



Analysis of Contemporary Leadership Styles in the Croatian Gastronomy Sector

Mario Buble, Monika Orlić

Department of Tourism (Gastronomy), Aspira University of Applied Sciences, Split, Croatia

Email: monika.orlic@aspira.hr

How to cite this paper: Buble, M. and Orlić, M. (2026) Analysis of Contemporary Leadership Styles in the Croatian Gastronomy Sector. *Open Access Library Journal*, **13**: e15721.
<https://doi.org/10.4236/oalib.1115721>

Received: July 1, 2026

Accepted: August 8, 2026

Published: August 11, 2026

Copyright © 2026 by author(s) and Open Access Library Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

The gastronomy sector is continuously evolving in response to changes in both supply and demand. Gastronomic establishments strive to adapt their services to the needs of individuals, families, business professionals and tourists. Their success largely depends on effective human resource management, making leadership an important factor in organizational performance. Contemporary leadership approaches emphasize employee motivation, collaboration, flexibility and ethical behavior, which contribute to service quality and organizational competitiveness. The aim of this study was to examine which contemporary leadership styles are most commonly applied among managers in the Croatian gastronomy sector and to identify differences in their application across selected regions. The research was conducted on a sample of 50 managers and owners of gastronomic establishments from Dalmatia, Istria and Zagreb using a structured questionnaire. The collected data were analyzed using descriptive statistical methods. The findings indicate that transformational leadership was the most frequently reported leadership style among the surveyed managers, particularly in tourism-oriented regions such as Dalmatia and Istria. Interactive leadership showed stronger presence among managers in Zagreb, while servant leadership was more evident in Istria. Charismatic and transactional leadership were more frequently observed among respondents from Dalmatia. The results suggest that regional characteristics, tourism intensity and organizational conditions may influence the selection and application of leadership styles in Croatian gastronomy.

Subject Areas

Business Management

Keywords

Gastronomy, Leadership, Contemporary Leadership Styles, Managers, Croatia

1. Introduction

The gastronomy sector in Croatia represents an important part of the service industry and plays a significant role in connection with tourism development. This sector is characterized by constant changes in supply and demand, seasonal fluctuations, increasing customer expectations and the need to provide high-quality and personalized service experiences. In such a dynamic environment, human resources represent one of the most important factors influencing organizational success, while effective leadership and team management contribute to employee satisfaction, service quality and business competitiveness [1].

Due to the increasingly complex challenges faced by managers, traditional leadership approaches are gradually being complemented by contemporary leadership styles that emphasize flexibility, open communication, teamwork, employee motivation and ethical behavior. Modern leadership approaches recognize the importance of employee participation, motivation and adaptability as essential elements of successful leadership [1]. Transformational, interactive, servant, transactional and charismatic leadership styles represent different approaches through which managers influence employee behavior, organizational culture and overall organizational performance.

In the gastronomy sector, where service quality largely depends on direct interaction between employees and guests, leadership has a particularly important role. Managers influence not only operational efficiency but also employee motivation, workplace atmosphere and the consistency of service delivery. The ability to adapt leadership approaches to specific organizational conditions can therefore represent an important competitive advantage for gastronomic establishments.

The purpose of this research is to examine which contemporary leadership styles are most commonly applied among managers in the Croatian gastronomy sector and to explore possible differences in their application between selected regions. The research focuses on three important Croatian regions Dalmatia, Istria and Zagreb which represent significant tourism and gastronomy centers with different economic and organizational characteristics.

The research examines whether regional characteristics, tourism intensity and working conditions may influence the preferred leadership approaches among gastronomy managers. The study is based on empirical data collected through a structured questionnaire administered to 50 managers and owners of gastronomic establishments from the selected regions.

The collected data were analyzed using descriptive statistical methods to identify the most frequently applied leadership styles and observe differences between regions. Due to the limited sample size and the unequal distribution of respondents between regions, the findings should be interpreted as indicative of possible trends rather than fully representative conclusions for the entire Croatian gastronomy sector.

The paper is organized as follows. The second chapter presents the theoretical background of contemporary leadership styles. The third chapter describes the

research methodology, followed by the research assumptions in the fourth chapter. The fifth chapter presents the empirical findings, while the sixth chapter discusses the results and research limitations. Finally, the seventh chapter presents the conclusions and recommendations for future research.

