

Barriers and Motivators for Research Among Biomedical Laboratory Scientists: A Mixed-Method Study in a Danish Pathology Department

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Clinical laboratories are essential to evidence-based healthcare, providing data critical for diagnosis and treatment. International ethical codes emphasize the role of biomedical laboratory scientists (BLS) in research and implementation of scientific advances. Despite this, Scandinavian literature reveals limited knowledge on BLS research, although barriers such as limited research culture, and academic confidence are explored in other healthcare professions. Hence, this study aims to explore barriers and motivators for BLS research.

This mixed-methods study was conducted at the Department of Pathology, Odense University Hospital. Seventy-four BLS's were invited to complete a questionnaire, and ten participated in follow-up semi-structured interviews. The questionnaire covered aspects and perceptions of research. Interviews were recorded and fully transcribed. Data was analyzed by descriptive statistics and thematic content analysis.

The survey response rate was 69%. All agree that BLS research is important in evidence-based practice, but fewer perceive it important for developing personal competencies. Awareness of the local research frameworks is limited, and insecurities about research skills and a wish for further training were expressed. Likewise, three main themes emerged from the interviews: limited awareness of research opportunities, motivators and barriers to conduct research, and self-perceived research competencies. Despite being motivated, barriers include work-life balance, impression of limited support from management and colleagues and a notion of inferiority to other professions. Most informants feel confident in laboratory tasks but uncertain about initiating projects and academic writing, expressing a need for mentorship and further research training.

In conclusion, this study reveals that BLS's recognize the importance of research for evidence-based practice but fewer in relation to their own professional growth. Most perceive research as an area for specialists or other professions, which limits their engagement. Barriers include limited knowledge on research opportunities, support systems and internal hierarchies. The informants emphasize the need for research culture, improved communication, mentorship, and collaboration to enhance motivation.

Keywords: Barriers, Motivators, Biomedical Laboratory Science, Research

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Introduction

Clinical laboratories play an essential role in patient care by ensuring high-quality medical testing, which supports clinical decision-making.¹⁻⁵ This provides healthcare professionals with objective, evidence-based data critical for disease prevention, diagnosis and treatment. A key goal of evidence-based and value-based laboratory medicine is to maximize the impact of laboratory tests. Thus, improving patient outcomes while optimizing resource use and minimizing unnecessary costs.^{1,2,4,6-9} This calls for a continuous process to ensure development and research meet the goals of evidence-based and value-based laboratory medicine.

The International Federation of Biomedical Laboratory Scientists (IFBLS) suggests a code of ethics for biomedical laboratory scientists (BLS) worldwide, that emphasizes the obligation of BLS's to contribute to healthcare through their professional competencies in laboratory medicine.¹⁰ The code highlights the duty of the BLS to implement scientific advances in laboratory analysis that benefit patients. This underscores the need for BLS's research to enhance practice and laboratory quality.¹⁰

Scandinavian publications addressing perspectives on BLS core competencies do not include references to laboratory research.^{11,12} However, the IFBLS guidelines explicitly identify planning, performing and implementing research as core competencies.¹³ Thus, there is a pressing need to enhance the focus on BLS research. Scandinavian laboratories often report BLS research projects as in-house implemented and rarely publish the results.^{14,15} This calls for a paradigm shift in sharing of research data, by publishing original evidence-based data to implement research.¹⁶

To date, there has been limited focus in Danish and international literature on BLS barriers and motivators to conduct research. However, such topics have been explored in other healthcare professions. Literature on research culture and implementation of research findings in the nursing- and allied

professions identifies considerable challenges.¹⁷⁻²⁴ These include a lack of research culture, dedicated time, financial resources and self-reported academic competencies as the most reported barriers. Likewise, Scandinavian studies examined barriers and motivators to research in the radiography profession.²⁵⁻²⁷ The studies revealed that radiographers are willing to conduct research. Despite this, the number of actively involved remains low due to multiple factors, including the lack of a robust research culture and a clear strategy for implementing clinical research. The Norwegian radiography profession even proposed a national research strategy to address the growing attention on research and implementation to accommodate barriers.²⁶

Integrating evidence into patient care is an ethical and professional duty for laboratory professionals.^{11,13,28} Despite this, getting research results into practice is often challenged or delayed.⁴ This emphasizes the importance of local applied laboratory research close to practice.^{4,23} In 2019, chief management of the Department of Pathology at Odense University Hospital (OUH), Denmark, provided an initiative to enable non-academic BLS's to conduct in-house laboratory research. This included financial support, five days of dedicated time for data collection, access to in-house support from researchers and opportunities for international conference participation. Even though several BLS's expressed interest in conducting research, none engaged in projects over a three-year period, suggesting the presence of unknown barriers. The aim of this study was to identify barriers and motivators to conduct research at the Department of Pathology, OUH, Denmark.

