Disaster Medicine and Public Health Preparedness

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Original Research

Cite this article: Le Bloc'h F, Schumacher L, Bonnabry P and Widmer N (2026). Tabletop Exercise for Training and Improving Business Continuity Plan Development in Hospital Pharmacies. *Disaster Medicine and Public Health Preparedness*, **20**, e156, 1–10
https://doi.org/10.1017/dmp.2026.10424

Received: 05 August 2025 UTC
Revised: 04 June 2026 UTC
Accepted: 27 July 2026 UTC

Keywords:
business continuity plan; disaster preparedness; pharmacy department; tabletop exercises; simulation training

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Tabletop Exercise for Training and Improving Business Continuity Plan Development in Hospital Pharmacies

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Abstract

Objectives: While tabletop exercises (TTX) are frequently used for disaster preparedness, their value for strengthening hospital pharmacies' (HPs) business continuity plans (BCPs) remains uncertain. This study aimed to assess the impact of a TTX on the quality of HPs' BCPs and on links between BCPs and crisis response training.

Methods: Swiss HPs' BCPs were evaluated with a grid scoring 48 items (5-point Likert scale; 1 = "not at all sufficient" to 5 = "excellent"; 3 = minimal satisfactory expectation). Baseline BCP assessments were followed by a TTX simulating a blackout. A hot debriefing immediately after the TTX, followed by a written report from investigators, highlighted areas of improvement in business continuity management. Nine months later, follow-up BCP assessments were followed by a full-scale exercise (FSX) simulating cyberattacks and observed by four assessors. Participants reported satisfaction using questionnaires. The primary outcome was the difference between pre- and post-TTX BCP scores; the secondary outcome was the correlation between follow-up BCP scores and overall FSX responses.

Results: Mean percentage of expected key items included in five HPs' BCPs rose from 47.9% to 54.2% ($P < 0.05$). Mean overall BCP score increased by 8.6%, from 1.74 ± 0.15 to 1.89 ± 0.16 ($P < 0.05$). Aspects relating to risk reduction or response improved more than those involving risk readiness or recovery. HPs with better BCP scores responded better to the FSX ($R^2 = 0.78$). Participants greatly appreciated both exercises.

Conclusion: HPs' BCPs slightly improved, with a correlation between BCP quality and HPs' ability to deal with crisis. The study highlighted the benefits of strengthening HPs' business continuity preparedness and the usefulness of disaster simulations, including TTX.

Highlights

- Tabletop exercises can be valuable means of learning theoretical concepts about and raising awareness of business continuity management, but their effects on business continuity plans have not been determined.
- Business continuity planning processes help respond to and recover from crises, such as blackouts or cyberattacks.
- Disaster simulations are an effective and highly appreciated form of continuing education for hospital pharmacy staff.

Introduction

Disasters[1] put health care systems under pressure for several reasons. These include massive influxes of patients,[2] direct physical damage to health infrastructure,[3–6] and vulnerability to technological disruptions.[7–9] Major events can severely disrupt hospital institutions' normal operations, including hospital pharmacies (HPs). However, health care providers must be able to maintain a minimum level of services and ensure the provision of "routine" care.[10–12] This can be greatly aided by having a business continuity plan (BCP). Business continuity is an organization's ability to maintain its essential functions during and after an event seriously disrupting its normal activities.[10] This is a major step in the preparation for and subsequent management of crises,[13,14] and BCPs should define all the measures to be taken to that end.[15,16]

HPs' processes rely on several upstream necessary elements[17]; disruption of one or more of them can lead to the interruption of potentially essential operations, preventing HPs from fulfilling their missions. This includes lack of human resources (e.g., staff shortages during the COVID-19 pandemic), the loss of essential external partners (e.g., drug suppliers), critical

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equipment failures (e.g., ventilation in a sterile manufacturing laboratory), problems with public infrastructure (e.g., power outages), and information technology (IT) breakdowns (e.g., cyberattacks).[6,18–20] The latter represent major and current threats to modern health care systems that rely increasingly on electronic patient records and various critical software.[4,21] Furthermore, hospitals' heavy reliance on technology makes them vulnerable to major geopolitical upheavals or extreme climatic events, as the global supply of goods (e.g., drugs) or energy (e.g., gas, electricity) can quickly be disrupted.[9,22] When these events occur, BCPs enable the activation of strategies that can help maintain essential operations and minimum necessary levels of service.[17] The recent power outage in Spain (2025 Iberian Peninsula blackout) demonstrated the importance of hospitals being resilient.[23] Furthermore, the 2026 major geopolitical upheavals in the Middle East and the blockade of the Strait of Hormuz illustrated once again the heavy reliance on strategic supply chains,[24] with a marked rise in energy prices and growing concerns about fuel and energy shortages.[25]

Disaster preparedness is to be encouraged among all health care providers.[26–28] Simulation exercises familiarize staff with crisis plans, help them to react better, and test their organization's resilience to disasters.[10,16] They also contribute directly to defining, validating, and improving plans.[13,15,17] Simulations are pedagogical tools imitating reality and safely training participants in practical response processes. The choice of the exercise run depends on the resources available and the skills to be trained.[29] One way of preparing for a crisis is using tabletop exercises (TTXs). TTXs are discussion-based and frequently used by managers and decision-makers.[30,31] They use a simulated emergency scenario to get participants to familiarize themselves with existing plans, to consider the potential impacts on capacity, and to identify gaps in their plans and devise improvements.[29] Participants are asked to describe the actions they would take in such a stressful situation, but here in a calm environment.[29,32,33] A TTX requires little equipment, time, or money.[29,34] However, this format precisely fails to replicate the sense of urgency felt during real crises and does not engage as many of the resources as an operational exercise would. Another option, therefore, is using full-scale exercises (FSXs). These are means of more faithfully replicating a disaster scenario, with the aim of assessing response efficiency by mobilizing both personnel and their equipment. This is the most intense form of simulation as it creates a more realistic level of stress and provides a tangible estimate of a plan's actual efficiency.[35] Schumacher *et al.* demonstrated the usefulness of FSX in Swiss HPs for improving disaster response.[36] However, its greater investment in time and organization prompted a search for other forms of simulation that could test organizations' BCPs, including TTXs.

