Enhancing Emergency Response: The Role of Collective Competence in Epidemiological Teams for Effective Laboratory Data Collection and Analysis

Nuha Alghamdi[1], Mohra Alshedukhi[1], Bashayr Abudahsh[1], Wafa Hamad Alshedoukhi[2], Mohammed Saad Alghamdi[3], Hamda Saad Alotaibi[4], Faraj Moedh M Alamer[5], Faleh Ali Al-Qahtani[6], Fatima Mohammed Al Shamri[7]

[1]Medical Laboratory, Tissue typing laboratory & Cytogenetic and molecular genetics laboratory, PSSMC, KSA.
[2]IVF & Reproductive Medicine Department , Women's Health Hospital for National Guard, KSA.
[3]University Medical Services Center at King Abdulaziz University, Pharmacy, KSA.
[4]General practitioner , AlThagar General Hospital, KSA.
[5]Epidemiology, Alhussiniah PHCC, Najran, KSA
[6]Medical Laboratory Technician, Medical Center at Majmaah University, Majmaah city, KSA.
[7]Medical Laboratory Technician, Al Majmaah University Medical Center , Al Majmaah City, KSA.

Abstracts

Background: Health systems globally face ncreasing challenges from health crises and epidemic threats, necessitating the pivotal role of epidemiological teams in emergency response. This study investigates the significance of collective competence within these teams, focusing on their ability to collect, analyze, and manage laboratory data effectively. Methods: A cross-sectional descriptive study design was used to survey epidemiological teams in Saudi Arabia. A structured questionnaire was developed based on existing literature and distributed electronically to participants. Data analysis was performed using the Statistical Package for the Social Sciences (SPSS), using descriptive and inferential statistics to summarize participant characteristics and explore associations between variables. Results: A total of 208 epidemiological teams member completed the questionnaire, yielding insights into their The Role of Collective Competence in Epidemiological Teams. The findings reveal high levels of agreement regarding the effectiveness of management approaches, knowledge sharing, and team collaboration, with the average score exceeding 4.0 on a 5-point scale. Notably, team efficacy was found to significantly enhance the efficiency of laboratory data collection and analysis, accounting for approximately 25.9% of the variance in efficacy. Discussion: These findings underscore the need to invest in developing team competencies within epidemiological teams to improve emergency response capabilities. The study provides practical insights into enhancing team collaboration and coordination, ultimately contributing to more effective public health interventions in future health crises.

Keywords: Emergency, Collective Competence, Epidemiological, Laboratory, Data Collection, Saudi Arabia.

Introduction

Health systems have recently witnessed many health crises and epidemic threats that have a high capacity to spread locally and internationally. This has made epidemiological teams an essential and vital element in responding to health emergencies. Therefore, an effective response to health crises and epidemic threats requires investment in health care systems and workforce, especially epidemiological teams, which play a pivotal role in the process of collecting, analyzing and storing laboratory data, which is a reference basis for making evidence-based decisions [1,2].

The generally agreed-upon core competency of epidemiological teams is to understand epidemiological methods for responding to outbreaks by collecting, analyzing laboratory data and presenting it to the competent authorities to make decisions, deal with health crises and manage the emergency [3].

To achieve this, there must be a high level of coordination and effective communication between members of epidemiological teams, so that laboratory data is collected from its sources and then accurately analyzed and presented in a clear manner to specialized departments and policy makers [4,5]. Hence, the role of collective competence appears as a major factor in enhancing the team's ability to deal with the major challenges that arise during health crises [6].

The concept of collective competence includes a combination of individual skills of epidemiological team members and the ability to communicate effectively, distribute tasks appropriately, and achieve coordination between different disciplines [7]. In addition to the ability to deal with unexpected events that teams may face while managing health crises. According to a Parry et al., which indicated that epidemiological teams characterized by collective competence have the ability to collect and analyze data accurately, which contributes to making better decisions and directing the response to emergency situations more effectively [8]. In addition, good coordination between team members and the presence of a communication system helps in exchanging laboratory information faster and with high accuracy, which enhances the rapid response to crises [9].

