2013-05-13

Use of a needs assessment tool for the development of research curriculum for postgraduate medical education trainees in King Faisal Specialist Hospital and Research Centre (KFSH&RC)

Alhaider, Sami

UNIVERSITY OF CALGARY

Use of a needs assessment tool for the development of research curriculum for postgraduate medical education trainees in King Faisal Specialist Hospital and Research Centre (KFSH&RC)

by

Sami Alhaider

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE

DEGREE OF MASTER OF SCIENCE

DEPARTMENT OF MEDICAL SCIENCE

CALGARY, ALBERTA

April, 2013

ABSTRACT

Objective: To conduct a needs assessment for a research curriculum development by assessing perceptions of postgraduate trainees and educators toward research training in King Faisal Specialist Hospital & Research Centre (KFSH&RC).

Methods: Two questionnaires (one for trainees and the other for educators) were employed. A total of 70 trainees (residents and fellows) out of 117 participated, for a response rate of 59.8%. Fifty two percent of participants were females. The majority of trainees ranged in age between 26-30 years (54%). There were more residents than fellows (58% vs. 42%). Nearly half of the responding trainees graduated from King Saud University (KSU) in Riyadh, Saudi Arabia (41.5%). The responding trainees had different levels of training which was found to be relatively equally representative of each training-year in the program. The majority of responding trainees belong to medical programs (68.7%). The remainder of trainees belongs to surgical (11.9%), laboratory (4.5%), and other (14.9%) programs (Pathology: 6%, Radiology: 4.5%, Dentistry: 3%, Pharmacology: 1.5%). A total of 40 educators (program directors, deputy program directors, consultants involved in training programs and consultants with research interest) responded to the questionnaire, out of 70 educators contacted, for a response rate of 57%. The majority of the responding educators were males (72.5%) and with age below 50years (36-40yrs: 20%, 41-50yrs: 52.5%). More than half of educators defined their role as program directors (52.5%) with the remaining as educators (30%), and researchers (5%). Fifty eight percent of educators belong to pure medical specialties (57.5%) and the rest from surgery (25%), and others (10%) while the rest are unknown (7.5%).

Results: Trainees and educators shared similar perceptions about the role of research. Most trainees reported that they have no research productivity during their training (93% never applied for research grants, 74% never had presentations or scientific publication). Most

educators (75%) reported ongoing research projects in their departments. Most participants (trainees and educators) agreed that current strategies are not sufficient to address research training (66% and 78%), KFSH&RC represent rich environment for research training (76% and 70%), lack of protected time represent a barrier for research training (85% and 70%), hands-on research projects to be part of the proposed curriculum, and to be part of graduation requirements (69, 60% and 90, 73%). The two top priorities in research curriculum were skills in the scientific writing and critical appraisal. Between groups comparisons among trainees showed young trainees to have higher number of publications, attending larger number of educational lectures, and larger proportion reporting availability of mentorship in research training compared to older trainees. Trainees from surgical disciplines reported higher rate of lack of mentorship and higher rate of lack of interest in research training compared to other disciplines.

Between group comparisons among educators showed that younger educators compared to older ones had slightly less belief that research activity will enhance their academic career, and had slightly less belief that research activity will enhance their future career. Younger educators also reported lack of skills as a barrier of research training compared to older educators. Compared to trainees educators had higher scores in the following items: research training increases clinical investigator, lack of interest as a barrier to research training, and methodology as an important component of the proposed research curriculum. By contrast trainees had higher scores in the following two areas: research training will compromise medical expert competency, and lack of protected time and lack of research questions as barriers to research training.

Conclusions: The collected perceptions of trainees and educators represent the needs assessment step for research curriculum development in KFSH&RC.

ACKNOWLEDGMENT

This project would not have been possible without the support of many people. The author wishes to express his gratitude to his supervisor, Prof. Claudio Violato who was abundantly helpful and offered invaluable assistance, support and guidance. Deepest gratitude are also due to the members of the supervisory committee, Dr. Harish Amin, Dr. Tyrone Donnon, and Dr. Tanya Beran and the program administrator without their assistance this study would not have been successful.

Special thanks also to all his graduate friends.

The author wishes to express his love and gratitude to his beloved family; for their understanding & endless love, through the duration of his studies.

TABLE OF CONTENT

ABSTRACT…….……..…….....ii

ACKNOWLEDGMENTS……..…….....iv

TABLE OF CONTENT……..……..……...v

LIST OF TABLES……..…….….….viii

CHAPTER ONE: INTRODUCTION…….……..……...1

Research training in the new era of competency based medical education.....……1

Needs assessment of PGME programs……..…….....1

Research training in Saudi Arabia……..……2

Statement of the Problem……..…….3

CHAPTER TWO: LITERATURE REVIEW……..……..5

Research curriculum……..…….5

Needs assessment……..…….....15

Needs assessment in postgraduate medical education……17

Needs assessment for research curriculum development…….....20

Systemic review of resident research curriculum…….22

Research focus……..……23

Research questions……..…….24

CHAPTER THREE: METHODS…….……..…….....25

Participants…….……..…….…….....25

Summaries of trainee participants……...……..25

Summaries of educator participants…….....27

Survey design…….…….….…….....28

Procedure…….…….....…….29

Data Analysis…….…….……..…...…30

Ethical approval…….…….…….....31

CHAPTER FOUR: RESULTS…….……..……..…...32

Descriptive statistics of trainees' survey……..…….…….……...….....32

Trainee questionnaire: Attitude towards the role of research training….....36

Trainee questionnaire: Productivity…….…….…….37

Trainee questionnaire: Current efforts…….…….…..…...37

Trainee questionnaire: Available resources in KFSH&RC….…….…….……38

Trainee questionnaire: Barriers to research training……...……..…….38

Trainee questionnaire: Perceived needs for new training curriculum……...39

Descriptive statistics of educators' survey……..…….…….……...….....40

Educator questionnaire: Attitude towards the role of research in PGME

programs..…….....43

Educator questionnaire: Current research involvement & productivity…….....44

Educator questionnaire: Existing strategies, resources, and support to

enhance research training in KFSH&RC……...…….....…...44

Educator questionnaire: Barriers to research training…….……..46

Educator questionnaire: Perceived needs for new research training

Curriculum……...46

Between groups differences……...…….…….……...….....47

Sex differences……..……...47

Group differences among trainee respondents by sex, age, and discipline

characteristics……..…….48

Group differences among educator respondents by sex, age, role and Discipline characteristics……..……..52

Group differences between trainees and educators…….....53

Factor Analyses and Reliability ……...……57

Qualitative analysis……..…….…….....63

Trainee questionnaire: Suggestions for curriculum development…….....63

Educator questionnaire: Suggestions for curriculum development……..65

CHAPTER FIVE: DISCUSSION…….....68

What are the perceived needs, from this study to be considered for the development of research curriculum?.....…….68

The benefits of "Research curriculum" implementation…….....71

Barriers to research training during PGME…….....73

Limitations of the present study……...74

Implications for future research……..…….74

Conclusion…….……...75

REFERENCES……...……..76

Appendix-A

Postgraduate programs offered in KFSH&RC…..……...……81

Appendix-B

Trainee questionnaire form…….……..…….……82

Appendix-C

Educator questionnaire form.…….……90

LIST OF TABLES

Table-2.1 Classifications of learning needs.....18

Table-2.2 Tools which can used in needs assessment.....18

Table-3.1 Summaries of trainee respondents.....26

Table-3.2 Summaries of educator respondents.....27

Table-4.1 Descriptive statistics of trainees' survey - Likert scale items.....32

Table-4.2 Descriptive statistics of trainees' survey - categorical items.....34

Table-4.3 Descriptive statistics of educators' survey - Likert scale items.....40

Table-4.4 Descriptive statistics of educators' survey-categorical items.....42

Table-4.5 A cross tabulation of sex by role of respondent.....48

Table-4.6 Group difference: trainee mean scores by sex.....49

Table-4.7 Group difference: trainee mean scores by age category.....50

Table-4.8 Group difference: trainee mean scores by discipline.....51

Table-4.9 Group difference: Educator mean scores by age category.....52

Table-4.10 Descriptive statistics of combined (trainees and
educators similar items) survey.... 54

Table-4.11 : Group difference: trainees vs educators mean scores.....56

Table-4.12: Trainees data-set Principal Component Orthogonally
Rotated Varimax Factor Matrix to the Normalized Kaiser Criterion.....59

Table-4.13: Educators data-set Principal Component Orthogonally
Rotated Varimax Factor Matrix to the Normalized Kaiser Criterion.....61

CHAPTER 1

INTRODUCTION

1.1 Research training in the new era of competency based medical education

Until relatively recently, the overriding focus of the postgraduate medical education programs (PGME) in any specialty or subspecialty was to ensure training "medical experts". However, doctor competencies have become an increasing focus of medical education at all levels across the globe.[1] Many models of competencies have been proposed with the central competencies are related to patient care, with an emphasis on the importance of basic skills in critical appraisal of the literature required to provide evidence-based care.[2] Competency in research skills has been well recognized as one of the key competencies needed to be considered in any PGME program.[3-4] For example the *Royal College of Physician and Surgeon of Canada* (RCPSC), within the scholar competency, requires that physicians "demonstrate a lifelong commitment to reflective learning, as well as the creation, dissemination, application and translation of medical knowledge." [4] Residents' research lead to better clinical care, correlates with the pursuit of academic careers, increases numbers of clinician investigators, and is an asset to those applying for fellowships.[5-8] In recognition of the importance of research in the ongoing care of patients, many PGME regulatory bodies recommend research curricula for their trainees. The aim should be to equip PGME trainees with the skills necessary to evaluate and use medical literature competently, and to gain a basic knowledge of scientific methods, research design fundamentals, core statistical principles, and the means to conduct literature reviews.[9]

1.2 Needs assessment of PGME programs

Curriculum development requires a needs assessment. It is a process by which curriculum developers identify the differences between the ideal and the actual characteristics of the targeted learner group and between the ideal and the actual characteristics of their

environment.[10] According to the Kern et al. approach for curriculum design in medical education, “needs assessment” is the initial and most important phase.[10] This involves two steps: 1) problem identification, and 2) general needs assessment followed by needs assessment of the targeted learners. These are critical steps before setting up goals and specific measurable objectives and then choosing the appropriate educational strategy. According to a systematic review of published resident research curricula, 11 out of 41 articles (27%) documented needs assessments step in their curriculum development. The methods employed included holding planning sessions attended by educators and researchers, literature reviews, and surveying residents about their interests and skills.[11]

1.3 Research training in Saudi Arabia

In Saudi Arabia, despite the advances in the tertiary care and medical education, there is a general sense that research activity in general, and research training in particular, are far below expectations. King Faisal specialist Hospital and Research Centre (KFSH&RC) is an 894-bed multi-facility, multi-entity tertiary care hospital and one of the leading healthcare institutions in the Kingdom of Saudi Arabia. The mission of KFSH&RC is to provide medical services of highly specialized nature and promote medical research and education programs, including postgraduate education training, as well as contribute to the prevention of disease. KFSH&RC provides advanced education and training to health care professionals in a multidisciplinary academic environment and endeavors to bring forward the finest in hospital leadership and staff through dynamic educational programs. Academic and Training Affairs in KFFSH&RC administers structured residency training programs in 18 various specialties and 53 subspecialty fellowship programs (see appendix-A).[12] The programs enroll sponsored residents and accommodate trainees from other programs for specific rotations. Over the last 25 years, Academic and Training Affairs graduated 273 residents from 17 residency training programs. The fellowship programs have graduated 369 fellows,

and many of them now are in leading positions in health care, academic medicine, and clinical research. In addition to that, as its name implies KFSH&RC is a well recognized research institute.

In Saudi Arabia there is a growing concern with regard to utilization of the available high-standard health care system to promote and facilitate research skills acquisition by the PGME trainees. The Saudi Commission for Health Specialities (SCFHS) is a national commission that regulate PGME for both residency and fellowship programs including the accreditation process for the involved training centres in Saudi Arabia. Though SCFHS general objectives include promoting medical research and publication, however currently no mandatory strategies have been implemented in any of its PGME programs.[13] This resulted in individual PGME programs variation in their strategies addressing research training.

Implementation of a "research curriculum" for PGME trainees at KFSH&RC may result not only in improving competency achievement for the future physicians in Saudi Arabia, but also may provide a solution for the ongoing national needs in medical research which are still far below expectations and will provide a role model that can be adopted in other national centres.

1.4 Statement of the Problem

Competency in research skills is recognised as an integral part of PGME programs. However, many programs still lack structured educational activity directed to research training. Implementation of a research curriculum represents a key solution to ensure that scholar competency related to research skills is effectively delivered to PGME candidates. As for any curriculum development, a needs assessment phase is needed in order to define the specific goals and objectives and then to choose the appropriate educational strategy for the curriculum.

The main purpose of the present thesis was to conduct a needs assessment step which can help educators and other stakeholders to develop a research curriculum applied for PGME in KFSH&RC. The general goal of this needs assessment is to understand the environment of research training in KFSH&RC. More specific objectives will focus on perception of PGME trainees, program directors, educators and researchers in KFSH&RC toward research training aspects which include their attitude towards the role of research training, current productivity, current efforts implemented in their programs to enhance research training, available resources, barriers, perceived needs, and their suggestions to improve research training in KFSH&RC. Due to the heterogeneity in the PGME programs at KFSH&RC it will be interesting to examine perception differences among different disciplines (medical, surgical, laboratories, and others). The analyses can be done to examine perception differences between trainees and educators. Impact of training level (residency or fellowship), experience (year of training), and demographic characteristics (sex, age, medical school, etc) will also be assessed.

In the present thesis, the literature review in Chapter II provides a comprehensive overview of the reported PGME research curricula and examples of needs assessment approaches in curriculum development. This overview establishes a context and framework for the interpretation of the research data and subsequent studies. Chapter III contains a description of the methods employed in this study. The results of the study are described in Chapter IV and are summarized in tables. A discussion of the results and how they relate to the literature is presented in Chapter V. In this chapter, the findings are summarized, limitations of the study are identified, and implications for the intervention and further research are explored.

CHAPTER 2

LITERATURE REVIEW

2.1 Research curriculum

A study from the University of Alberta described a process of research curriculum development for pediatric residents.[14] The process started with the formation of Resident Research Subcommittee (RRS) under the residency training committee which was responsible for defining curricular objectives, structure and implementation. The objectives were driven from the RCPSC "Objectives of Training and specialty Training requirements in Pediatrics". The aim was to address competencies related maintaining a questioning and inquisitive attitude toward medical information that will lead to appreciation of the necessity for ongoing research and enhance contribution to develop new knowledge. A needs assessment phase was conducted by interviewing faculty members and residents, chief residents, and participants of residents'/fellows' research competition. The needs assessment phase focused on factors thought to influence resident involvement in research. Barriers listed included a lack of "protected" research time, a lack of individual interest or skill, and a lack of adequate faculty mentorship. Positive factors which were listed to enhance research involvement of residents included protected research time, a formal research program, access to biostatisticians and seminars addressing research methodology, and adequate funding support conference attendance. The research curriculum was then developed consisting from three main components: resident research projects, supportive training environment, and accessible research funding. Curriculum evaluation was based on assessment of the short-term difference in pre-curriculum and post-curriculum resident research productivity, as measured by the proportion of residents with at least one conference presentation, manuscript publication, or grant. The curriculum was fully implemented which resulted in all residents assigned research mentors and initiated their individual research projects before the second

year of training. All residents have scheduled up to 12 weeks of cumulative protected research time during their first 3 years of training. This resulted in increasing the proportion of residents who had at least one conference presentation, manuscript publication, and internal or external research grant 2 years after curriculum initiation, however none of these observation were statistically significant.[14]

Another Canadian pediatric residency program implemented a 4 week course to teach research skills to first-year residents.[2] The goal was to meet the training needs in order to meet standards set by RCPSC and American Board of Pediatrics (APB). The main objective was to teach residents how to design a realistic project that could be completed in the available time frame during the training program. The first 2 weeks of the course involves didactic sessions on basic research topics (e.g. literature searches, critical appraisal, research question development, study design, statistics, and ethics). During this period the residents perform and submit a critically appraised topic which includes research question formulation and development of research proposal. During the third week each resident present and discuss their research on multiple occasions starting with other residents and course faculty followed by discussion with clinical investigators and members of research ethics board. The final week of the course is focused on developing teaching skills as it was recognised by course developers as an important aspect of the scholar role. The authors reported that their curriculum resulted in a marked increase in the number of successful research projects completed by their pediatric residents. The report was lacking for a well defined objective assessment of the curriculum outcomes.