Disaster TTXs are already used in various pharmacy contexts[37–40]; nevertheless, no published studies have evaluated the use of TTXs that seek to improve HPs' BCPs. This study aimed to assess a resource-limited TTX's impact on the quality and content of HPs' BCPs and on the link between business continuity preparedness and the concrete crisis responses observed in a subsequent FSX.

Methods

Study Design and Participant Recruitment

A pre–post-intervention study among HPs recruited through French-speaking Switzerland's Hospital Chief Pharmacists Group (*Groupement des Pharmaciens-chefs des Hôpitaux Romands*; GPHR) was conducted. Each hospital's chief pharmacist was required to agree to run the exercises. Participating HPs were asked to provide baseline data—including demographics, instances of previous real or simulated disaster management activities, and current business continuity management (BCM) preparedness—via the REDCap® online survey platform (REDCap, Vanderbilt University, Nashville, TN, USA; www.redcap-ispso.unige.ch). HPs whose chief pharmacist declined to participate or who had been involved in the design of the exercises were excluded. The Swiss Armed Forces Pharmacy (SAFP) also ran a complementary simulation exercise.

Each HP participated in 2 different disaster simulations focusing on an interruption to their internal activities. The first, a TTX, served as the study intervention. Six to 9 months later, the second exercise, an FSX, tested the HP staff's response to a simulated major disruptive event. Both exercises had been tested in a pilot HP (Pharmacy T) before being used in the study. The SAFP only ran the TTX.

Both scenarios were designed for pharmacy staff working in hospital or military settings and were structured using simulation guidelines.[29,41] Each exercise concluded with a 3-phase "hot debriefing"[36] of all participants involved in the simulation. Within a month, a written report summarizing the exercise assessors' comments was used as feedback in a "cold debriefing." Participants also completed a written questionnaire regarding their satisfaction with the exercise and their confidence in their abilities to face a major business disruption. HP managers were encouraged to incorporate any knowledge gained into their BCPs.

Hypothesis and Outcomes

Two hypotheses were tested. Hypothesis 1: TTXs could have a positive impact on the quality and content of HPs' BCPs. Thus, the primary outcome was the evolution of HPs' BCP scores, from before to after the TTX. Before each exercise, BCPs were collected from either their chief pharmacist or their quality assurance manager. These were provided together with a non-exhaustive list of examples of documents that might go into a BCP (e.g., risk analysis matrices, disaster management plans, standard operating procedures [SOPs]). BCPs were evaluated in a structured manner by a single assessor using a grid adapted from the Harvard School of Public Health's Emergency Exercise Evaluation Toolkit[32] and developed using relevant literature on BCPs (see Appendix A).[13,15–17,27,42–44] This grid was previously reviewed by three independent experts working in the fields of energy supply, crisis management consulting and military HP. It was structured according to the "all hazards" approach for preparing for major events,[35] was divided into the "4Rs" categories (risk Reduction, Readiness, Response, and Recovery)[45] and contained 48 items in total. This "4R" framework follows the principles of preparing for major events and emergency situations, while encompassing several terms from the Sendai Framework.[46] The "Reduction" phase refers to a thorough analysis of threats and vulnerabilities and the means to reduce them; the "Readiness" phase to the ability to maintain trained staff and up-to-date plans; the "Response" phase to crisis management; and the "Recovery" phase to the return to normal. This offers a straightforward and accessible approach to disaster risk management, particularly for those unfamiliar with BCM concepts. BCPs' evaluations involved listing the items one might expect to find in each "4Rs" category and assessing whether they were present (yes/no). The quality of each item present (yes) was scored on a Likert scale ranging from 1 (= not at all sufficient) to 5 (= excellent), with a rating of 3 (= sufficient) representing what might reasonably be expected of a HP's BCP (see Table 1). Scores were not communicated to participants in their

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Table 1. Evaluation grid of BCP items—Illustration of the Likert scale

Likert score	Qualitative score	Interpretation	Example of an item: *IT backup procedures*
1	Not at all sufficient	The items of the BCP are insufficient in relation to the expected level of preparedness and are considered unsatisfactory.	*No backup is planned in the BCP.*
2	Not sufficient	The items of the BCP exist but are considered not satisfactory enough considering the expected level of preparedness.	*Computer backups are mentioned in the BCP, but no details regarding instructions are provided.*
3	Sufficient	The items of the BCP are considered satisfactory and correspond to the minimum level of preparedness expected.	*Reference is made to computer backups and details of their contents, but without specifying backup frequencies or providing detailed instructions on backup procedures.*
4	Good	The items of the BCP are considered satisfactory and exceed the expected level of preparation.	*Computer backups and details of their contents are specified, with responsibilities, procedures, and frequencies.*
5	Excellent	The items of the BCP are judged to be very good and far exceed expectations: the level of preparation is considered high.	*Computer backups are part of a global IT continuity strategy, with backup material or external servers.*

BCP = business continuity plan; IT = information technology.

written report, to avoid their attention being focused on achieving higher ratings rather than on improving and understanding BCM principles.[47] For confidentiality reasons, BCP of the SAFP was neither collected nor evaluated.

