. Your participation is voluntary. You may refuse to participate or withdraw at any time without penalty or loss of benefits to which you are otherwise entitled, or skip any questions that you feel uncomfortable answering. The online questionnaire should take approximately 20 minutes. There will be no risks or discomforts associated with taking this questionnaire. Your contribution to this research will expand the knowledge of clinical laboratory science practice, and the contribution we can make to improving patient care.

Your responses will be confidential and will not be associated with your name or email address; however a unique number will be assigned to each respondent through the use of a computer program that has no meaning outside of the survey website. If necessary, this will allow each respondent to return to an incomplete survey and be taken directly to the point of exit. You also have the right to decide not to complete the questionnaire at any time. If you want to opt out of the survey at the end it will be possible.

Please note the following:

Internet communications are insecure and there is a limit to the confidentiality that can be guaranteed due to the technology itself. However, once the completed survey is received by the researcher, standard confidentiality procedures will be followed. Only summary data will be reported. If you prefer, you can open a pdf version of the survey instrument located at xxxxxxxxx, complete by hand, and then submit a fax or US mail to the address above.

If you have any questions, do not hesitate to contact Anne Ranne, Study Director, at aranne@uga.edu.

Additional questions or problems regarding your rights as a research participant should be addressed to IRB Chairperson, Institutional Review Board, University of Georgia, 612 Boyd Graduate Studies Research Center, Athens, Georgia 30602; Telephone (706) 542-3199; Email Address IRB@uga.edu.

Are you willing to complete this questionnaire? Please select yes or no below and click 'next'. If you select yes, you will continue with the survey. If you select no, you will be taken

immediately to the end of the survey.

O Yes
O No

NEXT

Appendix G

Follow-up Letters

Dear:
The New Year brings many new projects and unfinished jobs from the previous year. I know as a clinical laboratory professional this time of the year offers many new challenges, so work can be very busy and demanding. I recognize the value of your time. I just wanted to send a reminder concerning the survey sent to your email address on January 26, 2011. Your input is essential to the success of this research. Without your input the research findings will be severely limited.
As a professional I know you are interested in advancing our profession in the future. To get a complete picture of our participation in introducing a new test or instrument into the laboratory and the physician's practice, I need your input. The survey consists of 60 questions. It will only take 15 minutes of your time and it is easy to complete on the internet. Your participation is voluntary and your responses will be confidential. No individual data will be used, only summary data will be reported by the research website to me. Your input is valuable to this study and I appreciate your consideration.
To complete the survey just follow the link for online completion. The link is uniquely tied to your email address; do not forward the message to other individuals.
With appreciation,
Anne Ranne, MS, MT
Clinical Laboratory Science Program
Medical College of Georgia

Additional questions or problems regarding your rights as a research participant should be addressed to IRB Chairperson, Institutional Review Board, University of Georgia, 612 Boyd Graduate Studies Research Center, Athens, Georgia 30602; Telephone (706) 542-3199; Email Address IRB@uga.edu.

Dear
It has been documented that 70% of the diagnostic information available to the physician comes from our laboratories. We are a valuable asset to the healthcare community and with the advanced testing being developed for future diagnostic use our valuable skills will be very important.
I also know your time is very valuable between work and family, but I would appreciate your help. A survey was sent to you on January 26, 2011 because your input is vital to our profession. The only way to view our future challenges as a profession is to assess our current participation in moving new testing to daily diagnostic use.
I am currently conducting a research study about the clinical laboratory professional's participation in the implementation of new testing within the laboratory and getting the test results to the practitioner. As laboratory professionals, we are now looking at improvements in the pre- and post-analytical areas because they impact the test results we provide to the physician. The results will be an assessment of our participation in all phases of the clinical laboratory's role in providing accurate and safe patient data. Your input is valuable to this study.
The survey consists of 60 questions. It will only take 15 minutes of your time and it is easy to complete on the internet. Your participation is voluntary and your responses will be confidential. No individual data will be used, only summary data will be reported by the research website to me. Your input is valuable to this study and I appreciate your consideration.
To complete the survey just follow the link for online completion. The link is uniquely tied to your email address; do not forward the message to other individuals.
With appreciation

Anne Ranne, MS, MT
Clinical Laboratory Science Program
Medical College of Georgia

Additional questions or problems regarding your rights as a research participant should be addressed to IRB Chairperson, Institutional Review Board, University of Georgia, 612 Boyd Graduate Studies Research Center, Athens, Georgia 30602; Telephone (706) 542-3199; Email Address IRB@uga.edu.