The current study aims to investigate the importance and role of collective competence of epidemiological teams in collecting and analyzing laboratory data to enhance emergency response. In addition, the study seeks to enhance collective competence and develop effective strategies for collaboration between epidemiological teams. Thus, providing practical insights that can help build more effective and efficient epidemiological teams that could provide rapid and effective response and provide rapid and accurate laboratory data for future health crises.

2. Materials and Methods

2.1 Study Design:

This research adopts a quantitative research design utilizing a questionnaire to assess the role of collective efficacy in enhancing emergency response within epidemiological teams.

2.2 Study participants:

The study population comprises of Epidemiological Teams involved in managing health emergencies in different regions of Saudi Arabia. Epidemiological teams were defined as anyone

working in the field of epidemiology. We analyzed the responses of participants who indicated experience in responding to emergencies in epidemic situations.

2.3 Data Collection:

Data will be collected through structured questionnaires distributed electronically to participants. The questionnaire will be designed based on established frameworks and previous literature on strengthening health emergency response, with a focus on departments that collect and analyze laboratory data among epidemiological teams.

2.4 Data Analysis:

The quantitative data collected will be analyzed using the Statistical Package for the Social Sciences (SPSS), using a range of statistical methods. Descriptive statistics will be used to summarize the characteristics of the participants, providing a comprehensive overview of the demographics of the sample. This will include measures such as means, standard deviations, frequencies, and percentages to describe key variables related to the role of collective efficacy in epidemiological teams in order to effectively collect and analyze laboratory data. The relationship between collective efficacy and data collection/analysis efficiency will be examined using correlation and regression analyses to identify significant patterns and associations.

3. Results

3.1 Socio-demographics of the participants

A total of 208 of 245 questionnaires were completed and returned, yielding a response rate of 84.9%. The demographic and baseline characteristics of the participants are presented in Table 1.

Table 1. Sociodemographic traits of participants (n=208)

Variable		n	%
Your gender	male	145	69.7%
	Female	63	30.3%
Your age	21-30 years old	79	38.0%
	31-40 years old	63	30.3%
	41-50 years old	37	17.8%
	More than 51 years	29	13.9%
Highest qualification achieved:	Diploma or less	69	33.1%
	Bachelor's	91	43.8%
	Master's degree	44	21.2%
	PHD	4	1.9%
Epidemiology emergency response experience	≤ 2 events	140	67.3%
	3 or more events	68	32.7%

Our study highlights key demographic trends among Epidemiological Teams in Saudi Arabia. Males dominate the sample at 69.7%, while females represent 30.3%, which expresses the demographic composition of the epidemiological teams. The age of the participants working in the epidemiological teams was widely distributed. 38.0% were between 20 and 29 years old, and 30.3% were between 30 and 39 years old. The distributions of the study participants according

to educational level showed that the highest group of the study participants was finished the bachelor's degree (43.8%), (33.1%) was finished the diploma degree and less, (21.2%) was finished the master's degree. The results illustrated that only (1.9%) of them have the PHD degree. The survey asked about participants' experience responding to pandemic emergencies; 67.3% reported responding to ≤2 events, while 32.7% reported responding to 3 or more events.