Hypothesis 2: the HPs with the highest BCP quality and content scores would respond better to a major event impairing their usual operations. Thus, the secondary outcome was a comparison of the HP's response to the FSX with its BCP score at that time, using its level of preparedness as a proxy. Details on the conduct and assessment of the FSX are presented below.

Scenarios and Settings

Exercise scenarios and settings are presented in Table 2. All the exercises took place inside the participating HPs' premises. For their FSX, each HP site had one local "accomplice" who secretly prepared the simulation facilities. Just before the FSX, chief pharmacists informed the heads of their pharmacy units, enabling them to ensure routine activities and patient safety during the simulation.

The FSX simulation was evaluated by four assessors: an investigator, a local "accomplice," and one employee each from the local institution's quality assurance and IT departments. Evaluations were done by direct observation of each assessor's area of activity: disaster management; logistics; clinical pharmacy and pharmacy manufacturing activities; crisis communication.[48] Assessors used an adapted version of the Harvard School of Public Health's Emergency Exercise Evaluation Toolkit,[32] which provides qualitative and quantitative methods of measuring and evaluating participants' actions. Briefly, expected actions at each stage of the scenario were listed, evaluated as having been "performed or not," and then rated on a Likert scale ranging from 1 (= not at all satisfactory) to 5 (= excellent), with a rating of 3 (= satisfactory) representing what might be expected in that situation. If an expected action was not performed, it was given a score of 1. Assessors could leave comments or recommendations that were used to structure both the "hot debriefing" and the subsequent written exercise report.

Data Collection and Analysis

Data collection ran from February 2023 to February 2024. No patient data were collected, and the exercises did not disturb HPs' routine operations. The research protocol was presented to the Canton of Geneva's Research Ethics Committee, which waived the requirement for approval.

All data from HPs' BCPs and the information collected by the FSX assessors were compiled for statistical analysis. Raw data were exported into Microsoft Excel® 2013 software (Microsoft Corporation, Redmond, WA, USA). Descriptive statistics and pre–post-intervention comparisons were calculated using McNemar's test and the Wilcoxon signed-rank test. *P*-values <0.05 were considered statistically significant. An R^2 coefficient of determination was used to determine the correlation between each HP's responses to the FSX and its second BCP score.

Results

Five of the 11 HPs headed by members of GPHR were enrolled. Three HPs declined, 2 did not reply, and 1 was used to initially test the exercises (Pharmacy T). HPs A and B belonged to university hospitals with ≥1,000 beds each, and HPs C, D, and E belonged to regional hospitals with 200-1,000 beds each. HPs A, B and E reported having experienced a situation that had threatened their business continuity within the past 5 years (not including the COVID-19 pandemic), mainly a lack of staff or the failure of important electronic devices. At the time of their recruitment, these HPs declared that they already had a BCP (A and B) or were in the process of establishing one (E). HPs C and D had no formal BCP, mainly due to a lack of resources. HPs A and B had already trained with their BCPs in exercises prior to this study.[36]

The TTXs were conducted between 27 February and 29 March 2023, and the FSXs were played out between 10 October 2023 and 30 January 2024. BCPs were collected and analyzed before each exercise. The mean time between BCP analyses was 9.3 ± 0.7 months, corresponding to the time dedicated to improving HPs' plans based on the knowledge gained during their TTX. The results of each BCP's evaluation according to the "4Rs" categories are shown in Figure 1.[45] The mean percentage of expected key items observed in HPs' BCPs rose from 47.9% to 54.2% between the two analyses ($P < 0.01$). Mean overall BCP scores increased by 8.6% (from 1.74 ± 0.15 to 1.89 ± 0.16; $P = 0.03$). When considering only the items present in the BCPs, mean scores did not significantly increase (from 2.50 ± 0.30 to 2.58 ± 0.32; $P = 0.31$).

HPs' response to their FSX was evaluated as described above. Table 3 shows each HP's results, and Figure 2 shows the correlations between individual FSX results and individual BCP scores. An $R^2 = 0.78$ was calculated when considering the whole group's overall BCP scores, and $R^2 = 0.76$ when considering only the items present in their BCPs.

Table 4 summarizes the BCM aspects that were insufficiently or sufficiently developed in the BCPs overall, as identified by the BCP

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Table 2. Exercises' scenarios and settings