Few reports have focused on research curricula implemented in emergency medicine residency programs. Brautigan, in 1984 reported the outline of a residency research curriculum that was implemented within the time frame of residency program at Mount Carmel Mercy Hospital.[15] Four objectives were set to enhance residents competencies in

research critical appraisal, research project design and conduct, active participation in research projects, research paper writing and publication. The curriculum was designed to be covered in 36 hours of instructional time over a 3-year residency curriculum. The initial sessions were covered early in the residency and were concerned with the critical evaluation of research. The reminder of the didactic material was taught as the resident acquires practical research experience. These were conducted in a research committee format to guide the residents through the design, implementation, analysis, and presentation of their work. The author reported that in the first year of implementing this curriculum, four out of five residents have completed research projects under faculty supervision with one project accepted for presentation at an international congress. The author did not report how the curriculum was designed and whether a need assessment step has been undertaken.

Jones *et al* in 1987 described a research curriculum designed to operate within a community-based emergency medicine residency program.[16] The purpose of this curriculum was that on the completion of the residency program the resident will be able to critically evaluate medical literature and independently design a research project. They have identified a detailed set of educational objectives in research techniques that were divided into three parts: learn by studying (didactics & reading), learn by criticizing (critical appraisal), and learn by doing (research project design & conduct). Curriculum components included conference topics, journal clubs, and research projects. The report contained detailed description on how to create a research enhancing environment with specific focus on topics related to: faculty involvement, time allocation, evaluation, funding, and meeting time of research. The curriculum was evaluated by residents using standardised evaluation form and research productivity over 5 years. The majority of residents believed that the curriculum content and knowledge transition were useful. The authors reported that the number of resident publications in their institution has doubled over the 5 years of implementation of

this curriculum. There was also a noticeable improvement in quality content of the research products.

A survey study was conducted in order to determine how pediatric emergency medicine fellowship directors organize research training and to identify factors believed to be associated with successful research training.[17] The survey showed that trainee spend a mean of 10.9 research months during a 3-year program, however 93% of theses months were not protected time. Only 5 out of 39 responded programs provided some completely protected research months, and none of these were scheduled in blocks of greater than 3 consecutive months. Most of these research months were scheduled during the third year of training. The survey identified that the most likely explanation of the fellow successfully becoming research competent were eagerness to apply self and number of research months during training. Least likely explanations were faculty with peer reviewed funded grants and blocks of research time. The authors concluded that providing protected research months to fellows and arranging more opportunities for faculty members to serve as research mentors may maintain or possibly improve the likelihood of fellows to becoming research competent. The survey did not address issues related to research training content (e.g. presence of research curriculum) or evaluation of training outcomes.

Ruiz *et al* in 2001 reported their experience with the implementation of a comprehensive 3-year internal medicine residency research curriculum.[18] The curriculum was developed and implemented by a residency research committee which has assigned a chief resident for research and a faculty research director to coordinate and oversee all resident research activities. There was no description of the process of curriculum development and whether a needs assessment phase have been performed. The curriculum has three phases distributed over the first 3 years of training: preparatory (first year of training: selection of mentor, research project), investigatory (second year of training: proposal submission, and data

collection) and synthesis (third year of training: data analysis writing manuscript). Didactic teaching was given in the first year through seminar series in the first year which covers topics related to: methodology, statistics, research design, and manuscript writing. Monthly research forum was implemented for residents to present their work and receive meaningful feedback. In addition to that residents were required to submit an abstract and present a poster of their work at the annual departmental research day where awards were given to best research.

The authors compared research outcomes in their centre after 2 years of curriculum implementation with outcomes of the preceding year. They found that there is an increase in the absolute number of research scholarly products. By the second year of the curriculum, all 28 graduating residents had participated in some aspect of the curriculum. The number of peer-reviewed publications and presentations at national meetings doubled, and the number of presentations at regional meetings quadrupled. More residents had at least 1 type of peer-reviewed publication (32% vs 7%, $p < 0.05$) and at least 1 presentation at a national meeting (29% vs 4%, $p < 0.05$) compared with residents graduating before the research curriculum was started. The limitation to these observations is that the author did not track factors that may be associated with research productivity e.g. previous research experience, self motivation and US Medical Licensing Examination scores.

Kohlwes *et al* in 2006 reported their 4 years experience with the Primary Medical Education (PRIME) program.[19] The PRIME program is an internal medicine track that is nested within the University of California, San Francisco (UCSF) categorical medicine program. PRIME residents rotate every 3 months throughout the year in 2 teams. For 6 months each year, PRIME residents perform the typical inpatient duties of an internal medicine house officer. While on outpatient block, the typical weekly PRIME schedule is a mix of 3 half days of primary care clinics, 3 to 4 half days of subspecialty elective clinics, 2

half days of didactic time, and 1-2 half days of research time. PRIME curriculum utilizes didactic, frequent journal clubs, work-in-progress sessions, and active mentoring. Implementation of PRIME showed that among 32 residents in 4 years, 22 residents have produced 20 papers in peer-reviewed journals, 1 paper under review, and 2 book chapters. Of note, that clinical evaluation of these residents were equivalent to other UCSF medicine residents. The successful implementation of PRIME suggests that similar programs can be adapted at many academic teaching programs by combining the skills and energy of dedicated clinician educators and clinician investigators into a productive partnership. Among the limitation observed in this study was that there was no comparison group for research productivity. In addition to that the study did not look to factors associated with research productivity e.g. resident self motivation, resident prior skills, and efficacy of mentorship.

Madariaga *et al* in 2006 described a novel educational approach to develop research skills among infectious disease fellows.[20] Five infectious disease fellows and two faculty members participated in a collaborative research project as a vehicle for active, problem-based learning. The group was meeting for one hour weekly for one year to facilitate achieving the objectives of the project. Nine objectives were set: attributes of a good research question, skills of efficient Medline search and critical appraisal, research methodology, error and bias of measurements, research ethics, data management, data analysis, skills of abstract writing and presentation, authorship and manuscript writing. Beside the regularly scheduled weekly meetings of fellows and research faculty, fellows spent an additional 1-2 hours weekly when they were on inpatient clinical rotation and 4-8 hours when not directly responsible for inpatient care. Electronic mail was frequently used to share ideas, problem-solve and update investigators. The research project was completed over 6 months and the findings presented at two local meetings and as poster at a national meeting.

A research manuscript was also written and submitted for peer review. This resulted in publication in a leading journal in the specialty field and was accompanied by an editorial. The program was evaluated by a confidential survey at the end of the 12 months. Participants reported that they have attended more than 90% of weekly sessions and had rated the learning experience as excellent. All felt that the program had met its learning objectives, but they reported feeling frustrated trying to conduct research while meeting many other clinical and educational responsibilities. All the participants recommended the same educational approach for future cohorts of first-year fellows.

A study was conducted to investigate whether teaching an evidence-based medicine (EBM) curriculum increased the knowledge and use of EBM principles in residents' continuity clinics.[21] The authors initially conducted needs assessment phase followed by construction of a ten-session EBM workshop series. Resident-preceptor interactions during outpatient continuity clinic were tape-recorded prior to and 6 months following introduction of the curriculum. A 50-item, multiple-choice examination was administered before and after the workshop series. Residents at another residency program at the same university served as a control group. The study showed that baseline pre-intervention multiple-choice test results were similar in control and experimental groups. However, post-intervention test scores for the experimental group were significantly improved compared to control group (19% improvement in experimental group, $p<0.001$). The recorded resident-preceptor interactions showed a marked increase in the use of EBM terms which indicated awareness and use of EBM in the experimental group when compared with the control group. The "needs assessment" phase was well described in this study. The authors used three techniques to investigate the perceived needs of their residency program regarding specific teaching of EBM skills: Review literature, group meetings of members in residency educational committee, and survey directed to residents and faculty staff members. The information

gathered from the needs assessment phase were used to design the ten workshops in the curriculum. This study had some limitations which include the fact that the experimental and control groups were not randomized samples and that the preceptors and residents recorded in the initial and follow-up sessions were not identical. This clearly can lead to cross-contamination of groups. Also, due to residents' transition at the end of the academic year, it was difficult to obtain as much recording time at the control group site in the 6-month follow-up as it was done prior to the workshops. The recording time was also noticed to be longer at the control site than at the experimental site, so potential bias might tend to support the conclusion of this study. This study could not demonstrate that the use of EBM terms by residents and faculty in continuity clinics translated into changes in patient care or improved health outcomes. This study clearly did not involve "hands-on" experience of research training and was limited to teaching principles of EBM.

Supino and Borer reported their 15 years experience of conducting a comprehensive curriculum teaching clinical research methods to an academic medical community.[22] The aim of this course was to increase exposure among physicians, medical students, and allied health professionals to diverse methodological issues involved in performing quality research. The faculty for this program has included epidemiologists, clinical investigators, statisticians and medical ethicists. The authors described the steps of curriculum development which included: developing mission statement of the course, specific educational objectives and outlined key content. An advisory board comprising multidisciplinary faculty was then formed and reviewed the content of this program. The report did not explore if any "needs assessment" step was undertaken in order to define the content and the way of conducting the course. The course specific objectives were: to familiarize participants with principles of research problem definition and hypothesis construction, to clarify logic and proper application of alternative research design and statistical methodologies to test hypothesis, to

understand the importance of ethics in the responsible conduct of research, to heighten awareness of the requirements for data collection, recording and documentation and to provide guidelines for developing research protocols and writing and evaluating scientific papers.

The course content was delivered by 1-hour didactic weekly sessions for 20 weeks. The lectures followed an interactive approach to promote intellectual engagement with the subject matter and to enhance critical reasoning skills among course participants. During the final session, students were asked to select a published research in their respective areas of interest and to present a 5-10 minutes oral assessment of its quality to the panel and to other students in the class. The course was open to all interested members of academic community, attendance was not capped, there was no age restriction and no prior knowledge of methodological concepts was assumed or required.

The number of participants ranged in age from 24 to 36 years which showed progressive growth in the number of participants during subsequent years. Participants have included more than 500 members of all 25 academic departments. To evaluate the course performance an annual evaluation form was completed by each participant. In addition to this, faculty perceptions were collected during the final session of the course which reflected the impact of the course on participant competencies in research methodology. The majority of participants have provided 'excellent' rating for most criteria. Over the 15 years of conducting this course some modifications had been done to the course (based on participants' suggestions) such as using more patient-based practical examples for the statistics lectures, and increasing the number of lectures covering hypothesis construction, study planning and research design. Faculty perceptions during final session showed that most participants were able to apply course contents during their critical analysis of research manuscripts. The majority of students also were able to suggest refinements to improve the internal and/or

external validity of the studies that has been presented. The evaluation of this course did not include pre-test/post-test knowledge comparisons, control groups, or measures of course impact on research productivity. Feedback from faculty and participants suggests that the heterogeneous nature of the student body is not a barrier to effective teaching or learning, indeed for some the experience was especially motivating and stimulating. Among the challenges in conducting such a course is to avoid theoretical delivery of the content and the need for liberal use of clinical scenarios drawn from relevant published studies from variety of disciplines.

Rivera *et al* in 2005 reported the experience of a US-based international research organization (Family Health International FHI) in developing a Research Ethics Training Curriculum (RETC).[23] The aim was to meet the growing needs of basic training on research ethics which becomes mandatory component for research approval in many countries worldwide. The curriculum development went through two steps. The first step was to review existing training programs to analyze their content, and to determine their applicability in international settings. This process highlighted the importance of easy accessibility of the proposed curriculum. Three types of media were chosen to design the curriculum: a print version, a CD-ROM, and the Web. Emphasis was to maximize the interaction between the content and the student. The second step was to identify the curriculum's core content sections. Three core contents were identified: the universal principles of research ethics, the process of informed consent, and the role of ethics committee. The first draft was reviewed by several FHI staff members that resulted in a second draft, after which an external review was performed by 6 ethics experts each from a different country. This resulted in a third draft of the curriculum which was submitted for field testing. The field test was undertaken in research institutions in India, the Philippines, Zimbabwe, Kenya, and USA. Based on suggestions for improvement obtained from the pilot

users from the five geographical areas the final product was developed. This curriculum contains 2 evaluations: a reader's evaluation of the curriculum and a test of knowledge acquired by the participant. This curriculum has been widely used worldwide since it became available in 2002 (more than 1000 copies of the English-language CD-ROM, 450 copies of the English-language binder, 300 copies of the Spanish-language CD-ROM, 100 copies of the Spanish-language binder, 13,826 visits to English RETC Web, 6,085 visits to Spanish RETC Web, 1,068 to French RETC Web). This curriculum is an example of successful development and implementation of a research curriculum at an international level.

2.2 Needs assessment:

An educational "need" can be defined as the gap between an individual's present level of ability and a higher level of performance as determined by the learner, the organization or society.[24] Needs assessment is a systematic process of collecting and analyzing information by which educational needs are identified and ranked in order of priority.[25] Educational needs can be characterized by different approaches, which include: analyzing the discrepancy between the present situation and the ideal situation, the learner's wants or preferences, and/or the problem in particular field.[26] Needs assessment is widely accepted as a first step in curriculum development.[27] Nevertheless, many curriculum specialists have proposed that needs assessment is also required throughout implementation phase of curriculum.[26] Roger Kaufman have described six models of needs assessment and their relationship to a system approach referent:[28]

1. Alpha-Needs assessment: identify problem based upon need,
2. Beta-Needs assessment: determine solution requirements and identify alternatives,
3. Gamma-Needs assessment: select solution strategies,

4. Delta-Needs assessment: implement,
5. Epsilon-Needs assessment: determine performance effectiveness,
6. Zeta-Needs assessment: revise as required.

Kaufman's model defined the needs as the gap between the current results or situation and the desired results or situation. This gap can be analyzed at different levels, as the following:

1. Societal level: called "Mega" planning; the organizational element is the "outcomes",
2. Organizational level: called "Macro" level; the organizational element is the "outputs",
3. Individuals or small groups level: called "Micro" level; the organizational element is the "products".

The needs assessment can be done in formal or informal processes before or during the development or implementation of curriculum. Needs assessment has a triple data sources: society, learner, and subject matter.[29] The process of needs assessment is based on the following principles and hypothesis:[26]

- Curriculum needs assessment is a dynamic process: as such this process is not limited to development of curriculum but includes curriculum implementation. The stability of needs assessment products (due to needs continuous change) makes this principle of extreme importance.
- Curriculum needs assessment is a pluralistic process: as such the authority of making decision is distributed among the entire interested group.
- Curriculum needs assessment is a flexible process: as such to consider inputs from

different levels of interested groups, or outputs to different levels of curriculum implementation.

- Curriculum needs assessment is based on unequal attention principle: this refers to the fact that considering every element of the three sources of data (society, learner, and subject matter) at every level of needs assessment, one or two sources might be more important than others.
- Needs assessment is a proactive and reactive process: proactive when applied as the first step of curriculum assessment and reactive during or after implementation for performance improvement.