Appendix H

Revised Request for Participation

Dear Colleague,

In a recent *Labs Are Vital* survey, laboratory professionals expressed the view that other health care providers do not perceive us as equal partners. They want more internal support and external validation including help communicating the lab's value to other health care professionals. These are challenges facing the young laboratory professionals as they enter our profession. I know you share my desire to help advance our profession and that is why I am inviting you to participate in a research project that will identify some ways to raise awareness of our value to health care.

Currently, I am an assistant professor in the CLS program at the Medical College of Georgia as well as a doctoral student in the Adult Education program at the University of Georgia. The purpose of my research is to examine the ways laboratory professionals participate in the introduction of a new test or instrument in their organization. We are certainly aware of the vital information we provide the physicians, but we play a "behind-the-scenes" role compared to the collaborative role other health care professionals have in patient care. My research will hopefully add further understanding of our role in this collaboration.

You have been identified as a person who strongly supports the profession and wants to be instrumental in our future role in health care, so your input is invaluable. Your contribution to this research will be completing an on-line survey. It is completely voluntary and I personally guarantee the confidentiality of your responses. As a laboratory professional, I understand your time is valuable. You can complete the survey in approximately 15 minutes. The link to the Survey Monkey and my survey is listed below. It will contain further instructions.

Survey link:

This link is uniquely tied to this survey and your email address, so please do not forward this email to others. If you have not had any experience in the introduction of a new test or instrument within the last five years, you may answer the second question with a "No", and it will take you to the end of the survey. Thank you for your participation in this research. A cumulative report of the survey will be published in one of our professional journals.

Sincerely yours,

Anne Ranne, MS, MT
Assistant Professor
Medical College of Georgia

Appendix I

Code Books

CODE BOOK FOR QUESTIONNAIRE

CODE	QUESTION	RESPONSE	TYPE of QUES.
CQ1 CQ2	1&2	Yes=1 No=2	Willing to complete survey?/Have participated in KT in last 5 yrs.
AW1-AW11	1-11	Yes=1 No or missing=2	Awareness
AC12-AC24	12-24	Yes=1 No or missing=2	Acceptance
AD25-AD40	25-40	Yes=1 No or missing=2	Adoption
ADH41-ADH48	41-48	Yes=1 No or missing=2	Adherence
HD49	49	Associate =1 Bachelor=2 Master's=3 Doctorate=4 Other=5 a. post baccalaureate b. clinical mgt cert.	Highest Degree
GEN50	50	Female=1 Male=2	Gender
AGE51	51	numerical	Age of participant
RACE52	52	White/Cacuasian=1 African American=2 Filipino=3 Hispanic=4 Asian=5 American Indian 6	Ethnicity
CERT53	53	MLS/MT=1 MLT=2 Spec. Cert=3 Other=4	Certification
EXP54	54	numerical	Years of experience

CODE	QUESTION	RESPONSE	TYPE of QUES.
TITLE55	55	Lab Director=1 Manager=2 Supervisor=3 Sr. Tech=4 Bench Tech=5 MLS 1=6 Clinical Coord/Tech Spec.=7 Generalist=8 MLS 2=9 MLS 3=10 MLS 4 =15 Design Cons.=11 POC Coordinator=12 PhD/MD=13 Lecturer=13 Educator/faculty=13 Program Director=13 Sr. Research Scientist=14 QA Coordinator=16 Retired=17 Sales=18 Unemployed=19 LIS Developer=20 Operations Mgt=21	Current job title
JOB56	56	All admin=1 Mostly adm/some bench=2 Most bench/some adm=3 All bench=4	Description of current job
SET57	57	Univ. hosp. lab=1 VA or other Fed. Facility=2 Non-profit=3 For-profit=4 OP Clinic=5 Physician's Office=6 Commercial/Ref. lab=7 Blood Center=8 College/univ.=9 Commercial Co.=10 Professional Org=11 Community Health Center=12 Other=13	Work Setting

