Is Rome ready to react to chemical, biological, radiological, nuclear, and explosive attacks? A tabletop simulation

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ABSTRACT

Rome is vulnerable to chemical, biological, radiological, nuclear, and explosive (CBRNe) attacks. The study evaluates Rome's advanced emergency departments' state of emergency plans for massive influx of injures (PEIMAF) plans for CBRNe attacks. We propose a chemical attack on Saint Peter's Square during the Pope's General Assembly and its effects. The National Stockpile Antidotes' activation and territorial distribution timing work well for chemical attacks. We also estimated activation timing. Our data show that despite a good organization, travel times can be improved. We also believe that all major Roman hospitals must develop the PEIMAF, which should be followed by an organized training plan involving theoretical teaching and indoor and outdoor simulation to train hospital staff and evaluate PEIMAF weaknesses and vulnerabilities. The effectiveness and efficiency of first aid depend on timing, and each PEIMAF analyzed, while coherent and adequate for internal purposes, fails to integrate with the other hospitals. Integration can speed up National Stockpile Antidotes delivery and save lives. For the best CBRNe response, detailed intervention protocols must be created, updated daily, and exercised.

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Contributions: FR, AV, conceptualization; MV, methodology; FR, software; VC, GF, validation; MR, formal analysis; FR, MR, investigation; SR, resources; LR, data curation; ED, writing-original draft preparation; EDO, writing-review and editing; MM, visualization; SR, supervision, funding acquisition. All authors read and approved the final version to be published.

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Introduction

Due to the current evolution of the geopolitical landscape, the economic and social conditions of many countries have recently shifted, in largely unexpected ways.[1]

Numerous changes have been observed in recent times: the most significant are: the 2008 economic crisis, with its social and political ramifications; the European Union migration crisis and the following contestation of European governance; the Libyan civil war of 2011 with the consequent destabilization of the area, the rise of the Islamic State in the Levant (ISIL) in the Middle Eastern world, the desire of control of part of the Mediterranean by ancient powers, the Russia's renewed presence in the area, to which the pandemic from COVID-19 has recently been added.[2-6] The alteration of the *status quo* and the political instability that followed led to an increase in terrorist attacks. But which are the highest-risk countries? From an economic perspective, rich countries have been found to be most prone to attack.[7] However, democracies are less vulnerable than other types of government because of their political, economic, and religious stability.[8] This is a relevant issue because serious accidents such as natural disasters, complex road accidents, chemical, biological, radiological, nuclear, and explosive (CBRNe), terrorist attacks and violence in general are global problems. In the decade 2001-2010, an average of 700 natural and technological emergencies occurred worldwide each year, affecting 270 million people and 130,000 deaths each year.[9] Due to the ongoing war in Ukraine and the persisting tensions in the Middle East, the global geopolitical landscape has continued to evolve, impacting the economic and social conditions of many countries in unexpected ways. Recent developments include the conflict in Ukraine, which has escalated tensions between Russia and Western powers, leading to concerns about regional stability and security. Additionally, the situation in the Middle East remains complex, with ongoing conflicts, such as the Syrian civil war, the Yemeni crisis, and the Israeli-Palestinian conflict, contributing to regional instability.

The war in Ukraine has not only heightened geopolitical tensions but has also raised concerns about energy security and international relations. The annexation of Crimea by Russia and the ongoing conflict in eastern Ukraine have strained relations between Russia and the West, leading to economic sanctions and diplomatic tensions. Furthermore, the conflict has resulted in a humanitarian crisis, with millions of people displaced and in need of assistance.[9]

In the Middle East, the region continues to grapple with various conflicts and geopolitical rivalries. The Syrian civil war, which began in 2011, has led to widespread destruction and displacement, with neighboring countries, including Turkey, Lebanon, and Jordan, hosting millions of refugees. The rise of extremist groups, such as the Islamic State of Iraq and Syria, has further destabilized the region, leading to widespread violence and suffering.

The ongoing tensions in the Middle East have also had implications for global security, with terrorist attacks and insurgent activities posing significant challenges to stability and peace. The spread of extremist ideologies and the proliferation of weapons have exacerbated the security situation, making it difficult to resolve conflicts and achieve lasting peace in the region.