2.3 Needs assessment in postgraduate medical education

Ratnapalan and Hilliard in 2007 reviewed the applications of needs assessment in PGME. According to them, a needs assessment is a systematic way to collect and analyze information on what a targeted group needs to learn. Assessment of learning needs is considered as a fundamental step to ensure the relevance of the educational activity to the targeted audience in PGME programs. Learning needs assessment is often conducted to identify deficiencies in knowledge, skills, behavior, or attitude in current PGME programs teaching practices. It also helps to use PGME program's available resources to the maximum benefit of the learners and to anticipate deficiencies based on expected changes in health care needs. The learning needs of PGME candidates can be classified to different types that include: normative, prescribed, perceived, expressed, comparative, and unperceived (see table-2.1 for classifications of learning needs). There are different tools that can be implemented to collect information about the "needs assessment" process in PGME (see table-2.2 for tools that can be used for “needs assessment”).[30]

Table-2.1: Classifications of learning needs (from Ratnapalan and Hilliard, 2007 [30])

Learners' needs	Focus	Who decides	Utilizations
Normative	The set standards for learners' knowledge	Professional bodies e.g. American Board of Internal Medicine or Pediatrics Royal Colleges of Physicians and Surgeons of Canada and UK	Board certification, Licensing
Prescribed	Deficiencies in current educational program	Program directors Educators	Training residents in a particular program
Perceived	What the students may *think* they want to learn	Learners	For planning educational activities
Expressed	What the students *say* they want to learn	Learners	For planning educational activities
Comparative	Needs of 2 groups compared to one another	Program directors Educators	For improving a cohort of residents
Unperceived	What learners don't know that they need to know	Educators, Institutions, Allied health professional	For identifying some important educational objectives

Table-2.2: Tools which can be used in needs assessment (from Ratnapalan and Hilliard, 2007 [30])

Tool	Data collected	Area of needs assessed	Advantages for PGME programs	Utilization
Questionnaires	Quantitative	Perceived needs Expressed needs	Can sample large groups	Identify seminar topics
Interviews	Qualitative	Perceived needs Expressed needs	Identify individual learning needs	Plan remedial training
Focus groups	Qualitative	Perceived needs Expressed needs	Evaluate program and identify areas of discrepancy	Improving or modifying existing teaching strategies

Continuation: Table-2.2: Tools which can used in needs assessment (from Ratnapalan and Hilliard, 2007 [30])

Chart audits	Quantitative and qualitative	Prescribed needs Unperceived needs	Identify areas of weakness in a cohort of residents	Identify common medication errors
Chart-stimulated recall	Quantitative and qualitative	Prescribed needs Unperceived needs	Identify individual learning needs	Evaluate problem solving skills
Standardized patients	Quantitative and qualitative	Normative and Prescribed needs	Identify learning needs in attitude, or behavior	Identify learning objective for topics like ethics or counseling
Environmental scans	Quantitative and qualitative	Normative needs Unperceived needs Prescribed needs	Identify educational objectives, Evaluate previous educational activities	Plan educational activities that are relevant

Grant, in 2002 explored the limitations and cautions related to implementations of needs assessment in medical education, [31] which can be summarized in the following points:

- There is little evidence that needs assessment alone enhances educational effectiveness and outcomes, so it must be placed within the wider process of planned learning, relevance to practice, and reinforcement of learning in the appropriate context.
- Formal needs assessment can identify only a narrow range of needs and might miss needs not looked for, so breadth and flexibility of needs assessment methods should be embraced. It is very important to remember that exclusive reliance on formal needs assessment could render education an instrumental and narrow process rather than a creative, professional one. In professional education wider professional learning not related to a specific need is also of fundamental value where practice is not predictable.

- Individual and group learning needs are different; group learning needs may produce an average picture that sometimes fails to address important needs and interests of individual members of the group, so a balance is required when using each approach for the right purpose. The later concept of individual versus group learning needs assessment has an obvious and important effect on the utilization of resources and implementation of educational strategies.

2.4 Needs assessment for research curriculum development

Few studies were directed primarily to address the needs assessment of the targeted trainee as an early step to help in the development of research curriculum. A questionnaire based study was conducted among 115 pediatric residents in order to examine the factors associated with research during residency, which factors influence residents' abilities to conduct research, the number of residents conducting research in a research-oriented training program.[32] The response rate was 95%.

Conducting the questionnaire during 2 housestaff retreats helped to achieve this rate of response. Although 92% of respondents reported having conducted research before residency, only 18% were currently involved in research. Fifty-five percent reported interest in conducting research. Advanced degrees and future career plans influenced their decisions to do research. Clinical research was preferred over basic science or laboratory research. The most commonly identified influences to conducting research were availability of time (97%), personal interest in research (84%), availability of opportunities (76%), and mentors on hand (72%). This study found that interest in research during residency is high, but participation in research is low among the studied population. The limitation of this study is that it was limited to a single academic training institution. Selection bias might be a concern because all

residents were not included in the sample (only those attending housestaff retreats. Anonymity precluded tracking non respondents who did not attend the retreats.

Another internet-based survey study targeted residents in physical medicine and rehabilitation (PM&R) program.[33] The aim was to assess the extent to which PM&R residents' involvement in research and selection of postgraduate practice may be related to residency program research requirements and support for presentations. The response rate was only 24%. Eighty-five percent indicated research involvement, with 74% reporting a research requirement and 85% residency program financial support for presentations. On average respondents planned to devote 7% of their time to research once in practice. The study found that there was a statistically significant association between the existence of a research requirement and involvement in research. Limitations to this study included a low response rate, and potential selection bias toward increased research involvement as one would expect residents with research interest to be more likely to respond to the survey.

Another survey-based study assessed the attitudes of residents and program directors toward research training in al Canadian anesthesiology residency program.[34] There was 60% response rate form resident and 95% from program directors. Eighty-one percent of programs have mandatory research activity, although only 41% of residents think research should be mandatory. The majority of residents had been recently involved in a research project. The study found discrepancies between program directors' and residents' views about the availability of some of the resources to facilitate research. Residents regard the time needed to learn clinical anesthesia, schedule conflicts, inadequate faculty support, and a lack of protected research time as the top barriers to undertaking a research project. Program directors do not consider schedule conflict or a lack times as important barriers for residents research. Seventy-five percent of residents preferred to do another academic activity, such as

learning transesophageal echocardiography or taking postgraduate programs in education, rather than completing a research project during their residency.

A recent cross-sectional survey study was conducted to collect data on faculty members' profile, research activities, and obstacles impending research productivity in Saudi Arabia.[35] The response rate was 78%, among the surveyed 500 faculty members from 10 medical and health colleges during January to April 2011. Only 39% of respondents reported published work in the past 2 years. Of these, 80% indicated sole-authors research and around a quarter reported co-authors work. Males and young faculty members were more likely to publish research than their counterparts. Faculty members who reported involvement in administrative activities were less likely to publish. Those who reported supervising postgraduate students or had attained training on research methods were more likely to produce research. Respondents perceived that lack of time, research assistants, funds, and being busy with teaching load were the most cited obstacles impending research productivity. This study did not address in depth current activities or efforts to enhance research training at national level.

2.5 Systemic review of resident research curriculum

A systematic review of resident research curriculum identified 41 articles describing curricula.[11] The most common curricular objectives were to increase house officers' research productivity and improve their critical appraisal skills. Only one curriculum was designed with the goal of producing academic physicians. Among many instructional methods, conducting research projects, exposing learners to role models or mentors, and providing house officers with multiple opportunities to present their work were common. Sixty-six percent of curricula articulated goals or objectives, and 27% articulated needs assessments. Evaluation methods were often rudimentary, frequently limited to learners' self-assessments or authors' anecdotal reports. Twelve percent reported pre and post intervention

testing of learners' knowledge. No curricula were evaluated as prospective pre-test post-test controlled trials. A minority of articles reported costs, obstacles encountered, or modifications made in the curriculum. The authors of this review concluded that successful educational interventions should incorporate needs assessments, clearly defined learning objectives, and evaluation methods. While many curricula for resident research exist, the lack of detailed developmental information and meaningful evaluations hinders educators interested in adopting these curricula.[11]

2.6 Research focus

Competency-based medical education represents a promising model which aims to ensure high level of attaining educational outcomes. Though a competency-based medical education model is well received and getting adapted in many PGME programs worldwide, the implementation of effective strategies to achieve non-medical expert competencies are still lacking in many PGME programs. Research training represents an important part of the scholar competency of future physicians which has been historically claimed to be difficult to address systematically across PGME programs. A review of available literature revealed that the implementation of a "research curriculum" represents a key solution for PGME programs to ensure optimum outcomes in relation to this vital competency. The present thesis aims to provide a needs assessment step that can be used for the development of research curriculum for PGME programs at KFSH&RC.

Research questions

In the present thesis the following research questions were addressed:

1. What are the perceptions of trainees and educators at KFSH&RC toward the role of research in their programs?
2. How many activities related to research productivity and training in PGME programs at KFSH&RC are going on?
3. What are the perceived barriers to effective research training in PGME programs at KFSH&RC?
4. What are the perceived needs and priorities for any proposed research curriculum and how should a research curriculum be applied?
5. What are the suggestions of trainees and educators for improving research training?
6. What are the similarities and differences between the studied groups in relation to role of participant (trainee vs educator), demographics, discipline (medical vs surgical, laboratory, or other)?

CHAPTER 3

METHODS

3.1 Participants

The needs assessment process was carried out in the context of PGME programs in KFSH&RC. There are over 70 PGME programs (18 general residency programs and 53 sub-speciality programs) offered in KFSH&RC. Residents represent the majority of trainees compared to fellows (for example during 2006-2007 academic year there was 340 residents and 100 fellows). For each program there is an assigned program director. Program directors were contacted to identify active staff educators in their program. In each department there is a research representative at the general KFSH&RC research board.

3.2 Summaries of trainee participants

A total of 70 trainees (residents and fellows) out of 117, responded from different KFSH&RC's PGME programs (residency and fellowship programs) with a response rate of 59.8%. Table 3.1 shows summaries of trainee respondents. More than half (52%) of participants were females. The majority of trainees' age ranged between 26-30 years (54%).

As expected, residents were more than fellows (58% vs. 42%). Many of the responding trainees graduated from King Saud University (KSU) in Riyadh city (41.5%). The remaining trainees have graduated from King Abdulaziz University (KAU) in Jeddah city (12.3%), King Faisal University (KFU) in Dammam city (9.2%), and the rest (20%) from overseas universities (Sultan Qaboos University: 4.6%, Arabian Gulf University, Kuwait University and The Royal college of surgeons of Ireland University: each one 3%, Cairo University, Khartoum University, Punjab University, and Dubai medical college: each one 1.5%). The responding trainees had different levels of training which was found to be relatively equally representative of each training-year in the program. Respondents from residency programs had the following distribution: R1 (16.2%), R2 (11.8%), R3 (16.2%), R4 (11.8%), R5 (2.9%).

On the other hand, respondents from fellowship programs had the following distribution: F1 (19.1%), F2 (17.6%), and F3 (4.4%). The reason for the low percentage of R5 is related to the fact that the majority of residency programs have only four levels (R1-R4) and a small portion of residency programs have a fifth level (R5). Similarly the low percentage of F3 is due to the fact that the majority of fellowship programs have only two levels of training (F1-F2) and few programs have a third level (F3). The majority of responding trainees belong to medical programs (68.7%). The rest of the responding trainees belong to surgical (11.9%), laboratory (4.5%), and others (14.9%) programs (Pathology:6%, Radiology: 4.5%, Dentistry: 3%, Pharmacology: 1.5%).

Table-3.1: Summaries of trainee respondents

Characteristics	Frequency		Valid%	Missing
Sex	Female:	34	51.5	4
	Male:	32	48.5	
Age	<=25yrs:	4	6	3
	26-30yrs:	36	53.7	
	31-35yrs:	17	25.3	
	36-40yrs:	7	10.4	
	=>41yrs:	3	4.5	
University	KSU:	27	41.5	5
	KFU:	6	9.2	
	QU:	4	6.2	
	KAU:	8	12.3	
	KKU:	2	3.1	
	TU:	3	4.6	
	AGU:	2	3.1	
	Others:	13	20	
Training program type	Resident:	40	58	1
	Fellow:	29	42	
Training year	R1:	11	16.2	2
	R2:	8	11.8	
	R3:	11	16.2	
	R4:	8	11.8	
	R5:	2	2.9	
	F1:	13	19.1	
	F2:	12	17.6	
	F3:	3	4.4	

Discipline	Medical: Surgical: Laboratory: Others:	46 8 3 10	68.7 11.9 4.5 14.9	3

*University: KSU: King Saud University, KFU: King Faisal University, QU: Qassim University, KAU: King Abdulaziz University, KKU: King Khalid University, TU: Taibah University, AGU: Arabian Gulf University.

3.3 Summaries of educator respondents

A total of 40 educators (program directors, deputy program directors, consultants involved in training programs and consultants with research interest) responded to the questionnaire, out of 70 educators contacted, with a response rate of 57%. Table 3.2 shows summaries of educator respondents. The majority of the responding educators were males (72.5%) and with age below 50years (36-40yrs: 20%, 41-50yrs: 52.5%). The majority of the respondents defined their role as program directors (52.5%) with the remaining as educators (30%), researchers (5%), or unknown (12.5%). More than half of the respondents belong to pure medical specialties (57.5%) and the rest from surgical (25%), and others (10%) while the rest are unknown (7.5%).

Table-3.2: Summaries of educator respondents

	Frequency		Valid %	Missing
Sex	Female: Male:	8 29	20 72.5	3
Age	<=35yrs: 36-40yrs: 41-50yrs: 51-60yrs: =>61yrs:	3 8 21 5 1	7.5 20 52.5 12.5 2.5	2
Role	Program director: Educator: Researcher:	21 12 2	52.5 30 5	5
Discipline	Medical: Surgical: Laboratory:	23 10 4	57.5 25 10	3

3.4 Survey design

Planning sessions with representatives from academic affairs and selected program directors in addition to literature review all were carried out to develop the survey questionnaires that were used to collect the data required for this process of targeted needs assessment. Two slightly different questionnaires have been used: one for PGME trainees (residents/fellows) and the other one for educators (program directors, active educators, and researchers) who may be involved in the curriculum development and implementation.

Each questionnaire consisted of two parts with part one containing information about the role of participant (resident/fellow) or (program director/educator/researcher) and their discipline (medical/surgical/other) in addition to some demographic characteristics. Part two contains questions directed toward the needs assessment process.

The trainee's questionnaire contains 14 questions (see appendix: Residents/fellow form), which have assessed the following aspects:

a) Trainees attitude towards the role of research in their training (questions: 1-3),
b) Productivity (question: 4),
c) Current effort (questions: 5-7),
d) Available resources in KFSH&RC (questions: 8-10),
e) Barriers (question: 11),
f) Perceived needs (question: 12), and
g) Applying research training curriculum (question 13),
h) Suggestions for curriculum development (questions 14).

The educator's questionnaire contains 16 questions (see appendix: educators form) which have addressed the following aspects:

a) Educators attitude towards the role of research in their PGME programs (questions 1-4),

b) Current research involvement and productivity (questions: 5-6),

c) Existing strategies, resources and support to enhance research training in KFSH&RC (questions: 7-12),

d) Barriers (question: 13),

e) Perceived needs (question: 14) and

f) Applying a research training curriculum (question 15), and

g) Suggestions for curriculum development (question 16).

Questions varied with some applying Likert scale, preferred response, and open-ended questions.

3.5 Procedures

The surveillance process has been conducted between January to March 2010. To ensure the optimum involvement and participation of trainees and educators in the surveillance process, a systematic approach has been applied to conduct the survey. An initial step aiming to increase the awareness of the survey has been conducted. This step was achieved by the investigator visiting KFSH&RC 's departments and sections with active PGME programs to announce and introduce the project. This priming step resulted in facilitating the conduct of the survey. The second step involved the distribution of hard copies of the questionnaire. A sealed envelopes containing either trainee questionnaire or educator questionnaire have been delivered to each PGME program secretary with a log sheet. The secretary's role was to distribute the questionnaire among the available trainees and educators in the PGME program and then to use the log sheet to remind, retrieve and then to calculate the response rate in the program. Each secretary handled the collected filled-questionnaires to the investigator with the calculated response rate. The secretarial role helped to ensure close follow up of surveillance process without direct contact between the principle investigator and participants, which aimed to keep the participant anonymous and

prevent any response bias. Bi-weekly email reminders with soft copies of questionnaires have been emailed to trainees and educators involved in all PGME programs in KFSH&RC. This step aimed to increase response rate by reaching out to targeted trainees and educators who was missed due to their absence because of vacation, outside rotations, or other reasons.