3.2 The Role of Collective Competence in Epidemiological Teams for Effective Laboratory Data Collection and Analysis

Table 2. Mean, Standard Deviation, and Chi-Square for the statement on the axis "Administrative and Management Approaches"

Administrative and Management Approaches					
	Paragraph	Mean	Std. Deviation	Chi-Square	p-value
1	The management follows an administrative approach to assess the effectiveness of coordination between the emergency work team	4.44	0.82	404.51	.000
2	Senior management supports pandemic teams to achieve the highest levels of productivity and efficiency.	4.30	0.89	305.63	.000
3	There is a clear definition of responsibilities and distribution of tasks for the emergency team	4.24	0.95	274.66	.000
4	Management ensures that there is an independent professional body that issues appropriate guidance and supervises the analysis and storage of laboratory results.	4.17	1.04	251.22	.000
The Average		4.3	0.93		

Table (2) shows the average of the statements on the axis "Administrative and Management Approaches" was (4.3), we find that statement number 1 "The management follows an administrative approach to assess the effectiveness of coordination between the emergency work team" is ranked first with an average of (4.44) and a very high level of agreement. The value of the statistical significance level for the corresponding Chi-square test was (0.000), which is less than (0.05). This means that the differences are in favor of the level of agreement (strongly agree). In last order, the statement "Management ensures that there is an independent professional body that issues appropriate guidance and supervises the analysis and storage of laboratory results." has an average of (4.17) and a very high level of agreement. According to the value of the statistical significance level for the Chi-square test, which was (0.000), which is less than (0.05), this means that there are statistically significant differences in favor of the answer "strongly agree."

Table 3. Mean, Standard Deviation, and Chi-Square for the statement on the axis " Knowledge Sharing and Team Cooperation "

Knowledge Sharing and Team Cooperation					
	Paragraph	Mean	Std. Deviation	Chi-Square	p-value
1	The management is interested in enhancing cooperation between the work team to	4.32	0.93	334.66	.000

	exchange knowledge and experience related to epidemics?				
2	The team works together to complete tasks related to the collection and analysis of laboratory data in a timely manner	4.06	1.11	200.71	.000
3	Communication among the work team is effective	4.24	1.05	307.72	.000
4	There is collaboration between different teams (e.g. medical and laboratory teams) in improving the quality of laboratory data	4.29	0.96	316.96	.000
The Average		4.23	1.0		

Table (3) shows the average of the statements on the axis "Knowledge Sharing and Team Cooperation" was (4.23), we find that statement number 1 "The management is interested in enhancing cooperation between the work team to exchange knowledge and experience related to epidemics" is ranked first with an average of (4.32) and a very high level of agreement. The value of the statistical significance level for the corresponding Chi-square test was (0.000), which is less than (0.05). This means that the differences are in favor of the level of agreement (strongly agree). In last order, the statement "The team works together to complete tasks related to the collection and analysis of laboratory data in a timely manner" has an average of (4.06) and a very high level of agreement. According to the value of the statistical significance level for the Chi-square test, which was (0.000), which is less than (0.05), this means that there are statistically significant differences in favor of the answer "strongly agree."

Table 4. Mean, Standard Deviation, and Chi-Square for the statement on the axis " Data Collection and Analysis Systems "

Data Collection and Analysis Systems					
	Paragraph	Mean	Std. Deviation	Chi-Square	p-value
1	Do you think that collecting, storing and analyzing epidemiological information in your facility is important?	4.11	1.06	218.41	.000
2	Does your facility/laboratory have a system for collecting and analyzing epidemiological information?	4.16	1.08	261.04	.000
3	Technology is used to collect and analyze data.	4.26	0.91	288.41	.000
4	Effective strategies are followed to analyze data quickly and accurately.	4.31	0.89	314.30	.000
5	Has your facility/laboratory provided any awareness or practical training in the field of laboratory data management and analysis?	4.18	1.05	258.62	.000
6	Are you aware of any national laws or policies regarding laboratory information or security in handling laboratory data?	4.34	0.90	341.31	.000
7	Audit, control, and risk management systems are in place to ensure that undesirable results are prevented, detected, and analyzed.	4.16	1.05	247.93	.000
The Average		4.2	0.99		

Table (4) shows the average of the statements on the axis "Data Collection and Analysis Systems" was (4.20), we find that statement number 6 " Are you aware of any national laws or

policies regarding laboratory information or security in handling laboratory data " is ranked first with an average of (4.34) and a very high level of agreement. The value of the statistical significance level for the corresponding Chi-square test was (0.000), which is less than (0.05). This means that the differences are in favor of the level of agreement (strongly agree). In last order, the statement "Are you aware of any national laws or policies regarding laboratory information or security in handling laboratory data " has an average of (4.11) and a very high level of agreement. According to the value of the statistical significance level for the Chi-square test, which was (0.000), which is less than (0.05), this means that there are statistically significant differences in favor of the answer "strongly agree."