Type of disaster exercise	TTX	FSX
Exercise's purpose	Study intervention. The aim was to test Hypothesis 1 by improving HPs' BCPs.	The aim was to test Hypothesis 2 by measuring HPs' responses to a crisis.
Scenario	A temporary, planned national interruption of electricity delivery (known as "load shedding") due to a prolonged winter energy shortage.	A massive ransomware cyberattack shutting down all the hospital's computers and connected equipment.
Scenario construction	This scenario was developed and validated in collaboration with Vaud's cantonal authorities and was based on the current state of knowledge at the time of its design. It included the Swiss Confederation's planned actions in the event of load shedding.	This scenario was developed in collaboration with Pharmacy T's head of IT security and based on feedback from some French hospitals that had recently been hacked.
Local preparation	Each chief pharmacist designated 4–7 participants per exercise, preferably staff members with team-leadership responsibilities or who would make up their pharmacy's crisis management unit in the event of a disaster.	The number and type of participants in each FSX depended on the HP staff available and on chief pharmacists' decisions. The investigators suggested, however, that the TTX's participants attend, if possible, together with 1 to 3 additional participants per unit.
Timing	The TTX lasted 125 min, including a briefing with instructions (10 min), a description and discussion of the scenario (around 80 min), a break (5 min) and a "hot debriefing" (around 30 min).	The FSX lasted 180–210 min, including a briefing with instructions and safety rules (10 min), the simulation itself (105 min), a break (~25 min), and a "hot debriefing" (30–45 min).
Conduct of the exercise	Two facilitators led the exercise: 1 leading the discussions and running the scenario and 1 taking notes. This only required a room with tables and chairs for participants and a projector to display the scenario. Following an introduction to provide participants with the context, new elements were injected into the scenario every 5–15 min, causing it to evolve and the difficulty to increase. During the exercise, participants were asked to identify any potential problems or events that could be experienced in such a situation, as well as the solutions for responding to them and ensuring the continuity of critical activities.	Two investigators led the participants through the scenario's 15 steps and made telephone calls simulating fictional requests from wards, the pharmacy's partners, or the cyberhackers. Flyers were placed on computer screens to simulate the cyberattack. Green, orange, or red flyers were placed on other electronic devices to indicate to the participants how significantly (normally functioning, partially functioning, or non-functioning, respectively) the attack had affected their IT equipment. Participants were asked to act as if the situation were real and to manage the crisis.
Exercise evaluation	No	Yes

Abbreviations: BCP, Business continuity plan; FSX, full-scale exercise; HP, hospital pharmacy; TTX, tabletop exercise.

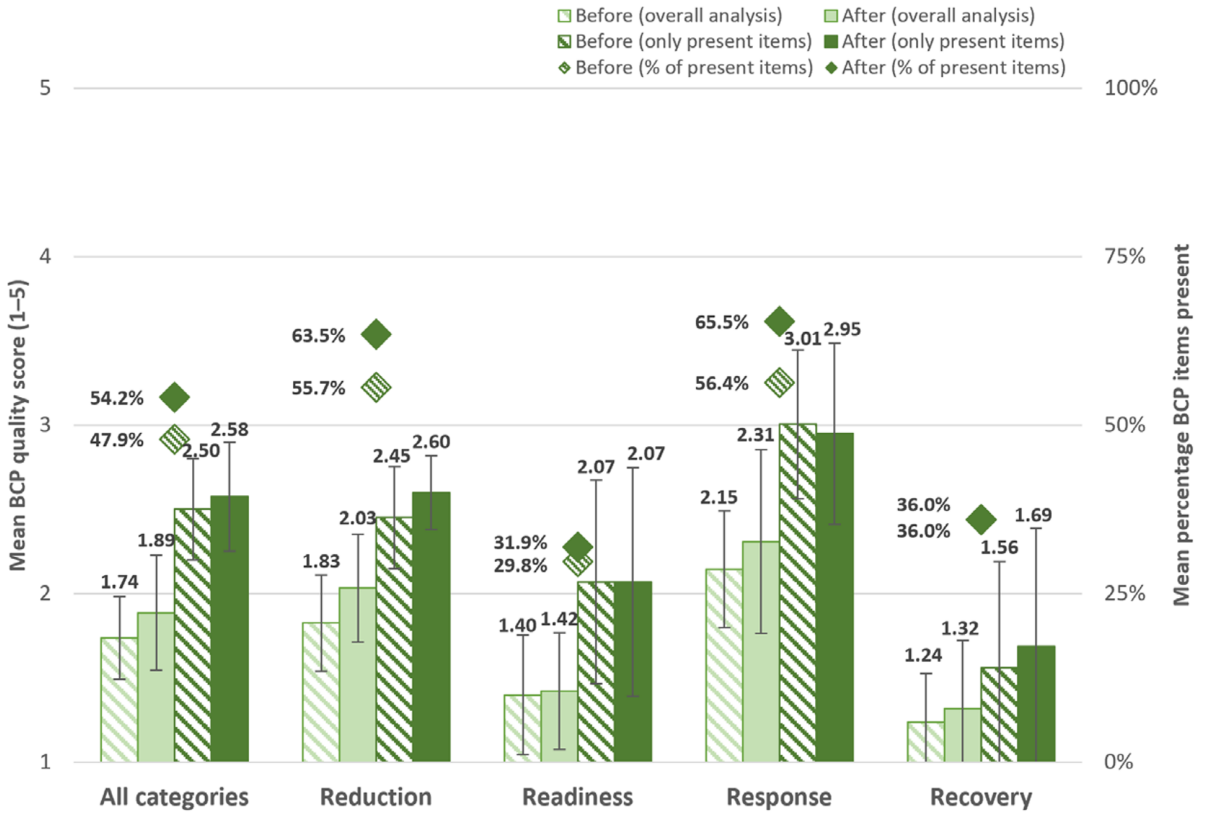


Figure 1. Business continuity plan (BCP) evaluation before and after the tabletop (TTX; scores shown for the overall analysis and just for the items found to be present in them).