3.6 Data analysis

Data analysis involved processing of both quantitative and qualitative measures. Multi-point scale responses have the advantage of transforming them to quantitative measures. Data analysis focused on presenting descriptive statistics (e.g., percentage) of the different aspects of the survey among the trainees and educators in KFSH&RC. Since KFSH&RC PGME programs contain a divergent spectrum of training level (residents/fellows) and speciality, differences between groups were analyzed. Crosstabs with Chi-Square test was used to compare differences between sex and role of participants. Differences between and within groups was assessed by using analyses of variance (ANOVA) in the case of sex (female vs male), role of respondent (trainee vs educator), disciple (medical, surgical, laboratory, others), educator role (program director, educator, researcher), age category, year of training, and university where MD degree was obtained. The ANOVA was used to determine whether scores from more than two groups are significantly different at selected probability level. Qualitative data transcribed to identify themes that emerged. These initial themes were then gathered together to develop a coding scheme, which was then applied for both trainees and educators set of data. Narrative analysis of individual cases was applied to open ended questions to see how the themes interrelate in particular case. Factor analysis was used to describe variability among the observed variables in terms of a potentially lower number of unobserved variables (factors).

3.7 Ethical approval

The study protocol was approved by the office of medical bioethics in University of Calgary (ID: E-22634) and by the office of research affairs in KFSH&RC. Respondents were informed of the purpose of the study and consent was obtained. Respondents were also assured of confidentiality.

CHAPTER 4

RESULTS

In this chapter the following components will be discussed: (1) Descriptive statistics of trainees' survey, (2) Descriptive statistics of educators' survey, (3) Between group differences, (4) Factor analyses and reliability, (5) Qualitative analysis, and (6) Summary.

As described in the previous chapter the study survey involved two questionnaires (one directed to trainees and the other to educators). The items in each questionnaire can be grouped into different domains based on the content assessed by these items (e.g. attitude towards research training, current productivity and efforts, barriers to research training, and perceived needs of the new curriculum). The descriptive statistics of each survey are reported under these domains.

4.1 Descriptive statistics of trainees' survey

Table-4.1 shows descriptive statistics of trainees survey with Likert scale items, whereas table-4.2 shows descriptive statistics of trainee survey with categorical items.

Table-4.1: Descriptive statistics of trainees' survey - Likert scale items

Statistics of trainees' survey - Likert items					
Item description	n	Mean	SD	Min.	Max.
1. Attitude toward research: mandatory training	70	4.41	.893	1	5
2. Attitude toward research: improve patient care	70	4.11	.713	1	5
3. Attitude toward research: enhance academic career	70	4.43	.714	1	5
4. Attitude toward research: increase clinical investigator	69	4.09	.800	2	5
5. Attitude toward research: facilitate fellowship acceptance	70	4.43	.791	1	5
6. Attitude toward research: asset to future career	70	4.40	.806	1	5
7. Attitude toward research: training in research will compromise medical expert competency	70	2.76	1.122	1	5
8. Current research training: current efforts are insufficient?	68	3.81	1.026	1	5

9. Research resources in KFSH&RC represent rich environment for research training	66	3.95	.753	2	5
10. Barriers to research training: lack of protected time	67	4.39	.887	2	5
11. Barriers to research training: lack of skills & knowledge	68	3.76	1.067	1	5
12. Barriers to research training: lack of mentorship	65	3.71	1.011	1	5
13. Barriers to research training: lack of interest	68	2.35	1.089	1	5
14. Barriers to research training: lack of research questions	68	3.07	1.137	1	5
15. New curriculum needs: methodology	68	3.99	.743	2	5
16. New curriculum needs: biostat.	68	3.87	.845	2	5
17. New curriculum needs: epidemiology	67	3.67	.746	2	5
18. New curriculum needs: scientific writing skills	68	4.22	.826	1	5
19. New curriculum needs: research ethics	68	3.85	.885	1	5
20. New curriculum needs: critical appraisal skills	68	4.21	.724	2	5
21. New curriculum application: First year trainee not ready to start research project?	69	3.43	1.266	1	5
22. New curriculum application: First year trainee more likely to complete research project?	68	2.82	.897	1	5
23. New curriculum application: Should have hands-on component!	68	3.90	.949	1	5
24. New curriculum application: Should be mandatory!	70	3.71	1.024	1	5
25. New curriculum application: should be longitudinal!	70	3.96	.875	1	5

Table-4.2: Descriptive statistics of trainees' survey - categorical items

1. Research productivity during training:		
Number of research grants	Frequency	Percent
0	58	82.9
1-3	3	4.3
4-6	1	1.4
Total	62	88.6
Unknown	8	11.4
2. Research productivity during training:		
Number of research publications	Frequency	Percent
0	46	65.7
1-3	14	20.0
4-6	1	1.4
Total	61	87.1
Unknown	9	12.9
3. Research productivity during training:		
Number of manuscript submissions	Frequency	Percent
0	39	55.7
1-3	18	25.7
4-6	4	5.7
=>10	1	1.4
Total	62	88.6
Unknown	8	11.4
4. Research productivity during training:		
Number of topic review presentations	Frequency	Percent
0	22	31.4
1-3	22	31.4
4-6	10	14.3
7-9	1	1.4
=>10	7	10.0
Total	62	88.6
Unknown	8	11.4
5. Number of research educational activity attended during training:		

Courses	Frequency	Percent
0	29	41.4
1-3	31	44.3
4-6	6	8.6
Total	66	94.3
Unknown	4	5.7

6. Number of research educational activity attended during training:

Conferences	Frequency	Percent
0	38	54.3
1-3	15	21.4
4-6	7	10.0
7-9	2	2.9
=>10	4	5.7
Total	66	94.3
Unknown	4	5.7

7. Number of research educational activity attended during training:

Workshops	Frequency	Percent
0	43	61.4
1-3	23	32.9
Total	66	94.3
Unknown	4	5.7

8. Number of research educational activity attended during training:

Lectures	Frequency	Percent
0	28	40.0
1-3	14	20.0
4-6	5	7.1
7-9	2	2.9
=>10	17	24.3
Total	66	94.3
Unknown	4	5.7

9. Do you have structured research training activity in your program?		
	Frequency	Percent
Yes	27	38.6
No	40	57.1
Total	67	95.7
Unknown	3	4.3

10. How available are research "opportunities" during your training?		
	Frequency	Percent
None	14	20.0
Rare	22	31.4
Adequate	24	34.3
more than enough	5	7.1
Total	65	92.9
Unknown	5	7.1

11. How available is "mentorship" support for your research training?		
	Frequency	Percent
None	14	20.0
Rare	22	31.4
Adequate	28	40.0
Total	64	91.4
Unknown	6	8.6

4.1.1 Trainee questionnaire: Attitude towards the role of research training

The majority (90%) of trainees chose "strongly agree" or "agree" to mandate research-skills training in any PGME program (58.6% and 31.6% for each one respectively).

The majority of trainees (80-94%) have a common consensus that research activities are beneficial in different aspects: better patient care (agree: 60%, strongly agree: 27.1%), enhance pursuit of academic career (agree: 42.9%, strongly agree: 51.4%), increase clinical investigators (agree: 48.6%, strongly agree: 31.4%), enhance fellowship training acceptance

and success (agree: 31.4%, strongly agree: 57.1%), asset for future career (agree: 35.7%, strongly agree: 54.3%).

It was obvious that trainees are not clear about the effect of research training on them becoming medical expert in their field. Answering a question if they believe that research training will interfere with them being medical experts in their discipline, almost half of the respondents were either neutral (25.7%) or believe it dose really interfere (agree: 20%, strongly agree: 7.1%), the rest of trainees believe that research training will not interfere with them being medical expert (disagree: 35.7%, strongly disagree: 11.4%).

4.1.2 Trainee questionnaire: Productivity

The majority of responding trainees have very low research involvement: 93.5% have never applied/gained research grants, 74.2% have never had scientific publication, and 62.9% have never had manuscript presentation. Large proportion of respondents (64.5%) reported activities in the form of topic review/case presentation in departmental grand rounds.

4.1.3 Trainee questionnaire: Current effort

A large proportion of the responding trainees have never come across educational activities directed towards research training during their training program (44% had never attended a course, 58% had never attended a conference, 65% had never attended a workshop, 42% had never attended a lecture related to research training). Almost two thirds of the responding trainees (60%) reported that they have no structured regular activity to enhance research training in their program. A majority (66%) of the responding trainees believe that current academic strategy applied in KFSH&RC programs are insufficient to address research training (38% agreed, 28% strongly agreed), whereas only 10% of the respondents of this group did not believe on this (7% disagreed, and 3% strongly disagreed).

4.1.4 Trainee questionnaire: Available resources in KFSH&RC

Most (55%) of the responding trainees believe that the available opportunities for research training are inadequate (with 34% believe that those opportunities are rare and 22% believe there are no existing opportunities). In contrast, 45% of the responding trainees believe that the available research opportunities are adequate (37% believe that those opportunities are adequate and 8% believe that they are more than adequate). A majority (56%) of the responding trainees believe that there is inadequate mentorship for research training in their programs (with 34% believe that there is rare mentorship and 22% believe there is no mentorship at all). In contrast, 44% of the responding trainees believe that the existing mentorship for research training in their programs is adequate. Only few (3%) of the responding trainees disagreed with the fact that the existing resources in KFSH&RC represent a rich environment for research training. In fact, the majority (76%) of the responding trainees believe on this fact (53% agreed and 23% strongly agreed).

4.1.5 Trainee questionnaire: Barriers to research training

The majority (85%) of the responding trainees agreed that absence of protected time for research is a barrier against their involvement in research activities (with 60% strongly agreed on this). The majority (72%) of the responding trainees agreed that their lack of the necessary skills and knowledge in research is a barrier against their involvement in research activities (with 15% disagreed and 13% neutral on this fact). The majority (63%) of the responding trainees agreed that the lack of mentorship is a barrier against their involvement in research activities (with 14% disagreed and 23% neutral on this fact). The majority (66%) of the responding trainees disagreed with the fact that the lack of interest in research is a barrier against their involvement in research activities (with 18% agreed and 16% neutral on this fact). It was not clear whether the lack of research ideas/questions is among the barriers

from trainees' involvement in research activities (35% agreed, 29% neutral and 35% disagreed with this).

4.1.6 Trainee questionnaire: Perceived needs for new research training curriculum

Trainees were asked to rank (low, very low, high, and very high priority) six different curriculum content items for a proposed research training curriculum (research methodology, biostatistics, epidemiology, scientific writing, research ethics, and literature review and critical appraisal). The majority (66-85%) of the responding trainees ranked all items under the high and very high priority. The two top ranked items were: scientific writing (44%: high, 41%: very high priority) and literature review/critical appraisal (48.5%: high, 36.8%: very high priority). This was followed by research methodology (54%: high, 23.5%: very high priority), biostatistics (54%: high, 20.6%: very high priority), research ethics (50%: high, 22%: very high priority), and epidemiology (56.7%: high, 9%: very high priority).

The majority of responding trainees (59%) believe that a first year trainee is not ready to start a research project compared with more senior trainee (39.1% agreed, 20.3% strongly agreed). On the other hand 26% disagreed on this statement and 15% were neutral. Most of the responding trainees (43%) did not believe on the statement that the first year trainee is more likely to complete their research projects during their training program compared with more senior trainee (39.7%: disagreed, 2.9%: strongly disagreed). On the other hand, 26.5% believe on that statement (25%: agreed, 1.5%: strongly agreed) and 31% were neutral. The majority (69%) of the responding trainees supported the "Hands-on" format of the applied curriculum (7%: disagreed and 24%: neutral). Most (60%) of the responding trainees agreed that the curriculum should be mandatory (9%: disagreed and 31%: neutral). The majority (76%) of the responding trainees agreed that the curriculum would be more effective if it is longitudinal throughout the training period rather than short format (6%: disagreed and 19%: neutral).

4.2 Descriptive statistics of educators' survey

Table 4.3 shows descriptive statistics of educators' survey with Likert score items, whereas table 4.4 shows descriptive statistics of educators' survey with categorical items.

Table-4.3: Descriptive statistics of educators' survey - Likert scale items

Item description	n	Mean	SD	Min.	Max.
1. Attitude toward research: mandatory training	40	4.53	.784	2	5
2. Attitude toward research: improve patient care	40	4.25	.870	2	5
3. Attitude toward research: enhance academic career	40	4.48	.554	3	5
4. Attitude toward research: increase clinical investigator	40	4.50	.555	3	5
5. Attitude toward research: facilitate fellowship acceptance	40	4.38	.774	2	5
6. Attitude toward research: asset to future career	40	4.43	.675	2	5
7. Attitude toward research: training in research will compromise medical expert competency	39	2.18	1.023	1	5
8. Attitude toward research: intention to support research curriculum	38	4.47	.603	3	5
9. Current research training: current efforts are insufficient?	40	4.15	.834	2	5
10. Research resources in KFSH&RC represent rich environment for research training	40	3.78	1.025	1	5
11. Barriers to research training: lack of protected time	40	3.83	1.107	2	5
12. Barriers to research training: lack of skills & knowledge	40	4.15	.864	2	5
13. Barriers to research training: lack of mentorship	40	3.65	1.075	1	5
14. Barriers to research training: lack of interest	40	3.53	.960	2	5
15. Barriers to research training: lack of research questions	36	2.53	1.158	1	5
16. New curriculum needs: methodology	40	4.40	.810	1	5

17. New curriculum needs: biostat.	40	3.88	.853	1	5
18. New curriculum needs: epidemiology	40	3.75	.870	1	5
19. New curriculum needs: scientific writing skills	40	4.33	.797	1	5
20. New curriculum needs: research ethics	40	4.10	1.008	1	5
21. New curriculum needs: critical appraisal skills	40	4.35	.622	2	5
22. New curriculum application: First year trainee not ready to start research project?	40	3.20	1.159	1	5
23. New curriculum application: First year trainee more likely to complete research project?	40	3.10	1.081	1	5
24. New curriculum application: Should have hands-on component!	40	4.15	.736	2	5
25. New curriculum application: Should be mandatory!	40	4.00	.987	2	5
26. New curriculum application: should be longitudinal!	40	4.23	.768	1	5

able-4.4: Descriptive statistics of educators' survey-categorical items

1. Current research training:		
Current research training: is research project part of your program requirements?	Frequency	Percent
No	22	55.0
Yes for both residents & fellows	15	37.5
Yes for fellows only	1	2.5
Total	38	95.0
unknown	2	5.0
2. Current research training:		
Do you have educational activity directed to research training?	Frequency	Percent
no	13	32.5
yes	25	62.5
Total	38	95.0
unknown	2	5.0
3. Current research training:		
is research project required during this activity?	Frequency	Percent
no	20	50.0
yes	5	12.5
Total	25	62.5
unknown	15	37.5
4. Current research training:		
Is there dedicated time for research in your program?	Frequency	Percent
no designated time	21	52.5
optional rotation	13	32.5
mandatory block	3	7.5
Total	37	92.5
unknown	3	7.5
5. Research resources/support:		
Awards	Frequency	Percent
no	16	40.0
yes	17	42.5
Total	33	82.5
unknown	7	17.5

6. Research resources/support:		
Funds	Frequency	Percent
no	18	45.0
yes	15	37.5
Total	33	82.5
unknown	7	17.5
7. Research resources/support:		
Biostatistics/epidemiologist consultations	Frequency	Percent
no	17	42.5
yes	16	40.0
Total	33	82.5
unknown	7	17.5
8. Research resources/support:		
Research Day	Frequency	Percent
no	10	25.0
yes	23	57.5
Total	33	82.5
unknown	7	17.5
9. Research resources/support:		
Staff with degree in Biostat./Epidemiology	Frequency	Percent
no	21	52.5
yes	12	30.0
Total	33	82.5
Unknown	7	17.5

4.2.1 Educator questionnaire: Attitude towards the role of research in PGME programs

The majority (93%) of the responding educators believe that research training should become a mandatory component in any PGME training programs (65% strongly agreed). Only 5% disagreed with this statement (among those no one selected the strongly disagree option).

Most of the responding educators (88-98%) believe that trainees involvement in research activities will result in benefits on many aspects: 87% to improve patient care, 98% to enhance academic career, 98% to increase investigators among clinicians, 88% to enhance residents chances to obtain acceptance and success in fellowship training, 95% to assess in future career.

Many (80%) of the responding educators disagree with the statement that research training will negatively impact trainees' ability to become medical experts in their speciality (of those 62.5% strongly disagreed and 17.5% disagreed). Of note, 10% of the responding educators agreed with this fact and 8% were neutral.

4.2.2 Educator questionnaire: Current research involvement and productivity

More than two thirds of the responding educators reported that one or more of their trainees have been participating in research activity over the last 5 years (15% with 1-2, 35% with 3-5 trainees, and 28% with 6 or more trainees involved in research activity). On the other hand, around 13% of the responding educators reported that none of their trainees have been involved in research activity over the last 5 years.