CODE	QUESTION	RESPONSE	TYPE of QUES.
BED58	58	numerical	#beds
LOC59	59	Rural=1 Suburban=2 Urban=3	Location of lab
#MLT60	60	numerical	# of MLTs
#MT61	61	numerical	#MTs
ASCLS62	62	ASCLS=1	Membership in:
ASCP62	62	ASCP=2	
AMT62	62	AMT=3	
CLMA62	62	CLMA=4	
NO62	62	NO=5	
OTHER62	62	Other:10 AABB AACC ASM AGT	

Appendix J

Listing of New Tests

We recently purchased the ThermoBrite instrument from Abbott Molecular, Inc. for fluorescence in situ hybridization analysis.

Blood in fecal specimens is a good indicator of many things depending on the patient population the specimen is coming from. We recently introduced the FIT test for blood detection in a stool sample in our laboratory. This uses a biomarker specific for human hemoglobin. The instrument uses a small vial of liquid which has a small baton of stool placed inside and mixed. The instrument samples from this small vial of mixed stool specimen and places it into a cuvette. Then the biomarker is added and we are looking for agglutination using a spectoscope in the instrument.

I Stat, the rest of our analyzers are nine years old, Vitro 250, ECI , Amax destiny plus, but the I Stat is the only thing that is new in our lab, which can do a lot.

PCR testing for hepatitis profiles

Sysmex Hematology Analyzer

SEBIA Electrophoresis/HYDRASYS Immunofixation

Siemens Centaur-Immunoassays, Hepatitis profile

STAGO Coagulation Analyzer

FISH Test

Centaur XP-Troponin

GenProbe for Chlamydia

Troponins

Coulter LH 780

Switched from Coulter hematology analyzer to Sysmex instrument

N/A

An i-STAT POC instrument was introduced for cardiac troponin I testing. Patient plasma is used for testing and the assay takes about 10 minutes.

Mayo Ref Lab Interface

Beckman DX C 600 and Access instruments

Dade xpand: chol, hdl, trig, gluc, lipase, amylase, AST, ALT, ALP, T. bil, Creat, BUN, TSH, Ferr, Electrolytes,CA. with all the crossovers, calibrations, and learning a new instrument is what FUN!

I work in acedemia, therefore am not involved in new tests or instrumentation within a clinical lab.

Micro Scan Walk away

I recently helped introduce a vitamin D assay within my laboratory. This test was a send out test and was costing us a substantial amount of money. We decided to bring it in house and utilize the LC/MS/MS system that we already have in place.

none

4 years ago I assisted with the installation and validation of a BC DXC 600, BC LH 500 and Stago Compact.

Abbott - i1000 We needed to perform anti-rejection drugs for our transplant program that had a reportable range on the lower end that met the surgeon's needs.

AutoScan

Provue blood bank analyzer

No recent activity in this area.

automated blood bank instrument-immucor ECHO

I am not currently involved in clinical medical technology. I am working in industry and in the medical software industry.

We did just get new chem analyzers from Beckman. DXC600 and DXI, I think. I don't work chem all that often. The advantages are supposed to be cap-piercing and putting general chem and immunoassay on the same machine. I was not personally involved in the decision making process or validation protocols.

We changed to a newer model of our Cardiac enzyme analyzer. It is used in our lab only to quantitate troponin although it has other tests available. The original instrument had been in place for about 4.5 years. The analyzer was bought out by a new large company and supplies that ran on the old model were no longer available to me in the US.

Criterion urinalysis analyzer

I had our students start using a Cell Dyn instrument.

I am an educator and do not work in a testing laboratory

I bought an Abbott I-Stat to teach my MLT students about electrolytes and point of care testing.