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Table 3. Comparison between hospital pharmacies: FSX results and second BCP evaluation

Hospital pharmacy	A	B	C	D	E
Type of hospital	U	U	R	R	R
Time between the TTX and the FSX [months]	7.4	7.9	7.8	8.6	10.2
Number of actions rated during the FSX	164	169	166	191	167
Percentage of actions accomplished during the FSX [%]	82%	59%	62%	54%	60%
Mean quality of FSX responses [1–5]	3.1	2.5	2.3	2.1	2.3
Mean overall BCP score at time of FSX [1–5]	2.5	2.1	1.4	1.7	1.8
Mean BCP score at time of FSX just for the items found to be present [1–5]	3.1	2.8	2.2	2.4	2.4

Abbreviations: BCP, Business continuity plan; FSX, full-scale exercise; R, regional hospital; TTX, tabletop exercise; U, university hospital.

evaluators. Participants' satisfaction questionnaires after both simulations were completed by 29 and 49 staff members, respectively (Figure 3).

Limitations

Firstly, BCP evaluations were highly dependent on participants' perceptions of what is required of a BCP and, therefore, on the provided documents for initial analysis. This analysis may thus not have reflected the HPs' true states of procedural readiness, as participants may not have identified all their relevant documents. Conversely, this may be the precise result of a lack of BCM knowledge. An exhaustive audit could have been carried out to inventory every document, but this would have been time-consuming and discouraging for HPs. Secondly, HPs A and B could have benefited from previous disaster simulations[36] that may have influenced their baseline documentation, their potential to learn from the TTX, and their ability to respond to the FSX. Thirdly, the sample size limited the statistical analysis (n = 5), and confounders prevent these findings from being generalizable (no control group, recruitment based on chief pharmacists' motivation, limited geographical spread). Nevertheless, in agreement with previous findings such as planning influence on crisis response[43] or satisfaction with simulations,[38,39,49] investigators' observations support TTXs as an adequate form of disaster preparedness training. Fourthly, BCPs were assessed by a single evaluator, and the subjective use of Likert scales could have been supplemented by inter-rater reliability tests to ensure consistency. However, having a single assessor may favor reproducibility between measurements. Furthermore, using a grid that had been reviewed by external experts provided a standardized means of evaluating BCPs and consistent, rules-based means of scoring them. However, this grid was developed from general BCM guidelines since there were no specific recommendations for HPs at that time. Finally, external factors may have increased participants' willingness to improve their BCPs—such as energy shortages,[23,50] cyberattacks on European hospitals,[4,21] or global drug supply issues[9]—thus confounding the true impact of the TTX. Nevertheless, exercise scenarios were aligned with these threats, helped to raise HP staff's awareness, and promoted the need to improve their planning processes.

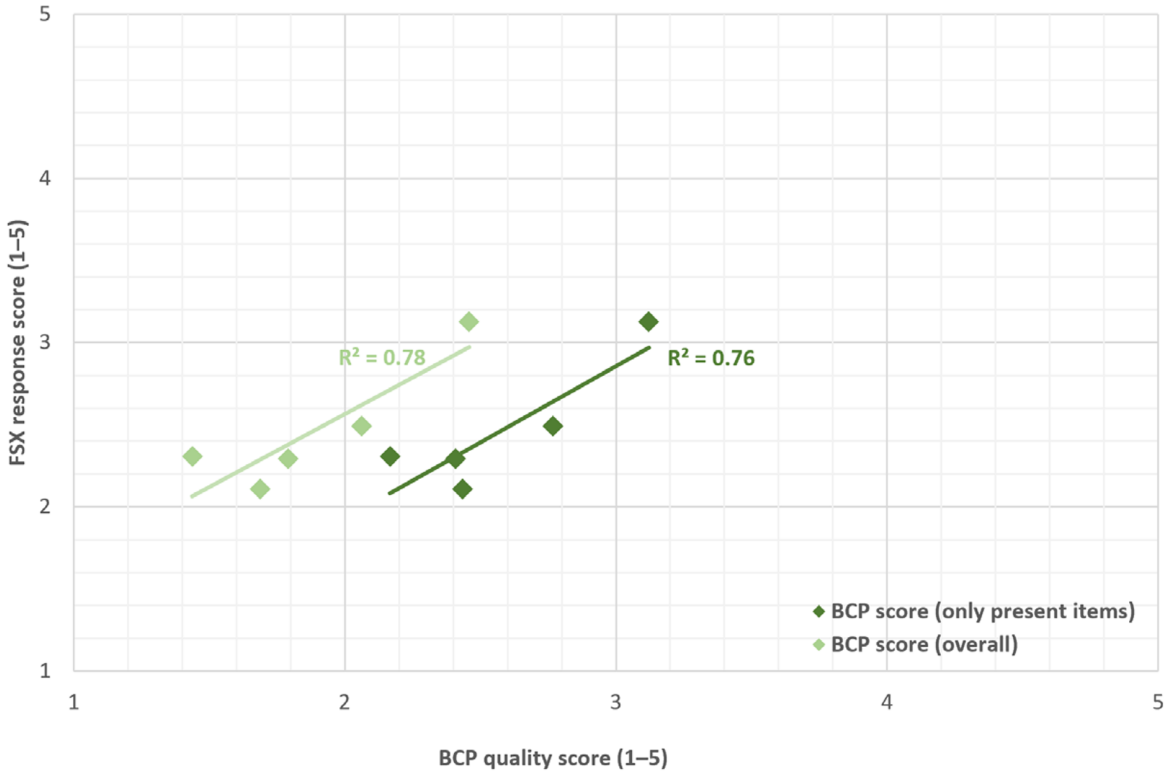


Figure 2. Correlations between individual hospital pharmacies' full-scale exercise (FSX) response scores and their individual business continuity plan (BCP) scores (scores shown for the overall analysis and just for the items found to be present in them).