2. Main Characteristics of Contemporary Leadership Styles

Contemporary leadership theories emphasize the importance of adapting leadership behavior to organizational conditions, employee characteristics, and environmental challenges. Unlike traditional approaches that primarily focused on authority, control, and hierarchical structures, modern leadership approaches place greater emphasis on motivation, communication, employee development and ethical responsibility [1].

In the gastronomy sector, where teamwork, flexibility, and direct interaction with guests are essential, leadership style can significantly influence employee satisfaction, service quality and organizational performance. Different leadership styles may be appropriate depending on the size of the establishment, organizational culture, employee structure and market conditions.

The following leadership styles are analyzed in this research: transformational, interactive, servant, transactional and charismatic leadership.

2.1. Transformational Leadership

Transformational leadership refers to a leadership approach in which leaders inspire and motivate employees to achieve organizational goals while encouraging personal development, creativity and innovation [2]. Transformational leaders create a clear vision, stimulate employees intellectually, provide individualized support, and encourage them to exceed expected levels of performance.

The main characteristics of transformational leadership include visionary thinking, inspirational motivation, intellectual stimulation and individualized consideration. Through these characteristics, leaders promote continuous learning, innovation, and employee engagement.

Transformational leadership is particularly suitable for dynamic environments such as gastronomy, where organizations must continuously adapt to changing customer expectations, market trends and competitive pressures. In restaurants seeking to develop a distinctive identity and deliver unique service experiences, transformational leaders encourage innovation, teamwork, and continuous improvement. Recent research in tourism and hospitality confirms that transformational leadership contributes to employee motivation, job satisfaction, innovation and positive organizational outcomes in service-oriented industries [3].

Individuals such as Elon Musk are sometimes discussed as examples of transformational leadership because of their emphasis on innovation, ambitious organizational goals and continuous change. However, leadership effectiveness depends on the organizational context and the quality of relationships established between leaders and employees.

For the purposes of this research, transformational leadership was assessed through questions related to strategic vision, willingness to accept risk, and encouragement of innovation. Responses were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Transformational leadership is particularly appropriate in periods of organizational growth, change, crisis management, and situations requiring innovation and long-term strategic adaptation.

2.2. Interactive Leadership

Interactive leadership emphasizes communication, cooperation, and the active involvement of employees in organizational processes. Unlike traditional hierarchical leadership approaches, interactive leadership is based on continuous two-way communication between managers and employees, encouraging dialogue, shared responsibility and collaborative problem-solving.

Although interactive leadership shares certain characteristics with participative and collaborative leadership, it is treated as a separate category in this study because it places particular emphasis on continuous interaction between leaders and employees rather than solely on participation in decision-making [4].

According to Kouzes and Posner [4], effective leaders encourage collaboration, build trust, and create an organizational environment in which employees feel respected, involved and motivated to contribute to organizational success.

Herb Kelleher, founder of Southwest Airlines, is frequently associated with this leadership approach because of his emphasis on employee trust, open communication, and organizational culture based on shared values. His leadership demonstrated how empowering employees and encouraging responsibility can contribute to organizational success.

In the gastronomy sector, interactive leadership is especially valuable in small and medium-sized establishments where communication, teamwork, and coordination directly influence service quality and customer satisfaction. By involving employees in daily decision-making and problem-solving, managers can strengthen organizational commitment, responsibility and employee motivation.

For the purposes of this research, interactive leadership was measured through questions concerning employee empowerment, understanding employee needs, and involving employees in decision-making processes. Responses were evaluated using a five-point Likert scale.

2.3. Servant Leadership

Servant leadership, introduced by Greenleaf [5], is based on the principle that leaders should primarily serve and support their employees. Instead of emphasizing authority and control, servant leaders focus on employee well-being, ethical behavior, personal development and the creation of a supportive organizational environment.

Key characteristics of servant leadership include empathy, active listening, re-

sponsibility, trust, and commitment to employee development. In the gastronomy sector, where employees often work under demanding conditions and considerable time pressure, this leadership style can contribute to stronger motivation, employee loyalty and a healthier organizational climate.