No new instruments have been introduced within the past year or more. We have introduced a couple of new tests added to an instrument in-house already. We also added group and types to be performed for the administration of Rh Immune Globulin to patients on site instead of sending this test to the main campus.

I recently implemented HbA1c testing in POC.

Siemans Vista 1500
Architect i1000 Immunoassay analyzer

The Stago Compac made by Diagnostica Stago company. instrument performs testing for common coagulation tests like PT and PTT. When the instrument was introduced we also included the addition of a new test - heparin anti-Xa

Beckman Coulter LH500 Hematology analyzer Hematology analyzer that runs WBC, RBC, and Platelet parameters. It has closed or open tube methods. Can count reticulocytes although my site didn't use that feature.

Cobas Integra 400 chemistry analyzer Given a visual display of main functions of an operator from everything like on/off to simple maintenance. Brief overview of functions the machine is capable of and when and how to notify tech support. Of course how to run patient samples, QC, and calibrations, and precision.

Beckman Coulter ACL TOP 500 coagulation instrument

Ortho Gel Card System- alternative to tube method of ABO/Rh identification

I am a bench technologist and we do not introduce new tests into the laboratory. We have a hematology and a chemistry technical specialist and generally are the ones that work up new tests and introduce them to the laboratory. I have had the opportunity to look at 2 chemistry analyzers. Our hospital will be building a new ER department and will be purchasing new instruments. The goal is to have all chemistry analyzers be the same by 2012 and we are currently very unhappy with the ones we have now.

Installation of new chemistry/immunochemistry instrument

Architect i2000 Immunoassay Analyzer

Plavix testing

The Special Hematology laboratory was preparing to switch from using reusable glass hemacytometers to disposable plastic hemacytometers. They collected paired sample cell count data. I helped them with statistical analysis (paired t-test). We showed there was no statistical difference between the two types of hemacytometers.

Ferritins, done on our Alfa Wasserman ACE Alera

I am no longer working in a laboratory. I am currently teaching at the MLT level. We recently

acquired a new POCT hemoglobin analyzer.

PERTUSSIS/PARAPERTUSSIS BY PCR WAS IMPLEMENTED ON OUR SMARTCYCLER THIS YEAR. THIS IS AN ASR TEST THAT WAS VALIDATED FOR TESTING IN OUR LAB.

Rapid Influenza A and B.

Biosite Triage Cardiac Markers

Updated Vitek for microbiology identification and sensitivites

new model cell washer

EnGen- a front end automation system that receives the samples, centrifuges, aliquots, decaps, delivers to the analyzer for testing, recaps, tracks and stores.

The Tango is an instrument that performs Blood Bank work; type, screen, panel, crossmatch, antigen ID.

Meridian illumigene for cdiff pcr.

I recently purchased and installed a new hematology analyzer, the Sysmex 1000i and the Pochi 100i.

I am an instructor in an MLT program, and not working in a POL or hospital lab at this time.

I have not been involved in any recent test/instrument introductions.

Four Atlas auto urinalysis instruments to replace manual urine chemistry strip readers.

In helping to teach the AST by bench top analyser (Humastar) to faculty in a developing country, it was important to teach in a step-wise process to include daily start-up maintenance, calibration, quality control and then patient testing and reporting.

Third generation CCP 3.1 igG/IgA method validation using the Dynex DSX. We compared to our reference method, CCP IgG.

LC-MS/MS for the determination of methylmalonic acid, 25-OH vitamin D2/D3, benzodiazepine confirmation panel, opiate confirmation panel, amiodarone, 5-hydroxyindole acetic acid, and tricyclic antidepressant panel.

Echo analyzer for immunohematology tests

We recently installed a new automation line for our processing area. We changed over our vendors and needed to validate our systems in order to connect onto the testing analyzers and still maintain accurate processing.

MDA 180 Coagulation Instrument

I suggested the used of gel technology in our classroom blood bank setting-I am in education

We brought up a Tosoh AIA 360 to do troponins.

We recently acquired a DiaSorin Liaison for the testing of Vitamin D on a reagent rental agreement.