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Table 4. Insufficiently developed and well-developed aspects of BCM in participants' BCPs

"4Rs" category	Absent or insufficiently developed aspects	Well-explored or well-developed aspects
Reduction	• Formal business impact analysis (e.g., major threats and risks, minimum resource requirements for performing an activity) • Identification of and agreements with helpful external partners (e.g., drug suppliers, other HPs, external laboratories)	• Process mapping and inventory of activities • Minimum human resources needs and replacements for critical operations • Existence of paper documents as a backup (e.g., order forms, chemotherapy manufacturing protocols)
Readiness	• Education, training and BCP evaluation	• Defined responsibilities for updating SOPs (date and person in charge)
Response	• Management of critical and non-critical activities in case of business disruptions (e.g., how to monitor them, what is the recovery time objective, what is the pre-defined minimum level of services) • Formal business continuity objectives in case of disruption	• Existence of some downgraded SOPs and responsibilities for updating them • Existing disaster plans for mass casualty incidents
Recovery	• Gradual resumption of activities after disruption (e.g., needs, steps and priorities) • Tools for crisis analysis and experience feedback	• Identification of the person responsible for deciding when the crisis is over

Abbreviations: BCM, Business continuity management; BCP, business continuity plan; HP, hospital pharmacy; SOP, standard operating procedure.

Discussion

Two complementary types of disaster simulations focusing on HPs' serious business disruptions were developed. Combining different types of exercises is useful for training and testing different skills.[29,51] The TTX intervention helped pharmacy management and team leaders to raise awareness about the need for BCM, while the FSX enabled entire pharmacy teams to test their responses to a business interruption. Both scenarios were relevant for HPs because they involved credible threats regularly observed throughout the world and were based on recommendations from other HPs, making them as realistic as possible. Despite the small number of volunteering HPs, those enrolled provided a mix of university and regional hospitals. A pilot intervention at Pharmacy T allowed us to adjust the exercises and train investigators before involving the study participants, which was very valuable.

Hypothesis 1 was not fully supported. Nine months after the initial intervention, a slight but significant improvement in the HPs' BCPs as per the scoring grid was measured. However, the quality scores for items found in the initial BCPs did not increase after the TTX, raising questions about its significance. The nine months allocated for HPs to act may not have been sufficient; improving plans and processes takes time, and leaders' willingness and involvement in BCM is essential for this,[13,42] so the TTX was principally targeted at them. This study focused on simulations because of their advantages over passive learning—encouraging participants' involvement, teamwork, discussions, critical thinking, and greater aid to the assimilation of information, to say nothing of the "fun factor."[52–54] Watson *et al.* showed that a TTX could improve pharmacy staff's understanding of disaster management activities.[38] Thus, the TTX may have provided participants with some valuable new information, but other factors (e.g., lack of a BCM culture or staff dedicated to this task, insufficient time provided between the analyses)[13,55] may have limited its translation into actionable procedures.

Whether this resulted from external factors or specific aspects of the intervention, like knowledge gained during the TTX or report recommendations (cold debriefing), is difficult. Risk "Reduction" (e.g., a business impact analysis or having key procedures) and "Response" (e.g., having a disaster plan or communication tools) were the main "4Rs" categories that improved, maybe reflecting the TTX scenario. Indeed, it covered several aspects of business disruption, such as infrastructure, human resources, and communication issues. Inversely, "Readiness" (e.g., BCP testing or audits) and "Recovery" (e.g., "back to normal" plans or structured feedback) were mostly discussed during the "hot debriefing" and in the written report, which may have had less impact on participants. Most of the documents laid out at the TTX were not formally grouped in a single BCP but were more often provided separately from one another. HPs appeared uncertain about which documents could form a BCP (see Table 4). However, the rise in provided documents and items found between analyses suggests the TTX still increased participants' awareness of BCM requirements.

Hypothesis 2 was confirmed, as the HPs with the best BCP scores also exhibited the best FSX responses. Disaster preparedness is an essential aspect of risk management, and it could be tempting to infer the positive impact of the TTX. However, numerous factors could have influenced this correlation (e.g., participation in previous disaster simulations, presence or absence of the chief pharmacist during the FSX, number of participants, subjective assessors' evaluation).[36] Furthermore, important BCM information not being in a plan did not mean participants were unaware of it.[34] Having BCPs is a significant milestone in risk management processes,[56] but data regarding their true efficacy in major disasters are scarce.[43] Hypothesis 2 stated that a TTX could encourage pharmacy managers to improve their BCPs and thus enhance their crisis response capacity. Although this relationship is not guaranteed, results supported previous findings on how business continuity planning processes helped disaster recovery.[43]

Participants expressed high satisfaction with both exercises and greater confidence in their abilities to respond to a future disaster. This was consistent with previous literature, indicating that simulation training should be promoted.[33,38,53] They enjoyed the evolving tempo of the TTX ("*[I liked] the exercise's 'dramatic' and sequential structure, and its level of realism.*") and its structure ("*A simulation of this form is quite an original way of making you think; there's no stress like there is in a disaster exercise; there are clear instructions. It quickly revealed our deficiencies.*"). They also appreciated the FSX's topic of a cyberattack[21] ("*We know it's something that can and will happen.*"). Some comments indicated a preference for the FSX with regards to planning and problem-solving, due to its immersive and realistic nature ("*Doing the exercise in 'real life' enabled us to better anticipate problems and confronted us with concrete decision-making.*"). However, discussion-based exercises complement operations-based exercises because they have different objectives and do not require the same skills level[29,32] ("*I think it's great to prepare both the executive format (tabletop exercise) and the [operational] format.*"). TTXs are well received as means of transmitting knowledge and raising participants' awareness.[38,39,49] They also require less time and