Historical figures such as Nelson Mandela, Martin Luther King Jr. and Mother Teresa are frequently associated with servant leadership because of their emphasis on service, empathy, and social responsibility. Nevertheless, such examples should be interpreted cautiously, as servant leadership is primarily an organizational leadership concept rather than a description of historical personalities.

For the purposes of this research, servant leadership was assessed through questions related to managers' support for employees, understanding of workplace challenges and efforts to provide the resources necessary for achieving work objectives. Responses were measured using a five-point Likert scale.

Servant leadership is particularly appropriate for organizations that promote employee development, continuous learning, creativity and long-term cooperation between management and employees.

2.4. Transactional Leadership

Transactional leadership is based on clearly defined organizational structures, established procedures, and the exchange relationship between employee performance and organizational rewards [2]. Leaders applying this style communicate expectations clearly, monitor employee performance, and use rewards or corrective actions to achieve organizational objectives.

This leadership approach is particularly effective in organizations where operational efficiency, standardized procedures, and clearly assigned responsibilities are essential. Within the gastronomy sector, transactional leadership may be especially useful in large restaurants, fast-service establishments, or organizations where consistency and speed of service are critical. Although this leadership style places less emphasis on inspiration and employee development than transformational leadership, it contributes to organizational stability, clarity of responsibilities and effective coordination of employees.

For the purposes of this research, transactional leadership was measured through questions related to task clarification, clearly communicated expectations and the use of rewards to encourage employee performance. Responses were evaluated using a five-point Likert scale.

2.5. Charismatic Leadership

Charismatic leadership refers to a leadership approach in which leaders influence employees through personal qualities, communication skills, confidence and the ability to articulate an inspiring vision [6].

Charismatic leaders frequently establish strong emotional relationships with employees through enthusiasm, optimism and personal example. In the gastronomy sector, where direct interaction between managers, employees and guests

plays an important role, charismatic leadership may contribute to stronger organizational identity, employee commitment and customer loyalty.

Mahatma Gandhi is frequently discussed in leadership literature as an example associated with charismatic leadership because of his ability to inspire large groups of people through personal values, communication and a compelling vision. However, charismatic leadership should not be evaluated solely through individual personalities, since its effectiveness depends on organizational context and the responsible use of influence.

For the purposes of this research, charismatic leadership was measured through questions related to managers' confidence, personal example, and ability to motivate and influence employees. Responses were evaluated using a five-point Likert scale.

Charismatic leadership should therefore be understood as the interaction between individual leadership characteristics and the organizational environment in which leadership takes place.

3. Methodology

3.1. Sample

The research was conducted on a sample of 50 managers and owners of gastronomic establishments located in three Croatian regions: Zagreb, Dalmatia and Istria. These regions were selected because they represent important Croatian tourism and gastronomy destinations while differing in terms of tourism intensity, organizational characteristics and business environments.

The sample consisted of 30 respondents from Zagreb, 10 respondents from the Split area representing Dalmatia, and 10 respondents from Istria. The unequal distribution of respondents between regions represents one limitation of the study and should be considered when interpreting the findings.

Participants were selected using a convenience sampling approach. Gastronomic establishments were identified through publicly available information, including online recognition and professional contacts. Many respondents were connected with the gastronomy programme of the Aspira University of Applied Sciences, which facilitated communication and data collection. Participation in the study was voluntary.

Because of the relatively small sample size and the non-proportional regional distribution, the results should be interpreted as indicative rather than representative of the entire Croatian gastronomy sector. Future studies should include larger and geographically more balanced samples.

The inclusion criterion required respondents to be owners or managers directly involved in managing employees and organizational processes within gastronomic establishments.

3.2. Survey Instrument

A structured questionnaire was specifically designed for the purposes of this re-

search. The questionnaire consisted of twenty questions divided into three sections.

The first section contained five questions concerning the characteristics of the gastronomic establishment, including organizational features and business conditions. The second section consisted of ten questions related to the demographic and professional characteristics of respondents. The third section included statements designed to assess five contemporary leadership styles examined in this research: transformational, interactive, servant, transactional and charismatic leadership.

Leadership characteristics were measured using a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), with higher scores indicating a stronger presence of a particular leadership characteristic.