Method

Study Design

This mixed-method study was conducted in The Department of Pathology, OUH, Odense, Denmark, between June 2022 and November 2023, using a combination of questionnaires and individual semi-structured interviews. Seventy-four BLS working at the department

were invited to complete an online questionnaire, and ten BLS voluntarily signed up to participate in follow-up interviews.

Questionnaire Development and Validation

A draft of the questionnaire, written in Danish, was developed using Survey XACT. The content, comprehensibility, wording and response categories were evaluated by two BLS, with experience in questionnaire development, from other departments at the hospital, the department research leader and two patients from the in-house research committee. Based on the evaluation, the authors revised and improved the questionnaire. The final draft was accepted by both authors and the department research leader.

The questionnaire comprised of 42 items, including respondent characteristics, individual experiences and knowledge regarding research opportunities, prior and current participation in research projects, and opinion on BLS possibilities of research activities. The questionnaire included various formats: yes/no questions, multiple-choice questions, statements rated on a 5-point Likert scale (1 = lowest, 5 = highest), and a few open-ended questions. The inclusion of a neutral response category was carefully evaluated and deliberately incorporated into selected response options. The questionnaire was distributed via the in-house mailing system, and a reminder was distributed 2 weeks after to increase response rate. All questions were mandatory for the respondents to complete the questionnaire.

Semi-Structured Interviews

Ten BLS voluntary participated in the follow up individual interviews. Besides motivation to talk about BLS research, no further inclusion criteria were determined. The informants comprised eight females and two males, reflecting the approximate gender distribution of BLS at the department. None of the informants were employed as laboratory specialists or had any further education besides a bachelor's in biomedical laboratory science.

To ensure anonymity, no background information was collected besides gender and time of graduation, which was no longer than ten years for any of the informants. A semi-structured interview guide was developed prior to interviews and used to ensure dialog on the most important topics. Both authors participated on equal terms in conducting the interviews, which each lasted 40-60 minutes. The interviews were audio recorded and subsequently transcribed in full length by both authors.

Data Collection and Analysis

The questionnaire response rate was calculated and evaluated. Data was cross tabulated in Survey XACT and analyzed in Microsoft Excel by descriptive statistics. The authors and the two patients from the in-house research committee individually evaluated the responses and provided suggestions for cross-tabulations to accommodate the data in various ways. Responses identified as particularly relevant for the aim of this study were marked to be elaborated in the follow-up interviews.

Both authors thoroughly reviewed and evaluated the transcriptions from all ten interviews by a phenomenological approach to identify key items using a thematic content analysis. The transcriptions were synthesized and scope themes were defined. Statements were categorized according to the themes identified.

Ethical Considerations

Ethical considerations in line with the Helsinki Declaration were reviewed.²⁹ The questionnaire did not include personal information, and participants were informed in an introduction cover letter ensuring that their participation was voluntary and anonymous. Consent from the respondents was considered given upon completion and submission of the questionnaire.

Prior to interviews, all informants were thoroughly notified both written and orally about their rights to withdraw statements, the interview being audio recorded, and their

participation was voluntary with their statements being anonymized. None of them declined, and none has since withdrawn their statements.

Results

Questionnaire.

Response rate was 69% (n = 51/74). Responses were analyzed to assess the perception of barriers and motivators to initiate research. An attrition analysis revealed that nine respondents initiated the questionnaire but did not complete. Hence, these respondents are not included in the statistics or response rate. The characteristics of respondents are presented in Table 1.

Table 1: Characteristics of respondents.

Laboratory specialists cover assignments as: expert resource person in specific laboratory technologies, union representative, working environment representative, expert in laboratory information systems, quality assurance expert, etc.

Variable	n (%)
Age (years)	
20-30	15 (29)
31-40	11 (22)
41-50	15 (29)
51-60	6 (12)
>60	4 (8)
Graduation year	
Before 1999	10 (20)
1999-2003	9 (18)
2004-2012	4 (8)
2013-2018	13 (25)
2019-2022	15 (29)
Further educations	
None	30 (59)
Education before BLS	7 (14)
One diploma module	6 (12)
More than one diploma module	0
Diploma of Health	5 (10)
Masters Education	0
Master's degree	2 (4)
Other	3 (6)
Employment time at the department (years)	
0-5	23(45)
6-10	9 (18)
11-15	5 (10)
16-20	4 (8)
21-25	3 (6)
>26	7 (14)
Laboratory specialists	
No	39 (76)
Yes	12 (24)

Abbreviations: n: numbers of answers; %: percentage of the total number of answers. BLS: biomedical laboratory scientists.