Almost half (47.5%) of the responding educators reported that 10 or more research projects have been performed by staff members of their departments over the last 5 years, on the other hand 27.5% reported less than 10 research projects. Of note that 20% of the responding educators did not answer this question and 5% (2 participants) reported that no research activity has been performed in their department over the last 5 years.

4.2.3 Educator questionnaire: Existing strategies, resources and support to enhance research training in KFSH&RC

The majority of the responding educators (78%; more than half of them strongly believe on this) believe that current academic strategies are insufficient to address research training in

their PGME programs. Of note that only 2.5% of the responding educators disagreed on this statement and 20% were neutral.

More than half (55%) of responding educators reported that research projects are only optional activities for their PGME programs trainees. Of note, around 38% of the responding educators reported that research projects are mandatory component in their PGME programs for both residents and fellows whereas only 2.5% reported this to be mandatory only for the fellows and not for the residents.

Most of the responding educators (63%) reported that they have educational activities to enhance research training, however only 13% of this group reported that the completion of a research project is a component of these educational activities. On the other hand, around one third of the responding educators (33%) reported that their PGME programs lack any educational activities to enhance research training.

More than half of the responding educators (53%) reported that no designated time in their PGME programs to allow their trainees to participate in research projects. On the other hand, 33% of the responding educators reported that their PGME programs offer optional rotation during electives to enhance their trainees' participation in research projects. Only 8% of the responding educators reported that mandatory rotations are part of their PGME programs to enhance their trainees' participation in research projects.

The majority of the responding educators (70%) believe that existing resources at KFSH&RC represent a rich environment to enhance research training. On the other hand, 10% did not believe that existing resources at KFSH&RC represent a rich environment to enhance research training and 20% were neutral to this issue.

Different resources have been reported by the responding educators in their PGME programs to support trainees' participation in research activity: competitions and awards in 43%, funds to attend/present in conferences in 38%, biostatistics and methodology

consultations in 40%, research day to present research activities in 58%, staff holding degrees in biostatistics and epidemiology in 30%. Of note, the lack of any of these resources was reported by 25 to 53% of the respondents.

The majority (90%) of the responding educators are willing to support the planning, implementation and maintenance of research training curriculum in their PGME program.

4.2.4 Educator questionnaire: Barriers to research training

The majority of the responding educators believe that multiple barriers have resulted in the limited participation of trainees in research activities: lack of protected time (70%), lack of necessary skills and knowledge (85%), lack of mentorship (63%). Lack of personal interest in research activity was reported by 50% as a barrier for the participation of trainees in research activities whereas 15% disagreed with this and 35% were neutral. On the other hand, 55% disagree with the claim that lack of research ideas/question is among those barriers whereas 15% believe that and 20% were neutral.

4.2.5 Educator questionnaire: Perceived needs for new research training curriculum

The majority of the responding educators believe that different items are needed with high or very high priority as content components of any proposed curriculum for research training: methodology (93%: with 53% ranked it as very high priority), biostatistics (70%: with 23% ranked it as very high priority), epidemiology (65%: with 18% ranked it as very high priority), scientific writing (93%: with 45% ranked it as very high priority), research ethics (83%: with 40% ranked it as very high priority), literature review and critical appraisal (97%: with 40% ranked it as very high priority).

When it comes to applying a new research training curriculum, larger proportions of the responding educators believe that the first year residents/fellows (because they are overwhelmed with the new environment of their PGME programs) are not ready to start their research projects compared with senior residents/fellows: 50% believe on this statement (with

around 13% strongly agreed on this) whereas 40% did not believe on this statement (with around 3% strongly disagreed on this statement) and 10% were neutral to this statement.

On the other hand, slightly larger proportion of the responding educators believe that the first year residents/fellows are more likely to be able to complete their research projects during their PGME program compared with senior residents/fellows: 38% believe on this statement (with around 10% strongly agreed on this) whereas 33% did not believe on this statement (with around 5% strongly disagreed on this statement) and 30% were neutral to this statement.

The majority (90%) of the responding educators believe that research training curriculum should include hands-on component (i.e. to incorporate research projects rather than containing only theoretical components).

Most (73%) of the responding educators believe that research training curriculum should be a mandatory component of their PGME programs (only 10% disagreed with this and 17.5% were neutral).

The majority (93%) of the responding educators believe that research training curriculum should be applied as a longitudinal activity running throughout their PGME programs rather than being a short course format (only 2.5% strongly disagreed whereas 5% were neutral).

4.3 Between group differences

A number of between group differences analyses were conducted using contingency table analyses (Fisher's exact Test), independent sample t-test, and analyses of variance (ANOVA).

4.3.1 Sex differences:

Female and male proportions were almost equal among trainee respondents (female = 51.1%, male = 48.5%), however among educators the proportion of female respondents was lower than male respondents (female = 20%, male = 72.5%). Between groups analysis is

conducted for sex differences (female vs male) by the role of respondent (trainee vs educator). Accordingly, a contingency table with sex by role of respondent and Fisher`s exact test was done as Table-4.5 shows is only 2x2 cells.

Table-4.5: A cross tabulation of sex by role of respondent

Description			Role of respondent		Total
			Trainee	Educator	
Sex	female	N	34	8	42
		% within sex	81.0%	19.0%	100.0%
	male	N	32	29	61
		% within sex	52.5%	47.5%	100.0%
Total		N	66	37	103
		% of Total	64.1%	35.9%	100.0%

It can be seen from Table-4.5 that there is a significant difference between the proportion of female trainees and female educators (trainee = 81%; educator = 19%; $X2(2)=8.863$, $p < .05$) while for males, there is very close to equal proportions (trainee = 52.5%; educator 47.5%).

4.3.2 Group differences among trainee respondents by sex, age, and discipline characteristics:

Multiple one way ANOVA tests were carried out to examine whether mean scores among trainee respondents are significantly different between and within groups based on sex (female vs male), age category, university where MD degree obtained, training type (residency vs fellowship), training year, and discipline (medical, surgical, laboratory, others).

The only statistically significant difference between female and male trainee respondents were found in the mean scores of two questions (do you have a structured research training activity in your program?: female mean score = 1.75, male mean score = 1.47; $F=5.617$, $p <.05$) and (Should have hands-on component in the new research curriculum?: female mean

score = 4.18, male mean score = 3.58; F=6.828, p <.05) [see table-4.6 for group difference: trainee means scores by sex].

Table-4.6: Group difference: trainee means scores by sex

Item	sex	n	Mean	Std. Deviation	Std. Error Mean
Do you have structured research training activity in your program?*	female	32	1.75	.440	.078
	male	32	1.47	.507	.090
	total	64	1.61	.492	.061
New curriculum application: Should have hands-on component!*	female	33	4.18	.769	.134
	male	31	3.58	1.057	.190
	total	64	3.89	.961	.120

*p<.05

To examine the effect of age category on mean scores of trainee respondents a one-way ANOVA test was run (independent variable: age category, dependent variable: item scores of the survey) [see table-4.7 for group difference: Trainees mean scores by age category]. Three items were found to be different among age category with statistical significance: (research productivity marker: number of publications during training; F = 2.765, p<.05; those trainees <= 25yrs old had higher mean score than other age categories), (attended research educational lectures during training: F = 2.778, p<.05; those trainees <= 25yrs old had higher mean score than older age categories with similar observation for those 26-30yrs and 36-40yrs when compared to older trainees), (availability of mentorship: F = 2.706, p<.05; trainees in <= 25yrs, 26-30yrs, 31-35yrs had higher mean score compared with >= 41yrs trainees).

Table-4.7: Group difference: Trainees mean scores by age category

Item	Age category	n	Mean	SD	SE
Productivity marker: number of publications during training*	<=25yrs	3	1.00	.000	.000
	26-30yrs	31	.19	.402	.072
	31-35yrs	16	.25	.447	.112
	36-40yrs	6	.17	.408	.167
	>=41yrs	3	.67	1.155	.667
	Total	59	.27	.485	.063
Attended research educational lectures during training*	<=25yrs	2	4.00	.000	.000
	26-30yrs	35	1.40	1.459	.247
	31-35yrs	17	1.47	1.772	.430
	36-40yrs	6	2.67	2.066	.843
	>=41yrs	3	.00	.000	.000
	Total	63	1.56	1.663	.210
Availability of mentorship*	<=25yrs	4	2.75	.500	.250
	26-30yrs	34	2.29	.836	.143
	31-35yrs	15	2.20	.676	.175
	36-40yrs	6	1.67	.516	.211
	>=41yrs	2	1.00	.000	.000
	Total	61	2.20	.792	.101

*p<.05

To examine the effect of discipline of training (medical, surgical, laboratory, and others) on mean scores of trainee respondents multiple one-way ANOVA test were run (independent variable: discipline, dependent variable: item scores of the survey) [see table-4.8 for group difference: Trainees mean scores by discipline]. Four items were found to be different among discipline with statistical significance: (research productivity marker: number of topic-review presentations during training; F = 3.318, p<.05; those trainees from "laboratory" training program had higher mean compared with trainees from "other" training programs), (attended research educational workshop during training: F = 4.314, p<.01; those trainees from "medical" training programs had higher mean score compared to laboratory programs, while

those from "other" programs had higher mean score compared to "medical" and laboratory" programs), (absence of mentorship as a barrier of research training: F = 5.540, p<.01; trainees from "surgical" programs scored higher mean compared to those trainees from "other" programs), and (lack of interest as a barrier of research training: F = 4.380, p<.01; trainees from "surgical" programs had higher mean score compared to "medical" and "other" programs).

Table-4.8: Group difference: Trainees mean scores by discipline

Item	Discipline	n	Mean	SD	SE
Research productivity marker: number of topic-review presentations during training*	medical	41	1.22	1.255	.196
	surgical	8	1.13	1.356	.479
	laboratory	2	3.50	.707	.500
	other	8	.50	.756	.267
	Total	59	1.19	1.279	.167
Attended research educational workshop during training**	medical	43	.26	.441	.067
	surgical	8	.50	.535	.189
	laboratory	3	.00	.000	.000
	other	9	.78	.441	.147
	Total	63	.35	.481	.061
Absence of mentorship as a barrier of research training**	medical	41	3.66	.965	.151
	surgical	8	4.63	.518	.183
	laboratory	3	4.33	1.155	.667
	other	10	2.90	.994	.314
	Total	62	3.69	1.034	.131
Lack of interest as a barrier of research training**	medical	44	2.32	1.006	.152
	surgical	8	3.50	1.414	.500
	laboratory	3	1.67	.577	.333
	other	10	1.90	.876	.277
	Total	65	2.37	1.112	.138

*p<.05, **p<.01

There were no significant differences between trainee respondents' mean scores based on university of graduation, training type (Residency vs fellowship), or training year level.

4.3.3 Group differences among educator respondents by sex, age, role and discipline characteristics:

Multiple one way ANOVA tests were carried out to examine whether mean scores among educator respondents are significantly different between and within groups based on sex (female vs male), age category, role in training program (program director, educator, or researcher), and discipline (medical, surgical, laboratory, others).

To examine the effect of age category of educators on mean scores multiple one-way ANOVA test were run (independent variable: age category, dependent variable: item scores of the survey). Four items were found to be different among age categories with statistical significance: (attitude toward research: enhance academic career: $F = 3.158$, $p<.05$; educators =< 35yrs had lower mean score compared to 41-50yrs), (attitude toward research: asset to future career; $F = 3.083$, $p<.05$; educators=< 35yrs had lower mean score compared with 36-40yrs and 41-50yrs), (lack of skills as a barrier to research training: $F = 4.414$, $p<.05$; educators =< 35yrs had higher mean score compared to 41-50yrs and 51-60yrs), and (new curriculum application: First year trainee not ready to start research project: $F = 5.645$, $p<.01$; educators 41-50yrs had higher mean score compared to 36-40yrs) [see table-4.9 for group difference: educator mean scores by age category].

No significant differences were observed among educator respondents based on their sex, discipline, or role in training program.

Table-4.9: Group difference: Educator mean scores by age category

Item	Age category	N	Mean	SD	SE
Attitude toward research: enhance academic career*	=<35yrs	3	4.00	.000	.000
	36-40yrs	8	4.38	.518	.183
	41-50yrs	21	4.71	.463	.101
	51-60yrs	6	4.17	.753	.307
	Total	38	4.50	.558	.090

Attitude toward research: asset to future career*	=<35yrs	3	4.00	.000	.000
	36-40yrs	8	4.75	.463	.164
	41-50yrs	21	4.52	.512	.112
	51-60yrs	6	3.83	1.169	.477
	Total	38	4.42	.683	.111
Lack of skills as a barrier to research training*	=<35yrs	3	5.00	.000	.000
	36-40yrs	8	4.25	.707	.250
	41-50yrs	21	4.33	.658	.144
	51-60yrs	6	3.33	1.033	.422
	Total	38	4.21	.811	.132
New curriculum application: First year trainee not ready to start research project **	=<35yrs	3	2.00	.000	.000
	36-40yrs	8	2.38	.744	.263
	41-50yrs	21	3.76	.995	.217
	51-60yrs	6	2.83	1.472	.601
	Total	38	3.18	1.182	.192

*p<.05, **p<.01

4.3.4 Group differences between trainees and educators

Common items in trainees' and educators' surveys were examined to explore whether there are differences between trainees' and educators' response [see Table-4.10 for descriptive statistics of combined (trainees and educators similar items) survey].

Multiple independent t-tests were carried out to examine whether there are differences between trainees and educators in the mean scores of common survey items (grouping variable: trainee vs educator, test variables: mean scores of the common survey items) [see table-4.11 for group difference: trainees' vs. educators' mean scores]. Statistically significant differences were found between trainees and educators in the following items: research training increase clinical investigator (t = -2.886, p<.01; educators had higher mean score than trainees), research training will compromise medical expert competency (t = 2.729, p<.01; trainees had higher mean score compared to educators), lack of protected time as a barrier to research training (t = 2.892, p<.01; trainee had higher mean score compared to

educators), lack of interest as a barrier to research training (t = -5.635, p<.001; educators had higher mean score compared to trainees), lack of research questions as a barrier to research training (t = 2.314, p<.05; trainees had higher mean score compared to educators), and methodology as an important component of the proposed research curriculum (t = -2.709, p<.01; educators had higher mean score compared to trainees).