When we went automated in the blood bank, we chose to go with th Ortho ProVue. When it came time to bring it into the lab, volunteers were asked from each shift to go to Rochestor, NY for training. I got to be the lead midnight shift tech for the instrument.

APPENDIX K

Ranking of Knowledge Translation Activities

Rank Order of Knowledge Translation Activities

Rank	Item	Component	Item Language	Percentage
1	23	Acceptance	Evaluate the ease of use for the lab professionals	86.1
2	19	Acceptance	Identify that it meets the lab's long term goals	85.3
3	18	Acceptance	Identify that it meets the needs of the practitioner	85.0
4	12	Acceptance	Compare it to a similar test or instrument	83.7
5	21	Acceptance	Evaluate the ease of set-up	81.7
6	17	Acceptance	Identify it as meeting your lab's standard of care	80.6
7	16	Acceptance	Compare the test's or instrument's turn-around time parameters to your lab's standard requirements	80.2
8.5	13	Acceptance	Evaluate it using lab quality indicators	80.0
8.5	3	Awareness	Hear about it from vendor's representative	80.0
9	28	Adoption	Participate in communicating with vendor	78.1
10	27	Adoption	Request vendor support during the start-up period	77.7
11.5	34	Adoption	Participate in performing a method validation study	77.5
11.5	42	Adherence	Monitored analytical and post-analytical problems related to the new test or instrument	77.5
12	24	Acceptance	Evaluate the new test's or instrument's cost per test with other comparable tests or instruments	77.4
13	43	Adherence	Participated in designing solutions to those problems associated with the new test or instrument	71.1
14	20	Acceptance	Identify that it is more cost effective to perform the test in-house than sending it out	70.9
15	31	Adoption	Participate in presenting training sessions for the lab professionals performing the test	70.4
16	44	Adherence	Participated in establishing competency evaluations for the lab	67.8

Rank	Item	Component	Item Language	Percentage
			professionals performing the new test or instrument	
17	2	Awareness	Hear about it from lab professionals in other labs	67.6
18	14	Acceptance	Evaluate it using lab evidence-based practice guidelines	67.4
19	30	Adoption	Attend a training session for the new test or instrument	67.2
20	25	Adoption	Participate in creating a time line in preparation for patient testing	65.3
21	29	Adoption	Request the vendor's technical representative be on site during the start-up period	64.3
22	35	Adoption	Write the testing procedure using the Clinical Laboratory Standards Institute (CLSI) guidelines	63.2
23	8	Awareness	Hear about it from a vendor's presentation	62.9
24	37	Adoption	Participate in developing a workflow design	60.6
25	15	Acceptance	Evaluate its durability	60.1
26	48	Adherence	Participated in improving the testing efficiency of the new test or instrument since it has been adopted	58.5
27	4	Awareness	Hear about it from your supervisor or manager	58.3
28	41	Adherence	Communicated with accessioners and phlebotomists on pre-analytical problems associated with the new test or instrument	57.3
29	26	Adoption	Participate in developing a troubleshooting guide	55.9
30	46	Adherence	Participated in evaluating the new test or instrument with evidence-based lab guidelines	54.3
31	1	Awareness	Hear about it from other lab professionals in your lab	52.6
32	10	Awareness	A professional journal/magazine	48.3
33	47	Adherence	Participated in providing evidence of improved patient care with the new test or instrument	48.1
34	33	Adoption	Write a down-time or back-up procedure	47.9
35	32	Adoption	Participating in presenting in-service classes introducing the new test or	47.4

Rank	Item	Component	Item Language	Percentage
			instrument to other lab staff	
36	36	Adoption	Participate in establishing the notification procedure for getting (STAT) test results to the practitioner	45.7
37	40	Adoption	Participate in introducing the new test or instrument to healthcare practitioners	45.5
38	22	Acceptance	Identify flexibility in adding interpretative text	45.3
39	38	Adoption	Participate in creating an interpretative narrative to accompany the test results	44.5
40	11	Awareness	Hear about it by visiting another lab	38.3
41	45	Adherence	Participated in providing consultation services for healthcare practitioners about the new test or instrument	37.2
42	9	Awareness	Hear about it in a continuing education presentation	33.6
43.5	11	Awareness	Hear about it from a professional listserv or website	30.6
43.5	39	Adoption	Participate in developing a test algorithm	30.6
44	5	Awareness	Hear about it from practitioners who would request the test	29.1
45	6	Awareness	Hear about it from another department in your organization	15.7