Development of the department and individual competences

Nearly all respondents agree that BLS research is necessary to develop and implement evidence-based laboratory research to ensure high-quality standards (Figure 1). However, the importance of research activities related to developing individual competencies is more evenly distributed (Figure 1). Moreover, the youngest BLS' report research activities as important in developing individual competencies, compared to senior BLS' (Figure 2).

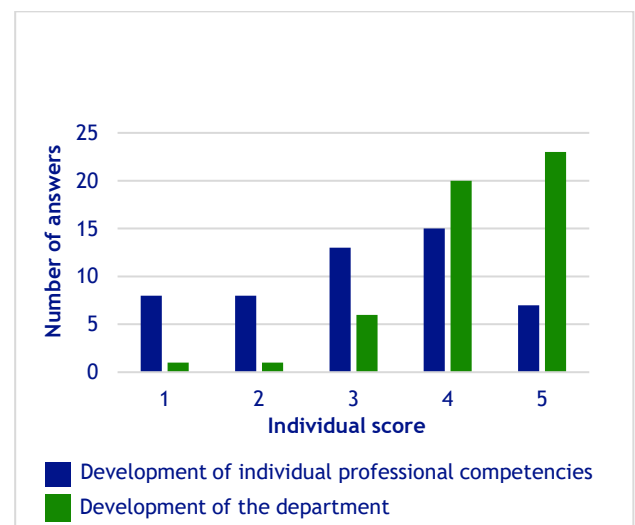


Figure 1: Importance of BLS research activities:

Respondents perceived importance of BLS research activities when it comes to individual competencies and developing the department. With 1 representing not important and 5 representing highly important.

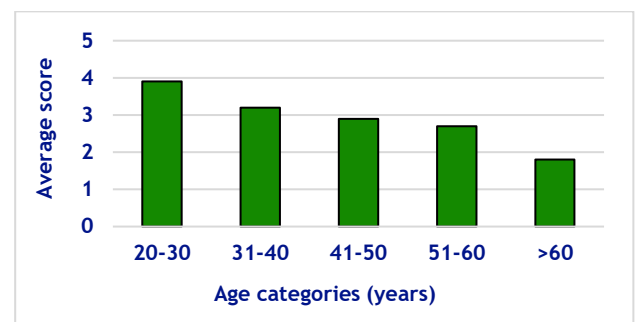


Figure 2: Biomedical laboratory scientist research and development of individual competencies.

Responders perceived importance of research and development of individual competencies compared to age. With 1 representing not important and 5 representing highly important.

Personal Research Competencies

Regarding personal research competencies (Figure 3), 37% of respondents identify lack of knowledge and skills to conduct research, while 41% are unsure. Additionally, 49% indicate the need for further training or education, while 37% are unsure.

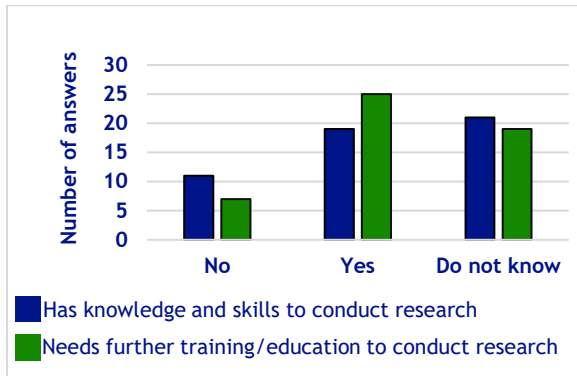


Figure 3: Personal research competencies. Respondents perceived personal competencies in research practices. Responses “Yes”, “No” and “Do not know” as a neutral response.

Awareness of Research Frameworks

Generally, respondents are unaware of the framework for research projects (Figure 4). Around half of the respondents (51%) do not know who to contact to initiate projects, 67% are unfamiliar with opportunities for financial support, and 88% do not know how to apply for external funding. Furthermore, 78% are unaware about the option of dedicated research time.