Table-4.10: Descriptive statistics of combined (trainees and educators similar items) survey

Item description	n	Mean	SD	Min.	Max.
1. Attitude toward research: mandatory training	110	4.45	.853	1	5
2. Attitude toward research: improve patient care	110	4.16	.773	1	5
3. Attitude toward research: enhance academic career	110	4.45	.658	1	5
4. Attitude toward research: increase clinical investigator	109	4.24	.744	2	5
5. Attitude toward research: facilitate fellowship acceptance	110	4.41	.782	1	5
6. Attitude toward research: asset to future career	110	4.41	.758	1	5
7. Attitude toward research: training in research will compromise medical expert competency	109	2.55	1.118	1	5
8. Current research training: current efforts are insufficient?	108	3.94	.969	1	5
9. Research resources in KFSH&RC represent rich environment for research training	106	3.89	.865	1	5
10. Barriers to research training: lack of protected time	107	4.18	1.008	2	5
11. Barriers to research training: lack of skills & knowledge	108	3.91	1.010	1	5
12. Barriers to research training: lack of mentorship	105	3.69	1.031	1	5
13. Barriers to research training: lack of interest	108	2.79	1.184	1	5
14. Barriers to research training: lack of research questions	104	2.88	1.168	1	5
15. New curriculum needs: methodology	108	4.14	.791	1	5
16. New curriculum needs: biostatistics	108	3.87	.844	1	5

17. New curriculum needs: epidemiology	107	3.70	.792	1	5
18. New curriculum needs: scientific writing skills	108	4.26	.813	1	5
19. New curriculum needs: research ethics	108	3.94	.936	1	5
20. New curriculum needs: critical appraisal skills	108	4.26	.689	2	5
21. New curriculum application: First year trainee not ready to start research project?	109	3.35	1.228	1	5
22. New curriculum application: First year trainee more likely to complete research project?	108	2.93	.974	1	5
23. New curriculum application: Should have hands-on component!	108	3.99	.881	1	5
24. New curriculum application: Should be mandatory!	110	3.82	1.015	1	5
25. New curriculum application: should be longitudinal!	110	4.05	.844	1	5

Table-4.11: Group difference: trainees' vs educators' mean scores

Items	Groups	n	Mean	SD	SE Mean
1. Attitude toward research: mandatory training	trainee	70	4.41	.893	.107
	educator	40	4.53	.784	.124
2. Attitude toward research: improve patient care	trainee	70	4.11	.713	.085
	educator	40	4.25	.870	.138
3. Attitude toward research: enhance academic career	trainee	70	4.43	.714	.085
	educator	40	4.48	.554	.088
4. Attitude toward research: increase clinical investigator*	trainee	69	4.09	.800	.096
	educator	40	4.50	.555	.088
5. Attitude toward research: facilitate fellowship acceptance	trainee	70	4.43	.791	.095
	educator	40	4.38	.774	.122
6. Attitude toward research: asset to future career	trainee	70	4.40	.806	.096
	educator	40	4.43	.675	.107
7. Attitude toward research: training in research will compromise medical expert competency*	trainee	70	2.76	1.122	.134
	educator	39	2.18	1.023	.164
8. Current research training: current efforts are insufficient?	trainee	68	3.81	1.026	.124
	educator	40	4.15	.834	.132
9. Research resources in KFSH&RC represent rich environment for research training	trainee	66	3.95	.753	.093
	educator	40	3.78	1.025	.162
10. Barriers to research training: lack of protected time*	trainee	67	4.39	.887	.108
	educator	40	3.83	1.107	.175
11. Barriers to research training: lack of skills & knowledge	trainee	68	3.76	1.067	.129
	educator	40	4.15	.864	.137
12. Barriers to research training: lack of mentorship	trainee	65	3.71	1.011	.125
	educator	40	3.65	1.075	.170
13. Barriers to research training: lack of interest**	trainee	68	2.35	1.089	.132
	educator	40	3.53	.960	.152
14. Barriers to research training: lack of research questions***	trainee	68	3.07	1.137	.138
	educator	36	2.53	1.158	.193
15. New curriculum needs: methodology*	trainee	68	3.99	.743	.090
	educator	40	4.40	.810	.128
16. New curriculum needs: biostat.	trainee	68	3.87	.845	.102
	educator	40	3.88	.853	.135

17. New curriculum needs: epidemiology	trainee	67	3.67	.746	.091
	educator	40	3.75	.870	.138
18. New curriculum needs: scientific writing skills	trainee	68	4.22	.826	.100
	educator	40	4.33	.797	.126
19. New curriculum needs: research ethics	trainee	68	3.85	.885	.107
	educator	40	4.10	1.008	.159
20. New curriculum needs: critical appraisal skills	trainee	68	4.21	.724	.088
	educator	40	4.35	.622	.098
21. New curriculum application: First year trainee not ready to start research project?	trainee	69	3.43	1.266	.152
	educator	40	3.20	1.159	.183
22. New curriculum application: First year trainee more likely to complete research project?	trainee	68	2.82	.897	.109
	educator	40	3.10	1.081	.171
23. New curriculum application: Should have hands-on component!	trainee	68	3.90	.949	.115
	educator	40	4.15	.736	.116
24. New curriculum application: Should be mandatory!	trainee	70	3.71	1.024	.122
	educator	40	4.00	.987	.156
25. New curriculum application: should be longitudinal!	trainee	70	3.96	.875	.105
	educator	40	4.23	.768	.121

*p<.01, **p<.001, ***p<.05

4.4 Factor analyses and reliability

Exploratory factor analysis was used to determine which items on the survey belonged together (i.e., became a 'factor' or 'scale'). This analysis allows the identification of the factors and numbers of factors for the instrument, the description of the relative variance accounted for by each factor and their coherence. These factors can then be used to establish the key domains (e.g., attitude towards research) for improvement while the items within each factor would provide more precise information about specific behaviors.

Several exploratory factor analyses were conducted resulting in 8, 6, and four factors. It was determined that the optimum solution was 4 factors as they accounted for 45% of the variance in the trainees data and for more than 55% in the educators data, were cohesive and

made theoretical sense (for trainees data-set see Table-4.12, and for educators data-set see Table-4.13 which show principal component orthogonally rotated Varimax factor matrix to the normalized Kaiser criterion). This optimum factor analysis solution resulted in the 4 following factors: (1) attitude towards research, (2) planning future curriculum, (3) barriers, and (4) resources.

As can be seen from the Table-4.12 and Table-4.13, the eigenvalue for the Factor 1 and 2 (attitude towards research and planning future curriculum) is larger (trainees: 4.387 and 4.339, educators: 5.004 and 4.427 respectively) compared to the rest of the factors. This shows that the participants attitude towards research and ideas of planning future curriculum across participant role, age, sex, professional level and discipline were rated as the highest components in the process of needs assessment for the research curriculum (accounting for a 34.9% of the variance among trainees and for a 36.2% of the variance among educators; see Table-4.12 and Table-4.13).

Table-4.12: Trainees data-set Principal Component Orthogonally Rotated Varimax Factor Matrix to the Normalized Kaiser Criterion

Item	Component			
	1	2	3	4
	Attitude towards research	Planning future curriculum	Barriers	Resources
1. Attitude toward research: mandatory training	**.712**	-.080	-.267	.114
2. Attitude toward research: improve patient care	**.746**	-.089	-.109	-.085
3. Attitude toward research: enhance academic career	**.768**	.053	-.135	.247
4. Attitude toward research: increase clinical investigator	**.675**	.026	.100	-.008
5. Attitude toward research: facilitate fellowship acceptance	**.688**	-.199	.098	.119
6. Attitude toward research: asset to future career	**.815**	.011	.093	.322
7. Attitude toward research: training in research will compromise medical expert competency	-.026	-.123	**.677**	-.122
8. Current research training: current efforts are insufficient?	.099	-.001	-.155	**.784**
9. Research resources in KFSH&RC represent rich environment for research training	-.055	-.256	-.365	**.280**
10. Barriers to research training: lack of protected time	.176	.119	-.057	**.725**
11. Barriers to research training: lack of skills & knowledge	-.051	**.494**	.364	.463
12. Barriers to research training: lack of mentorship	-.134	-.023	**.742**	.235
13. Barriers to research training: lack of interest	-.449	-.052	**.115**	-.083
14. Barriers to research training: lack of research questions	-.224	-.114	**.338**	.013
15. New curriculum needs: methodology	.112	**.815**	-.029	.033
16. New curriculum needs: biostat.	-.005	**.827**	.118	-.114
17. New curriculum needs: epidemiology	.011	**.747**	.156	-.038
18. New curriculum needs: scientific writing skills	.152	**.781**	.227	.232
19. New curriculum needs: research ethics	-.076	**.653**	-.428	-.092

20. New curriculum needs: critical appraisal skills	.155	**.813**	-.159	.263
21. New curriculum application: First year trainee not ready to start research project?	-.025	.145	**.556**	-.141
22. New curriculum application: First year trainee more likely to complete research project?	-.127	**.378**	-.174	.080
23. New curriculum application: Should have hands-on component!	.107	.226	.267	**.313**
24. New curriculum application: Should be mandatory!	**.567**	.222	-.200	-.053
25. New curriculum application: should be longitudinal!	**.639**	.237	.178	-.141
Eigenvalue	4.387	4.339	2.341	2.003
% of Variance	17.546	17.357	9.363	8.014
Mean	4.201	3.801	3.102	3.976
Cronbach`s alpha	.855	.837	.524	.533

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 6 iterations.

Table-4.13: Educators data-set Principal Component Orthogonally Rotated Varimax Factor Matrix to the Normalized Kaiser Criterion

Items	Component			
	1	2	3	4
	Attitude towards research	Planning future curriculum	Resources	Barriers
1. Attitude toward research: mandatory training	**.684**	.063	.386	-.162
2. Attitude toward research: improve patient care	**.695**	.071	.363	-.243
3. Attitude toward research: enhance academic career	**.818**	.055	.137	-.177
4. Attitude toward research: increase clinical investigator	**.790**	.142	.269	-.229
5. Attitude toward research: facilitate fellowship acceptance	**.781**	.117	.043	.138
6. Attitude toward research: asset to future career	**.821**	.130	.159	.074
7. Attitude toward research: training in research will compromise medical expert competency	-.306	.050	.028	**.645**
8. Attitude toward research: intention to support research curriculum	.167	.233	**.513**	-.208
9. Current research training: current efforts are insufficient?	.087	-.358	**.425**	.080
10. Research resources in KFSH&RC represent rich environment for research training	.249	-.379	**.223**	-.321
11. Barriers to research training: lack of protected time	**.433**	.000	.087	.347
12. Barriers to research training: lack of skills & knowledge	**.251**	.053	.598	.018
13. Barriers to research training: lack of mentorship	.117	.087	.454	**.481**
14. Barriers to research training: lack of interest	**.623**	-.050	-.101	.231
15. Barriers to research training: lack of research questions	-.002	-.218	-.248	**.776**
16. New curriculum needs: methodology	.183	**.817**	-.028	-.177

17. New curriculum needs: biostatistics	-.041	**.789**	-.230	.126
18. New curriculum needs: epidemiology	-.049	**.809**	.074	.243
19. New curriculum needs: scientific writing skills	.104	**.761**	.183	-.028
20. New curriculum needs: research ethics	.102	**.838**	-.081	-.106
21. New curriculum needs: critical appraisal skills	.127	**.746**	.162	-.066
22. New curriculum application: First year trainee not ready to start research project?	**.152**	-.016	-.670	.073
23. New curriculum application: First year trainee more likely to complete research project?	.146	**.382**	.282	.220
24. New curriculum application: Should have hands-on component!	.341	-.077	**.492**	.211
25. New curriculum application: Should be mandatory!	.300	-.064	**.683**	.066
26. New curriculum application: should be longitudinal!	.261	.145	.175	**.448**
Eigenvalue	4.766	4.409	2.929	2.195
% of Variance	18.330	16.958	11.267	8.444
Mean	4.125	3.986	4.125	3.256
Cronbach`s alpha	.775	.854	.599	.540
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 6 iterations.				

The results above (Table-4.12 and Table-4.13) show variable level of reliability of each factor ranging from poor to good level (the range of Cronbach`s alpha among trainees: 0.52-0.86, and among educators: 0.54-0.85).

Trainees' and educators' data-set factor analyses showed the best coherence of factors in factor 1 and 2 (Cronbach's alpha among trainees: Factor 1: .855, Factor 2: .837, and among educators: Factor 1: .775, Factor 2: .854). The overall pattern of factor loadings in Factor 1 and 2 also supported the coherence of the factors. For example, among Factor 1 (attitude towards research), "enhance academic career" (trainee: 0.768, educator: 0.818) and "asset to future career" (trainee: 0.815, educator: 0.821), also among Factor 2 (planning future

curriculum), "methodology" (trainee: 0.815, educator: 0.817) and "biostatistics" (trainee: 0.827, educator: 0.789). On the other hand, both factor 3 and Factor 4 for both trainees' and educators' data-set showed poor level of internal consistency (Cronbach's alpha among trainees: Factor 3: .524, Factor 4: .533, and among educators: Factor 3: .599, Factor 4: .540). Some loadings in each factor were low, with one loading very low (0.055).

4.5 Qualitative analysis

Both trainees' and educators' questionnaires contained an open-ended question to list general suggestions for research curriculum development. The collected data transcribed to identify themes that emerged.

4.5.1 Trainee questionnaire: Suggestions for curriculum development:

The last question in the trainees' questionnaire was an open ended question for any suggestion directed to research training. Twenty seven out of seventy (27/70) participants responded to this part of the questionnaire with some suggestions, ideas and few shared their experience and stories related to research training. The majority of participants to this section found to be: females (56%), (31-35 years) age group (41%), fellows (56%), from medical disciplines (74%), and graduated from King Saud University (26%). The ideas and suggestions were pooled and analyzed to come up with common themes which can be used for curriculum planning.

a. Research training block to be part of any PGME residency and fellowship programs: This was the commonest suggestion among the answers for this question (44% of the respondents to this question have mentioned this suggestion). The major goal was to ensure sufficient time to be secured for research training. Many participants justified this request with the busy service in KFSH&RC being the major barrier for their participation in research. Two different ways have been proposed to apply this suggestion; either securing one day per

week for senior residents and fellows or blocking a minimum of eight weeks rotation dedicated for research training during PGME program period.

b. Research projects to be among graduation requirements for PGME programs:

Twenty six percent of participants to this question suggested that research projects should be an integral part of research curriculum. Many of these participants stressed the point that didactic activity will not be sufficient to address their needs and competency in research skills will be better achieved when hands-on experience is included.

c. Establish effective research training mentorship program:

Fifteen percent of participants to this question addressed the important (and missed) role of an effective mentorship program. Many of these participants believe that the available resources and staffing in KFSH&RC if coupled with an effective mentorship program represent a great environment for research training.

d. Utilization of standardized and structured activities related to research training:

Fifteen percent of participants to this question suggested structured educational activities like courses and workshops to address research training. Different aspects of knowledge and skills related to research were suggested to be covered by these activities which include: epidemiology, biostatistics, research methodology, research ethics, scientific writing, and critical appraisal. Some participants suggested utilization of the available and well recognized online resources (like the National Institution for Health "NIH" online research courses) to be among all PGME programs requirements.

e. Others:

Some participants raised ideas related to the process of applying the research curriculum and others shared their stories with research training. Few participants stressed the importance of realistic and level-appropriate activities; and "to build and apply any proposed curriculum gradually otherwise it will be boring and hard to follow" as one participant stated. Few

participants raised the issue of considering differences in the background training of fellows especially for those who have no prior training in KFSH&RC as they might need extra time and preparation when compared with those fellows who have had their residency program done in KFSH&RC. One participant shared the story of his program director refusing to accept the evaluation of his elective rotation in research (claiming that trainee did not gain experience or exposures which can be accounted for his specific PGME program objectives!). This trainee overcome the situation after convincing his program director with the excellent achievement he gain during that rotation which resulted in two publications of a retrospective study and a case report. This story indicated the need for increasing awareness among program directors and staff involved in PGME programs.

4.5.2 Educator questionnaire: Suggestions for curriculum development

The last question in the educators' questionnaire was an open ended question for any suggestion directed to research training. Fifteen out of forty (15/40) participants responded to this part of the questionnaire with some suggestions, ideas and few shared their experience related to research training. The majority of participants to this section found to be: Males (73%), (41-50 years) age group (53%), program directors (60%), and from medical disciplines (40%). The ideas and suggestions were pooled and analyzed to come up with common themes which can be used for curriculum planning.

a. Research training block to be part of any PGME residency and fellowship programs in addition to staff protected time:

This was the commonest suggestion among the answers for this question (26% of the respondents to this question have mentioned this suggestion). The major goal was to ensure sufficient time to be secured for research training. Many participants justified this request with the busy service in KFSH&RC being the major barrier for both trainee and educator participation in research. In addition to measures to ensure that trainees will have secured

time for research training, some participants have addressed the importance of applying measures to support educators involvement like recruiting more educators and providing them with protected time for research activities. Few of the participating educators pointed the important role of the Saudi Commission for Health Specialties (SCFHS), as the organizing body of PGME programs across the country, to establish regulations and strategies for research training.

b. Research projects to be among graduation requirements for PGME programs:

Unlike the trainees consensus on this theme, educators had different views whether research projects should be mandated or not during any proposed curriculum. The majority of the participating educators stressed the point that didactic activity will not be sufficient and hands-on experience with research projects is needed to ensure competency in research skills. On the other hand, few of the participating educators suggested that educational activities related to research knowledge and skills should be mandatory component of PGME programs however, research projects should be kept as an optional component of these activities. The justification was that if research projects become mandatory for every PGME trainee they will result in significant time and effort demands which might interfere with clinical exposures, or become impossible to apply universally.

c. Utilization of standardized and structured courses related to research training:

Similar to suggestions from trainees, few of the participating educators suggested utilization of the pre-existing structured educational activities like courses and workshops to address research training. Different aspects of knowledge and skills related to research were suggested to be covered by these activities which include: epidemiology, biostatistics, research methodology, research ethics, scientific writing, and critical appraisal.

d. Others:

Few of the participating educators expressed other thoughts and believes related to research training. One participant raised the point of the differences between the residency and fellowship programs. He suggested paying more attention to research training during fellowship training in comparison to residency training. Another participant suggested increasing the number of accepted trainees in fellowship programs to enhance research training and productivity.