APPENDIX L

IRB Documents

IRB Approval - Cervero and Ranne

KIMBERLY C Fowler

Sent: Monday, May 03, 2010 3:55 PM
To: Ronald M Cervero
Cc: Anne BRACEWELL Ranne

PROJECT NUMBER: 2010-10755-0
TITLE OF STUDY: An Assessment of Knowledge Translation Participation in Clinical Laboratory Science
PRINCIPAL INVESTIGATOR: Dr. Ronald M. Cervero

Dear Dr. Cervero and Ms. Ranne,

The University of Georgia Institutional Review Board (IRB) has reviewed and approved your above-titled proposal through the exempt (administrative) review procedure authorized by 45 CFR 46.101(b)(2) - Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, /unless:/(i). the information obtained is recorded in such a manner that human participants can be identified, directly or through identifiers linked to the participants; /and/(ii). any disclosure of the human participants' responses outside the research could reasonably place the participants at risk of criminal or civil liability or be damaging to the participants' financial standing, employability, or reputation.

You may now begin your study. Your approval packet will be sent by mail.

Please remember that no change in this research proposal can be initiated without prior review. Any adverse events or unanticipated problems must be reported to the IRB immediately. The principal investigator is also responsible for maintaining all applicable protocol records (regardless of media type) for at least three (3) years after completion of the study (i.e., copy of approved protocol, raw data, amendments, correspondence, and other pertinent documents). You are requested to notify the Human Subjects Office if your study is completed or terminated.

Good luck with your study, and please feel free to contact us if you have any questions. Please use the IRB number and title in all communications regarding this study.

Thank you,

Kim Fowler, CIP
Human Subjects Office
627A Boyd Graduate Studies Research Center
University of Georgia
Athens, GA 30602-7411
kfowler@uga.edu
Telephone: 706-542-5318
Fax: 706-542-3360
https://www.ovpr.uga.edu/compliance/hso/

IRB Approval - Amendment - Cervero
KIMBERLY C Fowler
Sent: Friday, August 20, 2010 2:19 PM
To: Ronald M Cervero
Cc: Anne BRACEWELL Ranne

PROJECT NUMBER: 2010-10755-1
TITLE OF STUDY: An Assessment of Knowledge Translation Participation in Clinical Laboratory Science
PRINCIPAL INVESTIGATOR: Dr. Ronald M. Cervero

Dear Dr. Cervero,

The University of Georgia Institutional Review Board (IRB) has reviewed and approved your request for modifications to the above-titled human subjects proposal. It was determined that the amendment request continues to meet the criteria for exempt (administrative) review procedures.

Your approval packet will be sent via campus mail. Please remember that any changes to this research proposal can only be initiated after review and approval by the IRB (except when necessary to eliminate apparent immediate hazards to the research participant). Any adverse events or unanticipated problems must be reported to the IRB immediately. The principal investigator is also responsible for maintaining all applicable protocol records (regardless of media type) for at least three (3) years after completion of the study (i.e., copy of approved protocol, raw data, amendments, correspondence, and other pertinent documents). You are requested to notify the Human Subjects Office if your study is completed or terminated.

Good luck with your study, and please feel free to contact us if you have any questions. Please use the IRB number and title in all communications regarding this study.

Regards,

Kim Fowler, CIP
Human Subjects Office
627A Boyd Graduate Studies Research Center
University of Georgia
Athens, GA 30602-7411
kfowler@uga.edu
Telephone: 706-542-5318
Fax: 706-542-3360
https://www.ovpr.uga.edu/compliance/hso/

Reply Reply All Forward Chat

IRB Approval - Amendment - Cervero

KIMBERLY C Fowler

Sent: Friday, January 07, 2011 12:41 PM
To: Ronald M Cervero
Cc: Anne BRACEWELL Ranne

PROJECT NUMBER: 2010-10755-2
TITLE OF STUDY: An Assessment of Knowledge Translation Participation in Clinical Laboratory Science
PRINCIPAL INVESTIGATOR: Dr. Ronald M. Cervero

Dear Dr. Cervero,

The University of Georgia Institutional Review Board (IRB) has reviewed and approved your request for modifications to the above-titled human subjects proposal. It was determined that the amendment request continues to meet the criteria for exempt (administrative) review procedures.