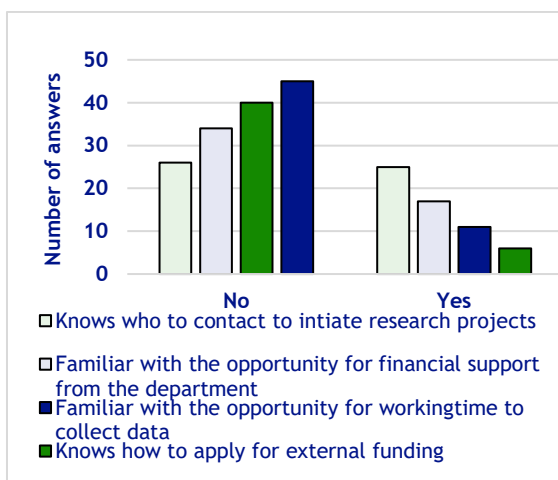


Figure 4: Research organization. Responses on knowledge about research organization and framework surrounding in-house research possibilities. Responses reflecting “yes” and “no” without a neutral category.

Respondent’s opinion on support to conduct research

Most of the respondents do not know whether they feel support to conduct research (Figure 5). Feelings of support from both chief management and daily management are 22%, research leader 29% and other professions 33%. Whereas support from colleagues seems to be more pronounced (37%).

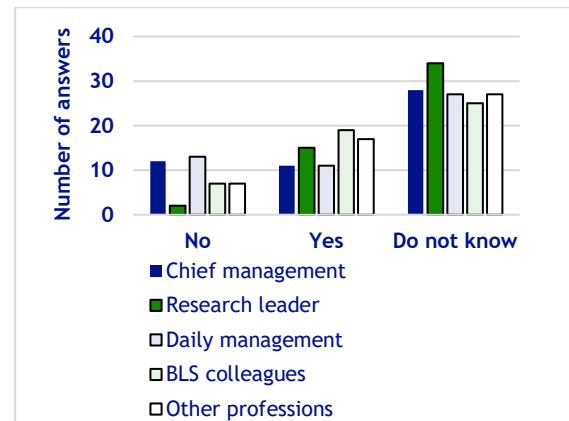


Figure 5: Support to conduct research. Respondents perceived opinion on support to conduct research. Response categories “No”, “yes” and “Do not know” reflects the options of responses.

Semi-structured interviews

Based in the thematic analysis three main themes emerged:

1. One’s perception of research competencies.
2. Perception of BLS research and research framework
3. Barriers and motivators for BLS research

One’s perception of research competencies.

The informants partially feel confident in performing laboratory work on their own. Hence, they are most concerned about their qualifications to develop and initiate research. This appears to be linked to a feeling of insecurity about deciding the scientific and clinical value of projects. Some informants highlight the benefit of BLS sharing research experiences potentially reducing some insecurities. Moreover, they highlight a feeling of an internal hierarchy in the department, leaving them feeling not as competent as doctors, pathologists and molecular biologists. Even

though they receive research training during their education, they wish for further education directly related to scientific research.

Perception of BLS research and knowledge about the research framework and support at the department level.

Most informants do not know that BLS research is an opportunity at the department level. Some informants view BLS research only to be possible for BLS' employed in special positions. Moreover, there seems to be a perception of BLS only doing laboratory research for other professions. Hence, they perceive their core competences primarily as routine-based laboratory analysis and some feel insecure about the requirements and complexity of BLS research. In line with these perceptions, they repeatedly mention the need for BLS research culture containing definitions and framework of possibilities. Moreover, they highlight the need for support from department management and awareness about current research conducted by other professions, to inspire BLS for future research projects.

Barriers and motivators for BLS research

The ten informants all express motivation to initiate and conduct research projects. Besides the obvious prospects of BLS research generating enhancements in laboratory tests beneficial to patients, they are intrigued by the potential to develop, use and maintain their current research skills. The BLS feel that this would improve their job satisfaction and keep them stimulated with new challenges. Moreover, motivators such as a dedicated go-to person, with research experience, and teamwork were suggested.

All informants mention work-life balance as a barrier to BLS research when asked about performing some research tasks, like researching literature or scientific writing, outside working hours. Although personal interest in a specific laboratory area seems to motivate a few of them to prioritize research activities outside working hours. Barriers include lack of guidelines in relation to project initiation. The

informants all express uncertainty about the extent of a BLS research project compared to projects carried out by other professions. They are unsure if the scope of their research ideas meets the department's requirements for project approval.