The questionnaire items were developed on the basis of the theoretical characteristics of contemporary leadership styles described in the academic literature, particularly the works of Bass [2], Greenleaf [5], Kouzes and Posner [4] and Northouse [1]. Example items included managers' willingness to encourage innovation (transformational leadership), employee involvement in decision-making (interactive leadership), support for employee development (servant leadership), clarification of work expectations (transactional leadership) and leading by personal example (charismatic leadership).

Due to the exploratory nature of the study and the relatively small sample size, the internal consistency of the leadership-style subscales was not statistically tested. This should be considered a limitation of the research.

3.3. Data Analysis

The collected data were analyzed using descriptive statistical methods. Frequencies, percentages, arithmetic means, and standard deviations were calculated to summarize respondent characteristics and examine the prevalence of different leadership styles across the selected Croatian regions.

The analysis focused on identifying the leadership styles most frequently reported by respondents and describing possible regional differences. Given the limited sample size, the findings were interpreted descriptively rather than inferentially and no statistical tests of significance were performed.

The analysis also considered the possible influence of regional characteristics, tourism intensity and organizational conditions on leadership practices within gastronomic establishments.

4. Research Assumptions

Based on the theoretical background of contemporary leadership styles and the characteristics of the Croatian gastronomy sector, the following research assumptions were formulated:

A1: Transformational leadership is expected to be one of the most frequently reported leadership styles among managers in the Croatian gastronomy sector,

particularly in tourism-oriented regions such as Dalmatia and Istria.

A2: Interactive leadership is expected to be more strongly represented among managers in Zagreb due to greater access to education, professional development opportunities and contemporary management practices.

A3: Servant leadership is expected to be more strongly represented among managers in Istria, where service quality, guest satisfaction, and personalized hospitality represent important elements of business practice.

A4: Charismatic leadership is expected to be more strongly represented among managers in Dalmatia, where personal relationships, communication and direct interaction with employees and guests may play an important role in business operations.

A5: Transactional leadership is expected to be more frequently applied in regions characterized by pronounced tourism seasonality, where clearly defined procedures, responsibilities and employee coordination are essential for maintaining operational efficiency.

5. Results

5.1. General Overview of Leadership Styles

The descriptive analysis showed that transformational leadership was the most frequently reported leadership style among managers included in the study, with a mean value of $M = 4.2$.

When regional differences were examined, transformational leadership achieved the highest mean values among respondents from **Dalmatia** ($M = 4.4$) and **Istria** ($M = 4.3$), while a slightly lower mean value was recorded among respondents from **Zagreb** ($M = 3.9$). These findings suggest that managers operating in tourism-oriented regions place considerable emphasis on employee motivation, innovation, professional development, and the creation of a positive working environment.

Interactive leadership represented the second most frequently reported leadership style, with an overall mean value of $M = 3.8$, followed by servant leadership ($M = 3.5$), transactional leadership ($M = 3.2$) and charismatic leadership ($M = 3.0$).

Overall, the results indicate that managers do not rely exclusively on a single leadership style but instead combine different leadership approaches depending on organizational needs, employee characteristics, and working conditions. Given the exploratory nature of the study and the limited sample size, these findings should be interpreted as indicative trends rather than conclusions that can be generalized to the entire Croatian gastronomy sector.

5.2. Interactive Leadership in Zagreb

The findings indicate that interactive leadership achieved the highest mean value among respondents from Zagreb. The average score recorded in Zagreb was $M = 4.1$, compared with $M = 3.7$ in Istria and $M = 3.5$ in Dalmatia.

This difference may be associated with characteristics of the urban business environment, including greater access to professional education, management development programmes, and contemporary organizational practices. Managers in Zagreb appear to place stronger emphasis on communication, teamwork, employee participation and collaborative decision-making.

Because of the unequal distribution of respondents across the three regions, these differences should be interpreted as descriptive observations rather than statistically confirmed regional differences.

5.3. Servant Leadership in Istria

The descriptive analysis showed that servant leadership achieved the highest mean value among respondents from Istria ($M = 3.9$), compared with Dalmatia ($M = 3.4$) and Zagreb ($M = 3.3$).

These findings suggest that managers in Istria place relatively greater emphasis on supporting employees, understanding their needs, and creating a positive organizational climate. Such an approach may reflect the importance of personalized service, guest satisfaction and long-term employee relationships within hospitality-oriented businesses.