Your approval packet will be sent via campus mail. Please remember that any changes to this research proposal can only be initiated after review and approval by the IRB (except when necessary to eliminate apparent immediate hazards to the research participant). Any adverse events or unanticipated problems must be reported to the IRB immediately. The principal investigator is also responsible for maintaining all applicable protocol records (regardless of media type) for at least three (3) years after completion of the study (i.e., copy of approved protocol, raw data, amendments, correspondence, and other pertinent documents). You are requested to notify the Human Subjects Office if your study is completed or terminated.

Memorandum

To: Dr. Ron Cervero
Dr. Tom Valentine
Dr. Laura Bierema
Dr. Barbara Russell

From: Anne Ranne

Date:

Re: Update on Research since Prospectus Meeting

Since the prospectus meeting April 22, 2010, I have been working to refine the questionnaire. I would like to update you on the progress of this work. The questionnaire (Appendix A) submitted as part of the prospectus had the IRB committee's approval, but it was decided at the prospectus meeting that it needed further work before it could be ready. I have made changes to the questionnaire with the assistance of an expert panel and several meetings with Drs. Cervero and Valentine. I received approval for these changes by submitting another IRB review.

I will discuss the results of the pilot survey and additional adjustments that need to be made based on the results. I will also discuss a tentative timeline for the completion of the research.

I would appreciate your review of the changes. If you have any questions, concerns, and suggestions please contact me through my email at aranne@mcg.edu or by telephone at (404) 433-4410. I look forward to receiving your feedback. According to Dr. Cervero if we do not hear from you by January 14, we will proceed with sending out the formal questionnaire.

The memorandum will address the following items:

- Instrument Development
- Statistical Analysis of Pilot Surveys
- Tentative Research Timeline

Instrument Development

To help you understand the development of this research study since our last meeting, I have included the constructs with their definitions that represent the framework of the study and the questionnaire (Appendix B).

As Dr. Valentine and I met with an expert panel of adult education graduate students on June 15, 2010, we discussed mainly the structure of the questionnaire. Since the work environment of the clinical laboratory professional was not familiar to most of the participants, it was difficult to get substantial suggestions. The panel made several recommendations for structural changes. The format was changed to make it easier for the participants to read the statements and select a response. It was also suggested to be consistent in using certain terms to avoid confusion or redirection of the statement. The main discussion was on the scale. Several members of the panel felt the scale should be Likert-like instead of dichotomous (Yes or No). With the type of questions we were asking Dr. Valentine, Dr. Cervero and I felt it would be difficult to change the scale. Another focus of discussion was on the negative aspects of awareness, acceptance, adoption, and adherence. There were no questions assessing how the respondents felt about the new test or instrument. What if the survey respondents did not like the instrument or test? How would that affect the acceptance, adoption, and adherence of

the participant? Dr. Valentine felt that research question would have to be included in future studies.

After the expert panel, I met with Dr. Valentine and made the changes to improve the structural framework of the questionnaire based on the suggestions from the expert panel. I have attached the pilot survey that was sent out through Survey Monkey (Appendix C). After the Human Subjects Office approved it, I used random sampling to select 100 respondents taken from a professional organization's mailing list. Since I only had a 25% response rate, it was decided to send out 300 additional surveys. On September 18th I sent out 298 introductory letters using the random sampling method. The response rate to the survey is listed below.