Furthermore, general support from colleagues working in the department is requested. Thus, some feel this as a prerequisite, especially in the development and initiation of projects to ensure high quality. An additional barrier is difficulties with balancing research projects and work responsibilities, exemplified by the feeling of leaving their colleagues with extra work. Some even feel hindered by their own perception and concerns about acceptance from colleagues. Finally, they highlight the importance of research being prioritized by the management, which would contribute to a more research-oriented work environment.

Discussion

Most respondents from the survey agree that BLS research activities are highly important when it comes to developing the department (Figure 1). The informants support this in their statements by elaborating the importance of BLS research generating laboratory tests beneficial to patients. The findings underscore the relevance of the IFBLS Code of Ethics, which emphasizes the responsibility of BLS professionals to improve laboratory practice.¹⁰ Moreover, it aligns well with chief management's recognition of the importance of BLS research. Similarly, studies from the Radiography profession found, that the majority of participating radiographers agree on the need for further research in the field of radiography.^{26,27} Despite this, like BLS in this study, the proportion of Radiographers involved in research is very low.²⁷ In the nursing- and allied profession there has been a dedicated focus on research over the last decade with great success.^{17,18,23,24,28,30} This suggests that the respondent's perspective on BLS research activities as being very important, aligns with the goals and perspectives in other healthcare professions.

When it comes to BLS research and development of individual professional competences, the responses are evenly distributed ranging from “not important” to “highly important” (Figure 1). Analysis of the average responses with age of respondents reveal a correlation (Figure 2). This indicates that the youngest BLS’ and new graduates perceive research activities as very important for developing individual competences, while senior BLS’ evaluate it as less important. The obvious reasons could be descending personal ambitions as senior BLS compared to younger BLS. Moreover, this might reflect that the educational system for BLS in Denmark has developed during the past 25-30 years from a technician apprenticeship to a bachelor’s degree.^{3,14} The Danish BLS education has continuously progressed since 2001 towards enhancing academic skills like methodologies, biostatistics, poster presentations and scientific writing. Some BLS students already participate in scientific studies during their education, which gives them opportunities to gain experience through participation research projects.¹⁴

In general, the informants feel intrigued by the potential to develop, use and maintain their research skills. They declare possibilities for conducting research as a motivational factor that will enhance their job satisfaction. Feelings of being stimulated with new assignments is in general considered a motivational factor, which is also addressed in the literature considering motivators for research in other professions.^{22,31,32} When asked about their own perception of research competence, less than half of the respondents declare to have knowledge and skills to conduct research and less than half do not know (Figure 3). At the same time half of the respondents state the need for further training or education and less than half do not know (Figure 3). These statements seem contradictory and were elaborated in the interviews. All informants wish for further education directly related to scientific research. They feel confident in laboratory procedures but specifically highlight developing and

initiating project ideas and deciding the scientific and clinical value of projects as challenging areas. This reflects their insecurity about whether their research ideas are sufficiently aligned with the department’s requirements for project approval. Developing research projects or implementing technological advancements is often the responsibility of laboratory specialists, pathologists or molecular biologists. Therefore, it is understandable that BLS find these skills particularly challenging. In general, BLS in the department rarely participate in scientific writing or conferences, which might lead to insecurities and barriers in these areas. In response to this, the informants highlight the importance of sharing experiences on research process, scientific writing and conference participation among the BLS.

From the interviews, it became clear that the informants perceive in-house research only to be possible for other professions or laboratory specialists. Most of the informants do not have any knowledge about opportunities for conducting research. This correlates with the respondents’ perception of the research organization. Even though they were not asked directly in the questionnaire, responses to questions related to research organization indicate missing communication (Figure 3). It is exemplified by the fact that most respondents are unaware of financial support or dedicated working time. This correlates with the informants repeatedly mentioning the need for a research-based culture and knowledge about possibilities of BLS research. Several studies concerning other healthcare professions also states the importance of a research culture and clear definitions of research possibilities.^{17-19,22,25-27,31-35} Despite this, establishing research practices and fostering a strong research culture remains a significant challenge.^{18,19,21,27,36} Studies in the nursing-, radiography- and allied professions suggests, that a strong research culture relies on fostering a positive attitude toward research in general.^{18,22,25,34} To ensure success, it is suggested that research must become an integral part of

daily practice, complementary to clinical activities.^{18,22,37} It would be beneficial to enhance focus on motivators rather than barriers to research and secure a strategic and strong communication to overcome barriers. Establishing a clear infrastructure for BLS research is a suitable step toward fostering an in-house research culture.