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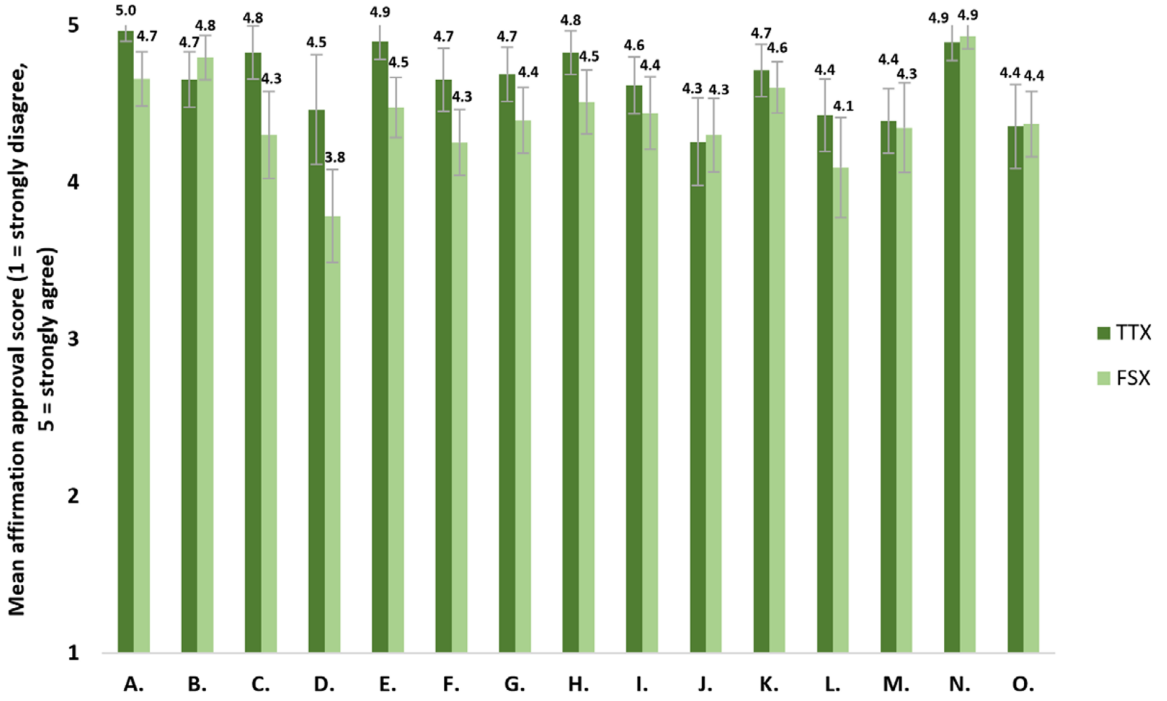


Figure 3. Individual participants' level of satisfaction with the exercises and their confidence in their ability to respond to a crisis after the tabletop exercise (TTX) and the full-scale exercise (FSX).

A: "The exercise was well structured and organized." B: "The scenario was realistic." C: "The pre-exercise briefing was useful and properly prepared me for the exercise." D: "I did not feel stressed during the exercise." E: "The format of the exercise was appropriate." F: "The duration of the exercise was appropriate." G: "The format of the exercise helped me to identify the key points in our BCP." H: "The debriefing was useful and helped me to understand what was at stake." I: "The exercise improved my understanding of hospital pharmacy business continuity issues and the risks associated with business interruptions." J: "The exercise effectively tested the plans and procedures for responding to an event disrupting my hospital pharmacy's activities." K: "The exercise enabled us to identify our BCP's strengths and weaknesses." L. "The exercise gave me a good overview of our plans and procedures." M: "The exercise gave me a good estimate of our ability to continue operations in the event of a real crisis." N: "I think the exercise will be useful for improving our BCP." O: "At the end of the exercise, I feel I'm better prepared to respond to a major event and keep my hospital pharmacy running."

resources than operations-based exercises, making them easier to set up.[29,31,41] This supports the notion that TTXs are appropriate simulation models and can be used as a low-resource method of disaster preparedness education.

The evaluation of a training program's impact can be classified into four gradual, educational categories: reaction, learning, behavior, and results.[57] Investigators directly evaluated participants' reactions using a satisfaction questionnaire. They indirectly evaluated their knowledge gain, as BCP evaluations were used as a surrogate for knowledge retention about BCM. Nevertheless, an increase in knowledge does not automatically imply the development and improvement of BCPs. Similarly, during a disaster event, the availability of BCPs does not necessarily make staff actions and responses more efficient—some training is surely also necessary.[36] Despite using a Likert-scale rating system, individual scores were not communicated to participants in the written reports; this decision was part of the investigators' objective to continuously improve BCPs regardless of the score obtained. Furthermore, as Goodhart's law emphasizes, a metric that becomes a target can lose its value as an effective indicator.[47] Instead, priority has been given to realistic scenarios during simulations, structured discussions during the hot debriefing, and qualitative feedback in the cold debriefing, enabling the formulation of tailored and actionable recommendations to strengthen participants' BCPs beyond their initial level. Investigators did not evaluate HPs' BCPs at a third time-point after the FSX, as this study focused on the TTX; it would have been interesting to estimate the effects of an operations-based exercise complementing a discussion-based TTX.[58] Likewise, given the rapid development of virtual reality (VR) technologies, future evaluation of VR-based TTXs would be worthwhile, as they are highly immersive and cost-effective for disaster training.[59]