The calculated response rate from the two pilot survey mailings was 16%. It was a low response rate, and we knew additional work needed to be done to improve the responses. A more persuasive introductory letter may get a higher response rate. Appendix D is the new introductory letter. The second and third letters were also reviewed to make sure the respondents understand how important their participation as professionals will be to this research. I also contacted the American Society of Clinical Laboratory Science (ASCLS) office to get their response rates, since we are using their mailing list. ASCLS's response rate usually is no higher than 10% on an electronic survey. We will be sending out surveys to their 5000 members, so a low response rate will still provide enough data for statistical analysis, although the low rate will not allow for any generalizability.

In reviewing the responses it was obvious that we had some retirees, college instructors, and commercial vendor sales representatives answering the survey. A

screener question had not been placed in the pilot survey. It was decided that we would have to put a screener question into the final survey to get an accurate response to the questions based on actual clinical experience that had occurred in the last 5 years. The retirees may not have had recent laboratory experience. The college instructors sometimes do not have any hands-on experience and the sales representatives may have no experience in the clinical laboratory, so their responses might be based on how they want or expect the laboratory professionals to respond to the survey. They do not have experience in day-to-day activities in the clinical laboratory. To avoid screening out individuals that have had actual new test or instrument experience we carefully worded the screener questions so as not to discourage respondents who could add to the conversation. The following screener question will be added to the survey:

This survey will ask about how you participated in the introduction of a new test or instrument in your laboratory. Have you participated in the last five years with introducing a new test or instrument in a clinical laboratory? Yes No

---

If they answer "No" to the statement, Survey Monkey will automatically take them to the last page that has a "thank you for your time" statement. A "Yes" answer will take them to the survey. By using the screener question it may eliminate partial responses by those specific respondents who start the survey and then realize they cannot or do not want to answer the questions.

Statistical Analysis of Pilot Survey Responses

Using SPSS Dr. Valentine and I reviewed the survey data (Appendix E). The first descriptive statistically analysis described reasonable distribution. The second analysis was a measurement of reliability. We took each construct (awareness, acceptance, adoption, and adherence) and used mean, standard deviation, and Cronbach's alpha to evaluate the data. All the constructs demonstrated even distribution or variance. The internal reliability or inter-correlation of the constructs was measured by Cronbach's alpha. The only construct that did not score high on reliability was awareness. Because the internal reliability score is low for awareness it may be necessary to look at the constructs as additive indexes. One reason for the low internal reliability was the fact that several statements were included to determine if the respondents got their information from outside sources such as continuing education programs or other healthcare professionals. These sources had the higher percentage of "No" responses. Another reason for the low score may be the wording of the question. The survey asks "how did you hear about it". This statement may have limited the responses because the respondent may have interpreted the statement as "when was the first time you heard about the test or instrument". To avoid this interpretation we would like to reword the statement. "Prior to the lab adopting the new test or instrument described in the previous section, from how many sources did you hear about it (select all that apply)?"

1. other lab professionals in your lab?
2. lab professionals in other labs?
3. vendor's representative?
4. your supervisor or manager?

5. physicians that would order the test?

6. another department in your organization that would request the test?

7. a professional listserv or web site?

8. a vendor's presentation?

9. a continuing education program?

10. a professional journal/magazine?

11. when visiting another lab?

If this change does not increase the internal reliability of the awareness construct, the constructs will be identified as additive indexes.

Tentative Research Timeline

Upon acceptance from the dissertation committee and approval from IRB, a formal survey will be sent out to appropriately 5,000 ASCLS members by the end of January. We will use Survey Monkey for the distribution of the survey. An introductory letter will be sent out directing the members to the survey. Two weeks later a reminder letter will be emailed to the participants and a week after that a final request will go out. A projected return on the survey will occur in six weeks. Statistical analysis will be conducted and the final chapters will be written. By the end of March the final dissertation will be sent to you. I would hope to have the dissertation defense by the middle of April. If we cannot meet this timeline, it will be completed by the end of summer semester.

	Pilot Survey I	Pilot Survey II
Introductory Letter	August 30th	September 18th
Second Letter	Sept. 13	Sept. 30
Final Letter	Sept. 22	Oct. 7
# Randomly Selected	100	298
# No Response	76	217
# Complete Response	16	50
# Partial Response	9	31
# Bounced	7	9
# Opted Out	--	6