3.3 Relationship between Collective Competence and Effective Laboratory Data Collection and Analysis

There is a statistically significant impact at the level of significance (0.05) to Collective Competence and Effective Laboratory Data Collection and Analysis enhancing Emergency Response.

Table 5. simple linear regression between (Collective Competence) and (Effective Laboratory Data Collection and Analysis)"

Model	β	t	Sig.	F	p-value	R	R-Square
(Constant)	13.504	9.138	.000	114.84	0.000	.509	.259
Collective Competence	1.204	10.716	.000				

Table (5) shows Simple linear regression analysis reports that there is a clear effect of Collective Competence on improving effectiveness and data collection analysis in the laboratory, with the referral factor β (1.204) showing a significant increase in operational effectiveness with increasing team capacity. The t-value (10.716) and p-value (0.000) support the significance of this issue. The trade-off of determination R-Square (0.259) also indicates that 25.9% of the variance in effectiveness data is explained by Collective Competence, indicating a moderate relationship that enhances the necessary Collective Competence.

4. Discussion

The study provides valuable insights into The Role of Collective Competence in Epidemiological Teams for Effective Laboratory Data Collection and Analysis in Saudi Arabia. The findings of this study underscore the critical role of collective competence among epidemiological teams in enhancing emergency response capabilities, particularly in the context of health crises. The data collected through questionnaires reveal a strong consensus among participants regarding the effectiveness of administrative and management approaches, knowledge sharing, and cooperation within teams. The high mean scores across various dimensions indicate that these factors significantly contribute to the efficiency of laboratory data collection and analysis, which is essential for informed decision-making during health emergencies.

The study results indicate that senior management follows the necessary administrative strategies and plans, such as clear task distribution and the presence of an effective communication system, which contribute significantly and increasingly to improving the speed of data collection and analysis. This is consistent with many literatures, which emphasize the importance of leadership in creating and building an interactive and collaborative environment, especially in emergency

and epidemic situations that require speed and accuracy in data collection by epidemiological teams [10]. The strong statistical significance of the results (p value < 0.001) confirms the effectiveness of these management practices, indicating that they are useful in enhancing team coordination and operational efficiency. The current study also focuses on the importance of knowledge sharing and effective communication between members of emergency epidemiological teams and other medical teams. High mean scores related to collaboration and timely completion of tasks reflect well-functioning team dynamics, which are essential to addressing the complexities of health crises [11].

The exchange of knowledge and expertise between epidemiological teams also contributes to enhancing the overall response to emergencies with other teams, in addition to improving the quality of laboratory data needed to deal with emergencies. Collective competence, which includes all individual skills and team dynamics, is essential for effective response to epidemics [12,13,14]. In addition, the study reveals a significant relationship between Collective Competence in Epidemiological Teams and the effectiveness of data collection and analysis in laboratories. Simple linear regression analysis indicates that approximately (25.9%) of the variance in data collection effectiveness can be attributed to collective competence, highlighting its importance in emergency response scenarios. This finding supports the idea that investing in developing collective competence within epidemiological teams can lead to improved outcomes during health crises [8,11].

5. Conclusion

This study highlights the need to enhance collective efficacy within epidemiological teams to enhance emergency response capabilities. The findings call for strategic investments in training, management practices, and communication systems to build more effective teams capable of responding quickly and accurately to health crises. Future research should explore the longitudinal effects of these strategies on epidemiological team performance and laboratory outcomes.

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