The informants mention a dedicated go-to person as a motivational factor but are unaware that this role was appointed by chief management. Interestingly, half of the respondents know who to contact to initiate a research project (Figure 4). The survey did not include a question requiring respondents to specify the appropriate contact for initiating projects. Consequently, it remains uncertain whether respondents referred to the individual formally designated by chief management or another relevant person in the department. The intention behind a dedicated go-to person is to provide a mentor for BLS interested in research. Mentorship is widely recognized as an essential component of research infrastructure and the development of early-career researchers.^{22,32,34,36,38,39} Thus, mentorship opportunities should be communicated as a key priority and correlate very well with the informants wish for collaboration in projects. Research is time-consuming, and most of the informants are aware that one week of dedicated time is not enough to ensure research of high value. Access to external funding could facilitate the reallocation of time from routine laboratory tasks to research activities. Data from this survey indicates that the BLS' do not have skills and knowledge to apply for external funding, which potentially could be a task for the mentor (Figure 4). Moreover, the informants have concerns about work-life balance. Hence, time is a well-known barrier to research in other professions.^{22,25,32,37,38} Securing external funding can be a time-consuming process, but investing the time may prove beneficial and ensure research that would otherwise be difficult to prioritize. In line with this, literature in radiography and allied health professions suggest, that

establishing partnerships and teaming up in research projects will strengthen the access of external funding, resources, and support implementing research into practice.^{22,23,25,32,38,39}

The informants in this study have concerns about support from both leaders and colleagues towards BLS in-house research. These overall concerns are also reflected in the respondents' answers to the questions about support to research. Most respondents are insecure or do not feel support from chief management (Figure 5). Lack of support for conducting research is a well-known barrier in various professions, which can be partially addressed through clear and systematic communication.^{21,23,25,40} The informants in this study also highlight the need for communication about possibilities for BLS research together with general support from colleagues. They have concerns about leaving colleagues with a heavier workload, if they engage in research. Acknowledgement and acceptance from colleagues is a motivational factor for conducting research.²⁵ However, data from the questionnaire imply a missing correlation between the perceptions of lacking support from colleagues, since the respondents find BLS research activities very important for developing the department (Figure 1). This indicates not only lacking communication from management about research possibilities but also missing communication between BLS.

The informants express experiences of intern hierarchy among healthcare professions at the department, challenging their aspiration of a BLS research culture. More than half of the respondents express "No" or "Do not know" to the question about support from other professions (Figure 5). These findings are also reflected in the radiography profession and by laboratory personnel as a barrier to research.^{25,41} Structures of hierarchy due to former professional boundaries must be assessed as outdated, if the aim is to maintain high performance in laboratory medicine.¹⁴ The studies from the radiography profession advise

to address hierarchy challenges by clear communication and support.^{25,41} To establish a strong research culture, it is essential to highlight the significance of BLS research and encourage a supportive and open positive attitude across professional groups.

Literature on research culture and capacity among other professions propose a clear strategy for establishing a research culture in clinical practice.^{22,24,25,30,35,39} It will be beneficial to enhance focus on motivators rather than barriers to research and secure a strategic and strong communication to overcome barriers. Establishing a well-organized infrastructure is a suitable step toward achieving the goal of fostering an in-house research culture within the BLS profession.

Conclusion

This study highlights that BLS recognize the critical role of research in developing the department and improving patient care through evidence-based laboratory practices. Despite this awareness, many BLS perceive research as the domain of specialized or academic colleagues, leading them to limited engagement in research activities.

Barriers identified are limited knowledge about the research framework, funding opportunities, and the processes involved in initiating and conducting research projects. Most

BLS are uncertain about their own research competencies, which impact their motivation. Additionally, internal hierarchies contribute to feelings of uncertainties and diminish the development of a BLS research culture.

Lacking support from management and colleagues is a barrier, together with concerns about the workload for colleagues. This perception along with a low awareness of a dedicated go-to person further highlights a gap in communication that could otherwise empower BLS researchers.

The findings underscore the necessity of establishing a supportive research culture within the department that actively promotes BLS involvement. Key motivators include fostering collaboration, mentorship and targeted research training. Encouragement from management to emphasize the importance of BLS research, along with recognition of BLS contributions, appears crucial in overcoming existing barriers. Ultimately, a supportive research culture would enhance the motivation, skills, and participation of BLS in research. This will not only benefit the individual professional development of BLS but also strengthen the overall quality and capacity of laboratory medicine.

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