One participant indicated that the research centre, which is part of KFSH&RC has not been utilized to address research training by PGME programs in an effective way. Two participants have come up with contradicting believes, one stated that: "there is total failure of hospital to support research programs" and another one stated that: "there is already initiative group formed to address this issue". This might indicate the need to improve communication between staff involved in PGME programs and the need to establish clear strategies for research training at institutional level.

CHAPTER 5

DISCUSSION

This project represents a needs assessment to develop a research curriculum for PGME programs in one of the largest tertiary healthcare institutions of Saudi Arabia. Both trainees (of residency and fellowship programs) and educators (working as program directors, researchers, or clinician educators) were surveyed in seven different domains: attitudes, productivity, existing efforts, available resources, barriers, perceived needs and suggestions concerning research training in their PGME programs at KFSH&RC. Our study showed similar findings observed in most of similar investigations with regard to PGME trainees' and educators' attitude toward research training.

5.1 What are the perceived needs, from this study to be considered for the development of research curriculum?

The trainees and educators had a consensus regarding the positive impact of research training on several aspects of patient care and training outcomes. Concerning the fear that research training might interfere with trainees effort to become medical experts in their field, unlike the trainees, the educators were more clear and had consensus that this fear is not valid.

Trainees and educators reported contradicting trends regarding research productivity. Trainees' responses indicated low rate of research involvement, whereas educators' responses indicated opposite results. This is likely due to the fact that research productivity is adequate at educator's level however, trainee's involvement is low. Both trainees and educators shared similar consensus that current strategies are not sufficient to enhance research training. However, both trainees and educators had opposite beliefs regarding the existing research educational activities. As the majority of trainees reported the lack of those educational activities, equal proportion of the educators reported the opposite.

This might indicate that existing research educational activities do not meet the trainees' specific needs or this might be due to underutilization of these activities (because of low encouragement of PGME programs of their trainees to attend or due to the lack of protected time). Both trainees and educators agreed that the available resources in their institution represent a rich environment to enhance research training. Nevertheless, the majority of trainees believe that mentorship and opportunities to participate in research projects are inadequate. This indicates that there is a great need to utilize the pre-existing resources to support trainees' involvement in research projects.

Both trainees and educators had similar views regarding barriers against research training which include: lack of protected time, lack of research skills, and lack of mentorship program. However, they hold different views regarding trainees lack of interest in research as a barrier (the majority of trainees disagreed with this, whereas the majority of educators agreed on this). The trainees had no consensus regarding the lack of research ideas as a barrier to research involvement, whereas the majority of educators disagreed with this statement. Both trainees and educators came to a consensus regarding their perceived needs for the components of research curriculum in the following sequence: literature review and critical appraisal, scientific writing, research methodology, research ethics, biostatistics, and epidemiology. Both trainees and educators exhibited vague views regarding the impact of applying the research curriculum during junior or senior levels of training (whether or not junior trainee will be ready to start and to complete research projects compared to senior one). Of note, both trainees and educators agreed that any proposed research curriculum to be a mandatory part of their PGME training, to be longitudinal program rather than short format, and to involve hands-on experience for research projects.

Between group comparisons among trainees showed young trainees to have higher number of publications, attending larger number of educational lectures, and larger

proportion reporting availability of mentorship in research training compared to older trainees. These observations indicate improvement in research productivity and training. Trainees from surgical disciplines reported higher rate of lack of mentorship and higher rate of lack of interest in research training compared to other disciplines. Future educational strategies should consider these observations to enhance research training.

Between group comparisons among educators showed that younger educators compared to older ones had slightly less believe that research activity will enhance academic career, and had slightly less believe that research activity will be an assist for future career. These observations might indicate that there is a need to enhance research activities by putting more weight on research productivity as a part of career promotion criteria. In addition to this, physician's joint appointment as faculty members in medical schools will help to improve educators' attitude towards research role in relation to their career. Younger educators were also noted to report lack of skills as a barrier of research training more than older educators. This indicates the need for "training trainer" programs.

Comparisons between trainees and educators showed some discrepancy between the two groups. Educators scored higher in the following items: research training increases clinical investigator, lack of interest as a barrier to research training, and methodology as an important component of the proposed research curriculum. Trainees scored higher in the following two areas: research training will compromise medical expert competency, and lack of protected time and lack of research questions as barriers to research training. These differences need to be considered in any future educational strategies. For example, PGME programs showed provide opportunities for trainees to express their interest in research training to their educators, and trainees should be assured that competency in research skills is in fact an assist to improve medical expert competency.

5.2 The benefits of research curriculum implementation from the available literature

Application of specific research curricula have shown positive outcomes such as: increased residents participation in research proposal submission, conference presentations, manuscript publication, research grant, and improved residents' research skills.[14, 19, 36-37] There are positive impacts as well on the faculty members involved in these curricula with their increased interest in and appreciation for the role of research in the their area of interest.[38] Kanna and college reported their experience at Lincoln Hospital, an affiliate of Weill Medical College Cornell University New York, in designing and implementing a structured research curriculum based on the *Accreditation Council for Graduate Medical Education* (*ACGME*) competencies taught during a dedicated research rotation.[37] The needs assessment for their curriculum was based on the annual on-line ACGME internal medicine resident program survey in the year 2004. The process elements included in the curriculum were: core lecture series on biostatistics and research methodology (an intensive 2-hour weekly sessions on research methodology for 4 weeks every year), completion of at least one scholarly activity under guidance of a faculty mentor and presentation of research projects (including annual research competition).

This curriculum showed significant improvement in scholarly activities outcomes in the group of residents who have done the research rotation when compared to those who didn't have it yet. The rotators group had significantly more residents participating in scholarly activities than the non-rotators ($p < 0.001$). The rotators group also outperformed the non-rotators group in total research projects (published & non-published) ($p < 0.001$) and letters to editors ($p < 0.001$). The number of residents who were able to publish among the rotators was marginally significant than the other group ($p = 0.053$). There were no significant differences in presentations between the two groups. Kohlwes et al. demonstrate that integration of clinical research training curriculum in another internal medicine residency

program have shown similar outcomes.[19] Among 32 residents in 4 years, 22 residents have produced 20 papers in peer-reviewed journals, 1 paper under review, and 2 book chapters. Their clinical evaluations are equivalent to other programs' residents. The authors concluded that participants' clinical skills did not suffer while participating in the clinical research curriculum, and the participants were motivated by the opportunity of performing mentored clinical research projects and take personal satisfaction from accomplishing this task during residency.

The study lacked a comparison group for research productivity for participants. Also this study cannot determine the extent to which the curriculum contributed to the resident's research productivity beyond the talent of the individual mentee and mentor. Such a positive impact was reported by implementing a resident research curriculum for pediatric residents at University of Alberta.[14] Compared with the year preceding curriculum implementation, there was an increase in the proportion of residents who had at least one conference presentation, manuscript publication, and internal or external research grant 2 years after curriculum initiation; however, none of the observed differences were statistically significant. This probably was due to inadequate power because of the unavoidably small sample size. Finally, Fraker et al reported the impact of a 5-day mandatory research methodology course designed for the first-year emergency medicine residents.[36]

The course involved didactic lectures paired with appropriate practical workshops and completion of a mock research project. Following completion of the course, the 16 emergency medicine resident participants showed significant improvement in research knowledge, assessed by pre- and post-tests. Resident's final course presentations were given ratings of "above average" to "superior" by all observing faculty members. Eighty seven percent of the residents felt that developing a mock project during the course increased their confidence and interest in conducting future academic research. Fischer and Cation described

a strategy to increase resident research activity implemented in a community-based internal medicine residency program.[38] Strategy components included a resident research director, a research elective, cost reimbursement, and a research requirement. The annual number of research submissions increased from 0 to 39 over 6 years. The greatest increase in number of research submissions was seen following the dual implementation of the cost reimbursement and research requirement interventions. The annual number of faculty coauthors rose from 0 to 24 in 6 years. Average cost per accepted project was $1,023.00.

5.3 Barriers to research training during PGME

Many barriers to residents' research have been identified. These include a lack of protected research time, a lack of individual resident interest or skill, and a lack of adequate faculty mentorship. [14, 32, 39] A survey of residents who presented at the 2002 American College of Physicians (ACP) Annual Session revealed that 44% of residents thought that the absence of a research curriculum was identified as a barrier to completion of a research project.[40] However, in a survey of internal medicine program directors in 1996, Alguire and colleagues demonstrated that only 37% of programs had an organized and comprehensive research curriculum.[41] A survey was conducted to review the state of resident research at internal medicine training programs since the introduction of the scholarly activity requirement, indicated that non university-based programs are doing as much as university-based programs in fulfilling scholarly activity requirement in spite of greater barriers.[42]

In a systematic review of published resident research curricula, Herbert and colleagues concluded that a lack of detailed developmental information and meaningful evaluation methods were barriers to effective implementation.[11] Positive factors included protected research time, a formal research program including access to biostatisticians and seminars addressing research methodology, exposure to and guidance from mentors, an environment supportive of research and adequate funding to support conference attendance.[14]

5.4 Limitations of the present study

Some limitations were encountered for this study. In spite of many efforts to increase the response rate of the targeted participants the achieved rate only slightly exceeded 55% for both trainees and educators. The large number of PGME programs in KFSH&RC and the use of hard copy format of the questionnaires resulted in unexpected time and effort demands for the investigator to conduct the survey. The use of electronic or web-based survey methods represent an alternative approach which may improve response rate with fewer demands. The low rate of participation of some PGME programs raised concerns of their under representation in this survey results. Some items of the survey might be liable for recall bias (e.g. research productivity and educational activities), which might be better addressed by reviewing records of residents' research day and/or institutional research registry.

Another limitation towards generalization of this study finding is that the tertiary level and the research infrastructures available in KFSH&RC would make the respondents' views toward the subject matter different than other population of different PGME environments. Further investigation should include more heterogeneous PGME programs.

Voluntary response bias can not be completely excluded, as those interested in research will have higher response rate compared to those who are not interested. The questionnaire wordings were cautiously selected to avoid any source of response bias.

5.5 Implications for future research:

The results of the present study can be utilized to facilitate the planning and implementation of a research curriculum for PGME programs at KFSH&RC. Future research will be required to evaluate the impact of such curriculum and as a result will provide a feedback mechanism to improve curriculum planning and implementation.

Though the results of this study can be used to help in planning and implementation of research curriculum in other institutions similar to KFSH&RC, they should not replace the

need for institutional needs assessment process to identify the specific needs of identified learners. Hence, the findings of this study can be used as a guideline for each PGME program planners to find the assessment needs for their trainees in order to enhance their skills in research. Further studies of the present sort should include larger samples of respondents to the survey and heterogeneous and larger focus groups.

5.6 Conclusions

In the present study the needs assessment step to develop a research curriculum for PGME programs at KFSH&RC has been conducted. Participants of the present study largely agreed that a research curriculum is highly desirable in PGME programs at KFSH&RC and that this should not compromise competency in becoming a medical expert. The majority of participants believed that a research curriculum should be mandatory, involve training with hands-on research projects, provide protected time, and ensure effective mentorship. The proposed curriculum content includes scientific writing, literature review and critical appraisal, research methods, biostatistics, research ethics, and epidemiology.

REFERENCES

1. Albanese MA, Mejicano G, Mullan P, Kokotailo P, Gruppen L; Defining characteristics of educational competencies; Med Educ 2008 Mar;42(3):248-55.

2. Wood E, Kronick JB; Association of Medical School Pediatric Department Chairs, Inc. : A pediatric residency research curriculum: J Pediatr. 2008 Aug;153(2):153-4, 154.e1-4.

3. Medical School Objectives Project. Learning objectives for medical student education – guidelines for medical schools. Report 1 of the Medical School Objectives Project. Acad Med 1999;74(1):13–8.

4. Frank, JR. (Ed). 2005. The CanMEDS 2005 physician competency framework. Better standards. Better physicians. Better care. Ottawa: The Royal College of Physicians and Surgeons of Canada.

5. Abramson M: Improving resident education: what does resident research really have to offer; Trans Am Acad Ophthalmol Otolaryngol 1977;84:984-5.

6. Hillman BJ, Fajardo LL, Witzke DB, Cardenas D, Irion M, Fulginiti JV; Factors influencing radiologists to choose research careers; Invest Radiol 1989;24:842-8.

7. Rosenberg LE: Young physician-scientists: internal medicine's challenge; Ann Intern Med 2000; 133:831-2.

8. Souba WW, Tanabe KK, Gadd MA, Smith BL, Bushman MS: Attitudes and opinions toward surgical research: A survey of surgical residents and their chairpersons. Ann Surg 1996; 223:377-83.

9. American Academy of Pediatrics Committee on Pediatric Research. Promoting education, mentorship, and support for pediatric research; Pediatrics 2001;107:1447-50.

10. Kern DE, Thomas PA, Howard DM, Bass EB. Curriculum development for medical education: a six-step approach; Johns Hopkins University Press; 1998.

11. Hebert RS, Levine RB, Smith CG, Wright SM; A systematic review of resident research curricula; Acad Med. 2003;78:61–8.

12. King Faisal Specialist Hospital and Research Centre (KFSH&RC); Academic and Training Affairs: Postgraduate Medical Training Programs: Fellowship and Residency. Date Updated:25 November 2008. Available from: http://bportal.kfshrc.edu.sa.

13. scfhs.org.sa[home page on the Internet]. Saudi Commission for Health Specialities (SCFHS); Role of the commission; "Arabic text": http://scfhs.org.sa/index.php?option=com_content&task=view&id=66&Itemid=103.

14. Roth D, Chan MK, Vohra S; Initial successes and challenges in the development of a pediatric resident research curriculum; J Pediatr 2006:149:149-50.

15. Brautigan M; A systematic approach to research curricula for emergency medicine residencies; J Emerg Med 1984: 1:459-64.

16. Jones J, Doughety J, Cannon L, Schelble D; Teaching research in the emergency medicine residency curriculum; Ann Emerg Med Mach 1987; 16:347-53.

17. Titus MO, Losek JD, Givens TG; Pediatric emergency medicine fellowship research curriculum; Pediatr Emer Care 2009;25: 550-54.

18. Ruiz J, Wallace EL, Miller DP, Loeser RF, Miles M, DuBose TD, Lichstein PR; A comprehensive 3-year internal medicine residency research curriculum; Am J Med 2011 May;124(5):269-73.

19. Kohlwes RJ, Shunk RL, Avins A, Garber J, Bent S, Shlipak MG; The PRIME curriculum: Clinical research training during residency; J Gen Intern Med 2006; 21:506–509.

20. Madariaga MG, Evans AT, Brobbey W, Phillips M, Lo E, Rezai K, Schwartz DN, Trenholme GM, Weinstein RA; Learning by doing: Developing fellows' academic skills through collaborative research; Med Teach 2006;28(1):77-80.

21. Ross R, Verdieck A; Introducing an evidence-based medicine curriculum into a family practice residency is it effective; Acad Med 2003;78:412-17.

22. Supino P, Borer J; Teaching clinical research methodology to the academic medical community: a fifteen-year retrospective of a comprehensive curriculum; Med Teach 2007;29:346-52.

23. Rivera R, Borasky D, Rice R, Carayon F; Many worlds, one ethics: Design and development of a global research ethics training curriculum; Dev World Bioeth 2005;5(2):169-75.

24. Knowles MS: The Modern Practice of Adult Education: Andragogy versus Pedagogy. New York: Association Press, 1970, pp 85.

25. Hauer J, Quill T. Educational needs assessment, development of learning objectives, and choosing a teaching approach. J Palliat Med. 2011 Apr;14(4):503-8.

26. Kourosh, Fathi Vajarga. Needs based curriculum approach: Toward a new conception of national curriculum. Paper Presented at Australian Curriculum Studies Association Conference; 29 September - 2 October 1999, Perth, Western Australia: http://www.acsa.edu.au/pages/images/99_kourosh_needs_based.pdf.