The absolute BCP scores on the grid were relatively low and had wide confidence intervals, reflecting the variability in HPs' levels of preparedness. Some observations about their state of preparedness can be made, nonetheless. Although staff were able to identify their HPs' critical processes, these were neither systematically analyzed nor amalgamated into overarching BCM strategies. HPs had several sets of SOPs that were interpreted as being equivalent to parts of an overall BCP. These mainly focused on equipment failures, staff shortages, or IT malfunctions. In contrast, the overall BCPs mostly lacked concepts involving BCM and other business continuity objectives, and were not incorporated into a single, formal, centralized BCP that could be easily found and used by all pharmacy staff. Focusing on vulnerabilities rather than risk scenarios when developing BCPs is recommended, as it prevents redundant work and avoids demotivating managers, even though key risks should still be addressed.[17] The present study observed how many downgraded procedures used during simulations were treated separately rather than through generic BCM strategies based on the pharmacy's key functions and vulnerabilities. Although each BCP must be adapted to its local context,[13,15] there remained a lack of literature on requirements for BCPs in HP settings at the time of this study, in contrast to community pharmacies.[44,60] Recent studies have been conducted to fill this gap.[61]

The TTX was also conducted with the SAFP (data not shown), enabling the investigators to test their training format in another

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setting. The scenario was slightly modified to the military context, but the main themes remained, demonstrating TTXs' flexibility and ease of use. However, the significantly different setting would have made it impossible to compare BCPs since this institution's missions are so distinct (e.g., manufacturing specific medicines or supplying drugs and medical materials to troops in the field). Nevertheless, investigating the expertise of active military pharmacists could provide precious added value, as their activities are more likely to directly involve disasters and conflicts than are civilian HPs' activities. Internal reorganization to ensure essential operations is almost certain to occur. As observed in HPs, participants relied on their knowledge and experience (particularly the COVID-19 pandemic); however, military pharmacists put crisis management tools and concepts (e.g., immediate measures, situation reports, or informing staff)[17,36] to work more quickly, revealing how this was routine for them. Participants also quickly identified their critical electrical equipment in case of a power cut or their external partners likely to help them (e.g., military resources, laboratories, drug suppliers). Conversely, the formal management of critical and non-critical activities during business disruptions was hardly discussed (see Table 4), illustrating the need to also firmly embed a culture of BCM.[13,43] TTXs are, therefore, helpful for military pharmacy staff as well, as ensuring critical functions is essential during conflicts or disasters. Joint exercises and experience sharing could also create opportunities to establish a dialogue between civilian HPs and military pharmacies to mutually reinforce BCPs.

Conclusion

Strong BCM is crucial for HPs. This study examined the importance of HPs having BCPs to enact during crises and highlighted the value of disaster simulations in improving preparedness. A discussion-based TTX was tested to improve the quality and content of HPs' BCPs. The statistical effects were modest, probably due to the limited time allocated to the whole approach, and confounding factors diminished the attribution of those effects to the TTX alone. Nevertheless, a correlation was found between the quality of BCPs and the HPs' ability to respond to an operation-based FSX, thus highlighting the need to strengthen crisis procedures. Participants highly appreciated both exercises, underscoring the pharmacy teams' interest in disaster simulation and the value of this type of training. Theoretical BCM concepts should be shared within every HP to enhance their disaster preparedness, and this can be achieved through low-resources simulations such as TTXs. Further studies should be conducted to determine the European HPs' level of compliance with recent recommendations[61] regarding their BCPs content for HPs.

Supplementary material. The supplementary material for this article can be found at http://doi.org/10.1017/dmp.2026.10424.

Data availability statement. Both scenarios will be freely available in French on the Specialised Centre for Emergency and Disaster Pharmacy's website (http://www.disaster-pharmacy.ch/).

Acknowledgments and affiliation. The authors would like to acknowledge the French-speaking Switzerland's Hospital Chief Pharmacists Group (*Groupement des Pharmaciens-chefs des Hôpitaux Romands*) for allowing to recruit hospital pharmacies for the study and thank the experts who reviewed and validated the BCP's evaluation grid (anonymized). The authors are grateful to all those who contributed their expertise in exercise simulation, their accounts of power shortages or cyberattacks, and all the excellent advice they shared, thus enriching the exercises' scenarios. The authors warmly thank all the pharmacy teams trained and all the exercise assessors for their active participation. The authors gratefully acknowledge the support of the Competence Center for Military and Disaster Medicine of the Swiss Armed Forces (Bern, Switzerland).

Author contribution. Ferdinand Le Bloc'h: Conceptualization, methodology, formal analysis, resources, writing—original draft. Laurence Schumacher: Conceptualization, methodology, supervision, writing—review and editing. Pascal Bonnabry: Conceptualization, funding acquisition, supervision, writing—review and editing. Nicolas Widmer: Conceptualization, funding acquisition, supervision, writing—review and editing.

Funding statement. The present study was funded by the Centre of Competence for Military and Disaster Medicine, Swiss Armed Forces, Bern, Switzerland.

Competing interests. The authors declare that they have no competing interests other than those resulting from the study's funding and no affiliations with the pharmaceutical industry.

Ethical standards. The research protocol was presented to the Canton of Geneva's Research Ethics Committee, which waived the requirement for approval. All hospital pharmacies involved in this study participated on a voluntary basis.

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