The observed pattern is consistent with the main principles of servant leadership, which emphasize employee development, support, ethical responsibility and organizational trust.

5.4. Charismatic Leadership in Dalmatia

Charismatic leadership achieved the highest mean value among respondents from Dalmatia ($M = 3.5$), while lower values were recorded in Istria ($M = 3.0$) and Zagreb ($M = 2.9$).

These findings indicate that managers operating in Dalmatian gastronomic establishments may rely more strongly on personal influence, communication skills, confidence and visible leadership presence.

The observed differences may reflect the importance of interpersonal relationships and direct communication within tourism-oriented business environments. Nevertheless, additional research involving larger and more representative samples is required before broader conclusions can be drawn.

5.5. Transactional Leadership and Tourism Seasonality

Transactional leadership showed the highest mean value among respondents from Dalmatia ($M = 3.6$), followed by Istria ($M = 3.1$) and Zagreb ($M = 2.9$).

The relatively higher presence of transactional leadership in Dalmatia may be associated with the seasonal nature of tourism, where clearly defined procedures, precise responsibilities, and efficient employee coordination become particularly important during periods of increased operational demand.

In organizations employing a substantial number of seasonal workers, structured management practices and clearly communicated expectations may con-

tribute to operational efficiency and consistent service quality.

Overall, the results indicate that transformational leadership represents the most frequently reported leadership approach within the examined sample, while differences in the application of other leadership styles appear to reflect regional, organizational and tourism-related characteristics.

6. Discussion

The aim of this research was to examine the application of contemporary leadership styles among managers in the Croatian gastronomy sector and to identify possible differences between selected regions. The findings indicate that transformational and interactive leadership represent the most frequently reported leadership approaches among the examined respondents.

The dominance of transformational leadership suggests that managers in Croatian gastronomy increasingly recognize the importance of employee motivation, innovation, adaptability and personal development. These characteristics are particularly relevant in service-oriented industries, where employee engagement and the quality of interaction with guests directly influence organizational performance. The findings are consistent with recent research in tourism and hospitality, which emphasizes the positive relationship between transformational leadership, employee satisfaction, motivation, innovation and organizational outcomes [3].

Recent hospitality research also indicates that transformational leadership contributes to stronger employee engagement by increasing employees' emotional energy and involvement in their work. These findings support the importance of leadership approaches that encourage motivation, commitment and positive workplace relationships in service-oriented industries [7].

Transformational leadership showed the highest mean values among respondents from Dalmatia and Istria. This result may be associated with the characteristics of tourism-oriented regions, where managers frequently face seasonal challenges, changing customer expectations, and the need to maintain high service standards. In such environments, leadership approaches that encourage employee commitment, creativity and adaptability may provide important support for organizational effectiveness.

Interactive leadership showed stronger presence among respondents from Zagreb compared with the other examined regions. This difference may be related to characteristics of urban business environments, including greater availability of professional education, management training opportunities, and contemporary organizational practices. The emphasis on communication, cooperation and employee involvement reflects the importance of teamwork and flexibility in modern gastronomic establishments.

The results also indicate differences in the application of servant, charismatic, and transactional leadership styles. Servant leadership showed the highest values among respondents from Istria, which may be connected with the region's strong

orientation toward hospitality quality, personalized guest experiences and long-term relationships with employees and customers.

Charismatic leadership recorded higher values among respondents from Dalmatia. This finding may reflect the importance of personal relationships, communication, and the visible role of managers in hospitality environments where direct interaction with employees and guests represents an important element of daily business activities.

Transactional leadership was also more frequently reported among respondents from Dalmatia. This may be associated with the seasonal characteristics of tourism, where clearly defined responsibilities, procedures, and efficient coordination are necessary during periods of increased workload. In such circumstances, transactional leadership can provide organizational stability and operational clarity.

Overall, the findings suggest that leadership practices among Croatian gastronomy managers may be influenced by regional characteristics, tourism intensity, organizational culture, and working conditions. Managers appear to combine different leadership styles rather than rely exclusively on one approach, allowing them to adapt their behavior to specific organizational challenges. Previous studies in hospitality have also emphasized that contemporary leadership research increasingly recognizes the need to examine different leadership styles and their effects on employee attitudes and organizational outcomes. This suggests that hospitality organizations benefit from flexible leadership approaches adapted to specific operational conditions [8].