27. Ratnapalan S, Hilliard RI. Needs assessment in postgraduate medical education: A review. Med Educ Online 2002;7:8.

28. Kaufman R; Needs assessment: Concept and application. New Jersey: Educational Technology Publications, 1979, pp 60.

29. Tyler RW; Basic principles of curriculum and instruction. Chicago: The University of Chicago Press, 1949.

30. Ratnapalan S, Hilliard RI; Needs assessment in postgraduate medical education: a review. Med Educ Online [serial online] 2002;7:8. Available from URL: http://www.med-ed-online.org.

31. Grant J; Learning needs assessment: assessing the needs; BMJ. 2002 Jan 19;324(7330):156-9.

32. Ullrich N, Botelho CA, Hibberd P, Bernstein HH; Research during pediatric residency: Predictors and resident-determined influences; Acad Med 2003;78:1253-58.

33. Segal NA, Garvan CW, Basford JR; Factors influencing involvement in research and career choice: A survey of graduating physical medicine and rehabilitation residents; Arch Phys Med Rehabil Nov 2006;87: 1442-46.

34. Silcox LC, Ashbury TL, VanDenKerkhof EG, Milne B; Residents' and program directors' attitude toward research during anesthesiology training: A Canadian perspective; Anesth Analg 2006;102:859 –64.

35. Alghanim SA, Alhamali MA; Research productivity among faculty members at medical and health schools in Saudi Arabia: prevalence, obstacles, and associate factors; Saudi Med J 2011; Vol. 32 (12): 1297-1303.

36. Fraker LD, Orsay EM, Sloan EP, Bunney EB, Holden JA, Hart RG; A novel curriculum for teaching research methodology; J Emerg Med 1996 Jul-Aug;14(4):503-8.

37. Kanna B, Deng C, Erickson SN, Valerio JA, Dimitrov V, Soni A; The research rotation: competency-based structured and novel approach to research training of internal medicine residents; BMC Med Educ 2006 Oct;17;6:52.

38. Fischer JL, Cation LJ; Impact of a residency research program on research activity faculty involvement and institutional cost; Teach Learn Med 2005 Spring;17(2):159-65.

39. Gill S, Levin A, Djurdjev O, Yoshida EM; Obstacles to residents' conducting research and predictors of publication; Acad Med 2001 May;76(5):477.

40. Rivera JA, Levine RB, Wright SM. Completing a Scholarly Project During Residency Training Perspectives of Residents Who Have Been Successful; J Gen Intern Med 2005 Apr;20(4):366-9.

41. Alguire PC, Anderson WA, Albrecht RR, Poland GA; Resident Research in Internal Medicine Training Programs; Ann Intern Med. 1996 Feb 1;124(3):321-8.

42. Levine RB, Hebert RS, Wright SM; Resident Research and Scholarly Activity in Internal Medicine Residency Training Programs; J Gen Intern Med 2005 Feb;20(2):155-9.

APPENDIX A: PGME programs offered by KFSH&RC

PGME Programs offered by KFSH&RC

Residency Programs:

- Anesthesiology*
- Emergency Medicine*
- General Surgery*
- Internal Medicine*
- Neurology*
- Neurosurgery*
- Obstetrics & Gynecology*
- Orthopedic Surgery*
- Otolaryngology*
- Pediatrics Neurology*
- Pediatrics*
- Plastic Surgery*
- Radiology*
- Urology*
- Dermatology*
- Psychiatry*
- Pathology*
- Dentistry*

Fellowship Programs

Anesthesiology
- Cardiac Anesthesia*
- Pain Management
- Pediatric Anesthesiology*

Emergency Medicine
- Pediatric Emergency Medicine*

King Faisal Cancer Center
- Adult Hematology*
- Medical Oncology
- Palliative Care

King Faisal Heart Institute
- Adult Cardiology*
- Pediatric Cardiology*

Liver Transplantation & Hepatobiliary-Pancreatic Surgery
- Hepatobiliary Pancreatic Surgery

Medical Genetics
- Medical Genetics

Medicine
- Critical Care Medicine*
- Endocrinology & Metabolism*
- Gastroenterology*
- Infectious Diseases*
- *Nephrology**
- Pulmonary Medicine*
- Rheumatology*

Neurosciences
- Epilepsy and EEG
- Pediatric Neurological Surgery

Obstetrics & Gynecology
- Gynecological Oncology
- Maternal Fetal Medicine
- Reproductive Medicine

Orthopedic Surgery
- Adult Reconstructive Surgery
- Pediatric Orthopedics
- Musculoskeletal Surgical Oncology

Otolaryngology, Head & Neck Surgery and Communication Sciences
- Head and Neck Surgery

Pathology
- Anatomic Pathology
- Hematological Pathology

Pediatrics
- Allergy and Clinical Immunology
- Pediatric Gastroenterology, Hepatology & Clinical Nutrition*
- *Pediatric Endocrinology & Diabetes**
- *Pediatric Infectious Diseases**
- *Pediatric Intensive Care**
- *Pediatric Nephrology**
- *Pediatric Rheumatology**
- *Neonatal/Perinatal Medicine**

Pediatric Hematology/Oncology
- Pediatric Hematology/Oncology

Radiology
- Body Imaging
- Interventional Radiology
- Musculoskeletal Imaging
- Neuroradiology
- Nuclear Medicine
- Pediatric Radiology
- Woman Imaging

Renal Transplant Unit
- Renal Transplantation

Surgery
- Colorectal Surgery
- Endocrine & Breast Surgery
- Pediatric Surgery*
- Renal Transplant Surgery

Urology
- Pediatric Urology*
- Urological Surgical Oncology

** Saudi Subspecialty Certificate Program*

- *List from: http://bportal.kfshrc.edu.sa.*

APPENDIX B: Trainees questionnaire form

Part-1: Please tell us more about yourself:

A-I am a Female, Male

B-My age is: ≤25yrs, 26-30yrs, 31-35yrs, 36-40yrs, ≥41yrs.

C-I have graduated from_____university/medical school, year of graduation_____.

D-I am a: Resident, Fellow

E-My year of training is: 1, 2, 3, 4, 5.

F-My discipline is considered: Medical, Surgical, Laboratory, Other: _____

☺ - ☺ - ☺ - ☺ - ☺ - ☺ - ☺ - ☺ ☺ - ☺ - ☺ - ☺ - ☺ - ☺ - ☺ - ☺

Part-2: Please answer all of the following questions. Some questions require scoring From a 5-scale score, some require checking (√) your preferred answer, and some require you to fill some information in a blank space.

1. Training in research skills is an essential and important task that should be **mandated** in any residency/fellowship program "check (√) your preferred answer":

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

>>Comment:_____

_____

2. Benefits from residents/fellows research activities will include:

"check (√) your preferred answer":

A-Better patient care:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

B-Enhance pursuit of academic careers:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

C-Increase clinician investigators:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

D-Enhance residents chances to obtain acceptance and success in fellowship training:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

E-Asset to future career:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

>>Comment:_____

_____

3. Due to it's time/effort demands, Research training will **interfere** with residents/fellows efforts to become **medical experts** in their speciality "check (√) your preferred answer":

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

>>Comment:_____

_____

4. How many **research activity** you have been involved with (including basic science and clinical research which resulted in: grant, manuscript presentation or publication): "please indicate how many activity between [ ]"

- Grant(s) [ ],
- Publication(s) [ ],
- Manuscript presentation(s) [ ],
- Topic review and Case presentation(s) in department grand round [ ]

>>Comment:_____

_____

5. How many **educational activity** in research training have you attended since you started your training in KFSH&RC: "please indicate how many activities between [ ]"

- Course(s) [ ],
- Conference(s) [ ],
- Workshop(s) [ ],
- Lecture(s) [ ]

>>Comment:_____

_____

6. Do you have a **structured regular activity** in your program to enhance research training:

Yes: Please describe:_____

No:

>>Comment:_____

_____

7. Do you agree that **current academic strategies** applied for residents/fellows in KFSH&RC is **insufficient** to address research training "check (√) your preferred answer":

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

>>Comment:_____

_____

8. During your training in KFSH&RC how do you rate the available **opportunities** for residents/fellows research training "check (√) your preferred answer":

I have not come across any opportunity,

Rare to find,

Adequate,

More than enough,

>>Comment:_____

_____

9. During your training in KFSH&RC how do you rate the available **mentorship** for residents/fellows research training "check (√) your preferred answer":

No available mentors to support me!

Rare to find,

Adequate,

More than enough

>>Comment:_____

_____

10. Research **resources** at KFSH&RC represent a rich environment that can be utilized to enhance research training for residents/fellows "check (√) your preferred answer":

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

>>Comment:_____

_____

11. Concerning **barriers** that limited your involvement in research activity during your training at KFSH&RC "check (√) your preferred answer":

A-Lack of protected time:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

B-Lack of necessary skills and knowledge:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

C-Lack of mentorship:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

D-Lack of personal interest:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

E-Lack of ideas/research questions:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

-Others:

_____

_____

12. To develop a **research training curriculum** we need to know your needs. For each of the following curriculum items please select the appropriate **"priority level" matching your needs** "check (√) your preferred answer":

A-Research Methodology:

1 (Very low priority)	2 (low priority)	3 (neutral)	4 (high priority)	5 (Very high priority)
( )	( )	( )	( )	( )

B-Biostatistics:

1 (Very low priority)	2 (low priority)	3 (neutral)	4 (high priority)	5 (Very high priority)
( )	( )	( )	( )	( )

C-Epidemiology:

1 (Very low priority)	2 (low priority)	3 (neutral)	4 (high priority)	5 (Very high priority)
( )	( )	( )	( )	( )

D-Scientific writing:

1 (Very low priority)	2 (low priority)	3 (neutral)	4 (high priority)	5 (Very high priority)
( )	( )	( )	( )	( )

E-Research Ethics:

1 (Very low priority)	2 (low priority)	3 (neutral)	4 (high priority)	5 (Very high priority)
( )	( )	( )	( )	( )

F-Literature review and critical appraisal:

1 (Very low priority)	2 (low priority)	3 (neutral)	4 (high priority)	5 (Very high priority)
( )	( )	( )	( )	( )

-Others:

_____

_____

13. Considering **application** of a new "Research training **curriculum**" in your residency/fellowship program "check (√) your preferred answer":

A-First year residents/fellows when compared to more senior residents/fellows are not ready to start their research projects because they are overwhelmed with the new environment:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

B-First year residents/fellows when compared to more senior residents/fellows are more likely to complete their research projects:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

C-The curriculum should involve **"hands-on"** experience (i.e. research project):

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

D-The curriculum should be **mandatory**:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

E-The curriculum would function better if it is a **longitudinal program** running throughout residency/fellowship program rather than being a short course format:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

>>Comment:_____

_____

14. Write your suggestions to academic affairs regarding development of research training curriculum:

_____

_____

_____

_____

_____

_____

Thank you for your participation!

☺

APPENDIX C: Educators questionnaire form

Part-1: Please tell us more about yourself:

A-I am a Female, Male.

B-My age is: ≤35yrs, 36-40yrs, 41-50yrs, 51-60yrs, ≥61yrs.

C-Your role is a: ( ) Program Director, ( )Educator, ( )researcher.

D-Your discipline is considered as: Medical, Surgical, Laboratory,

Other:_____

☺ - ☺ - ☺ - ☺ - ☺ - ☺ - ☺ - ☺ - ☺ - ☺ - ☺ - ☺ - ☺ - ☺ - ☺ - ☺

Part-2: Please answer all of the following questions. Some questions require scoring From a 5-scale score, some require checking (√) your preferred answer, and some require you to fill some information in a blank space.

1.Training in research skills is an essential and important task that should be **mandated** in any residency/fellowship program "check (√) your preferred answer":

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

>>Comment:_____

_____

2. Benefits from residents/fellows research activities will include:

"check (√) your preferred answer"

A-Better patient care:

1(strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

B-Enhance pursuit of academic careers:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

C-Increase clinician investigators:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

D-Enhance residents chances to obtain acceptance and success in fellowship training:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

E-Asset to future career:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

>>Comment:_____

_____

3. Due to its time/effort demands, Research training will **interfere** with residents/fellows efforts to become **medical experts** in their specialty "check (√) your preferred answer":

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

>>Comment:_____

_____

4. I will support planning, implementation, and maintenance of research training curriculum in KFSH&RC:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

>>Comment:_____

_____

5. How many **residents/fellows** in your program are **involved** now or have participated in research activity in the past 5 years:

Answer: _____

>>Comment:_____

_____

6. How many **research projects** have been performed by **staff members** in your department over the past 5 years:

Answer: _____

>>Comment:_____

_____

7. Do you agree that current academic strategies applied for residents/fellows in KFSH&RC is **insufficient** to address research training "check (√) your preferred answer":

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

>>Comment:_____

_____

8. In your program are residents/fellows asked to perform a research project **as a requirement**:

No.

Yes; please describe:_____

>>Comment:_____

_____

9. Do you have any **educational activity** in your program which is primarily directed to enhance residents/fellows research training:

No,

Yes; please describe the **number** and **nature** of activities (e.g. Structured journal clubs, lectures, courses, workshops, conferences..etc):

_____

_____

_____

_____

-If yes; is the **completion** of a research project required during this activity?:

Yes,

No.

10. How much **time** is provided to allow residents/fellows in your program to participate in **research activity**:

No time is designated for research,

Optional rotation during electives,

Mandatory rotation: please describe:_____

Others:_____

>>Comment:_____

_____

11. Research **resources** at KFSH&RC represent a rich environment that can be utilized to enhance research training for residents/fellows "check (√) your preferred answer":

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

>>Comment:_____

_____

12. What **support/resources** is/are **available** to enhance residents/fellows research in your program:

"can (√) more than one answer"

Competitions and awards,

Funds to attend/present in conferences:

Biostatistics/methodology consultations:

Research day for research presentation:

Staff holding degrees in biostatistics/epidemiology:

Others:_____

>>Comment:_____

_____

13. What **barriers** do you think limited the participation of residents/fellows in your department in research activities "check (√) your preferred answer":

A-Lack of protected time:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

B-Lack of necessary skills and knowledge:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

C-Lack of mentorship:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

D-Lack of personal interest:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

E-Lack of ideas/research questions:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

-Others:

_____

_____

14. To develop a **research training curriculum** we need to know **current trainee needs**. For each of the following curriculum items please select the appropriate "priority level" matching the needs of current trainee in your program "check (√) your preferred answer":

A-Research Methodology:

1 (Very low priority)	2 (low priority)	3 (neutral)	4 (high priority)	5 (Very high priority)
( )	( )	( )	( )	( )

B-Biostatistics:

1 (Very low priority)	2 (low priority)	3 (neutral)	4 (high priority)	5 (Very high priority)
( )	( )	( )	( )	( )

C-Epidemiology:

1 (Very low priority)	2 (low priority)	3 (neutral)	4 (high priority)	5 (Very high priority)
( )	( )	( )	( )	( )

D-Scientific writing:

1 (Very low priority)	2 (low priority)	3 (neutral)	4 (high priority)	5 (Very high priority)
( )	( )	( )	( )	( )

E-Research Ethics:

1 (Very low priority)	2 (low priority)	3 (neutral)	4 (high priority)	5 (Very high priority)
( )	( )	( )	( )	( )

F-Literature review and critical appraisal:

1 (Very low priority)	2 (low priority)	3 (neutral)	4 (high priority)	5 (Very high priority)
( )	( )	( )	( )	( )

-Others:

_____

_____

15. Considering **application** of a new **"Research training curriculum"** for residency/fellowship program "check (√) your preferred answer":

A-First year residents/fellows when compared to more senior residents/fellows are not ready to start their research projects because they are overwhelmed with the new environment:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

B-First year residents/fellows when compared to more senior residents/fellows are more likely to complete their research projects:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

C-The curriculum should involve **"hands-on"** experience (i.e. research project) :

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

D-The curriculum should be **mandatory**:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

E-The curriculum would function better if it is a **longitudinal program** running throughout residency/fellowship program rather than being a short course format:

1 (strongly disagree)	2 (disagree)	3 (neutral)	4 (agree)	5 (strongly agree)
( )	( )	( )	( )	( )

>>Comment:_____

_____

16. Write your **suggestions** to academic affairs concerning development of research curriculum:

_____

_____

_____

_____

Thank you for your participation!

☺