Several limitations should be considered when interpreting these findings. First, the research was conducted on a relatively small sample of respondents, with unequal representation of the examined regions, which limits the generalizability of the results. Second, leadership styles were measured through self-reported responses, which may introduce perception bias. Third, the exploratory nature of the research and the absence of statistical testing of causal relationships require cautious interpretation of the findings. Future research should include larger and more balanced samples, longitudinal approaches, and additional variables such as employee satisfaction, turnover intentions, organizational culture and leadership development programs.

From a practical perspective, the findings suggest that gastronomy managers should develop leadership flexibility and adapt their management approaches according to employee needs, organizational conditions, and market challenges. Combining transformational, interactive, and supportive leadership behaviors may contribute to improved employee engagement and service quality.

7. Conclusions

This research examined the application of contemporary leadership styles among managers in the Croatian gastronomy sector and explored differences between selected Croatian regions. The results indicate that transformational leadership

represents the most frequently reported leadership style among the examined respondents, followed by interactive leadership.

The findings emphasize the importance of employee motivation, communication, cooperation, and involvement in achieving organizational objectives and maintaining service quality. In the gastronomy sector, where employee behavior directly affects guest satisfaction and overall service experience, effective leadership represents an important factor in organizational success.

Regional differences were also observed in the application of individual leadership styles. Transformational leadership showed stronger presence among respondents from Dalmatia and Istria, which may be related to the characteristics of tourism-oriented environments and the need for continuous adaptation. Interactive leadership demonstrated higher values among respondents from Zagreb, possibly reflecting the influence of urban organizational environments and greater access to professional development opportunities.

Servant leadership showed stronger presence among respondents from Istria, while charismatic and transactional leadership achieved higher values among respondents from Dalmatia. These differences suggest that leadership approaches may be influenced by regional characteristics, tourism conditions, organizational requirements and employee management challenges.

The results indicate that successful gastronomy managers should not depend on a single leadership style but should combine different approaches according to organizational circumstances and employee characteristics. Flexible leadership behavior may contribute to stronger teamwork, employee satisfaction and consistent service performance.

Future research should involve larger samples covering a wider range of Croatian regions and should examine additional factors such as employee satisfaction, staff turnover, organizational culture and the effects of leadership development programs on hospitality performance.

Author Contributions

Both authors contributed equally to the conceptualization, methodology, analysis, writing, review and editing of the manuscript. Both authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Northouse, P.G. (2021) *Leadership: Theory and Practice*. 9th Edition, Sage Publications.
- [2] Bass, B.M. (1990) *Bass & Stogdill's Handbook of Leadership: Theory, Research, and Managerial Applications*. Free Press.
- [3] Ali, B. (2023) What We Know about Transformational Leadership in Tourism and

Hospitality: A Systematic Review and Future Agenda. *The Service Industries Journal*, **44**, 105-147. <https://doi.org/10.1080/02642069.2023.2250302>

- [4] Kouzes, J.M. and Posner, B.Z. (2017) *The Leadership Challenge: How to Make Extraordinary Things Happen in Organizations*. 6th Edition, Wiley.
- [5] Greenleaf, R.K. (1977) *Servant Leadership: A Journey into the Nature of Legitimate Power and Greatness*. Paulist Press.
- [6] Weber, M. (1947) *The Theory of Social and Economic Organization*. Free Press.
- [7] Bao, S. and Jolly, P.M. (2023) Engaging Employees through Transformational Leadership: The Mediating Role of Emotional Energy. *Journal of Hospitality and Tourism Insights*, **7**, 1169-1186. <https://doi.org/10.1108/jhti-03-2023-0152>
- [8] Elkhwesky, Z., Salem, I.E., Ramkissoon, H. and Castañeda-García, J. (2022) A Systematic and Critical Review of Leadership Styles in Contemporary Hospitality: A Roadmap and a Call for Future Research. *International Journal of Contemporary Hospitality Management*, **34**, 1925-1958. <https://doi.org/10.1108/ijchm-09-2021-1128>