As for the potential targets of CBRNe attacks, Rome is considered one of the most probable due to several factors: it is still seen as one of the birthplaces of Western society as a whole; it hosts the Holy See and is labeled as the capital of Christendom by several organization devoted to religious terrorism; finally, it is the capital of an active NATO country.[10] In addition to the religious and political aspects, there are also many industrial and infrastructural potential targets. The local prefecture recognized 17 different medium-risk sites of industrial interest (chemical, pharmaceutical, *etc*.), and manifestations.[11] As a matter of fact, threats against the city have already been made in recent times, especially by ISIL affiliates. Due to the above-mentioned considerations, the city of Rome is regarded by the authors as a high-priority target for potential attacks.[12]

The purpose of the present study is to analyze the awareness of the city response system to a potential CBRNe threat.

Rome hosts about 4-5 million of people per die, 2,9 of people are residents, while the rest are commuters, non-residents students/workers, and tourists. The component of non-resident people increases during special occasions, such as ceremonies, festivities, and major events.[13]

In the city, there are many emergency departments (EDs). According to the definition of the Ministry of Health,[14] we can differentiate the EDs into two different levels. The first level guarantees short-term therapy, general surgery, critical care, orthopedics, traumatology, and cardiology (with the cardiology intensive care unit). In addition, chemical, radiological, and microbiological analyses are guaranteed. In the second level, in addition to the performances offered by the first-level Department of Emergency Urgency and Acceptance, there are more specialized functions, such as neurosurgery, cardiac surgery, neonatal intensive care, vascular surgery, thoracic surgery, and specialist centers (burns, poisoning, *etc*).

In case of a chemical (C) or biological (B) release, antidote supplies may be necessary, especially in case of uncommon agents.

Antidotes have been classified on the basis of the urgency of their use:[15-17] i) antidotes needed must be immediately stocked at all hospitals; ii) antidotes needed within 2 hours can be stocked in specific main hospitals; iii) antidotes needed within 6 hours may be stocked in central regional deposits, if there are adequate facilities to transport them where needed, within the planned time limit.

For all categories of antidotes, there is the option to keep a small amount, sufficient to start the treatment, stocked in the hospitals. Further supplies will be obtained from a central stocking source as required. Rome currently hosts 5 of the National Stockpile Antidotes (SNA) warehouses, which are managed by the *Direzione Generale Prevenzione Sanitaria* (General Directorate for Health Prevention) of the Ministry of Health and *Esercito Italiano – Stabilimento Chimico Farmaceutico* (Italian Army Pharmaceutical and Chemical branch).[18]

The main purpose of this study is to investigate the current efficiency and effectiveness of Rome's hospitals in dealing with a non-conventional terrorist attack (CBRNe), firstly through the evaluation of activation times (*e.g.*, the response of Strategic National Stockpile (SNS) stocks, the emergency system, and the hospitals' organization) and, secondly, verifying the possibility to have margins of improvement (considering the number of lives saved, the economic assessment and the management needs) using full scale/tabletop simulations, reported analysis in scientific literature and comparisons with other European countries already victims of terrorist attacks.

Materials and Methods

First, we estimated the population of the city.[13] Second, we analyzed the EDs of the city, and how they are connected to the SNA, and how they can be managed, third, we analyzed the distance (traffic, panic, *etc*.) between the sensible targets and the EDs. Finally, we simulated a tabletop terrorist attack and the response of the city.

Plan for massive influx of injured analysis

Each hospital, in Italy, should have a State of Emergency Plan for Massive Influx of Injured (PEIMAF),[19] to respond promptly to a maxi-emergency. At first, we evaluated the availability of the PEIMAF to the employees. We verified if the PEIMAF was easily accessible by the operators and if they were instructed about its location and formulation. Second, we compared the PEIMAF to find a reference standard to optimize the different formulations. Finally, we used the average

PEIMAF in the tabletop simulation of the terrorist attack, to evaluate the timing and the efficacy and effectiveness of the response.

Simulation of the terrorist attack

We hypothesized a kind of chemical attack as the diffusion of harmful agents in the atmosphere.

The simulation was carried out with Google Maps®,[20] ALOHA® (Figure 1),[21] and MARPLOT® (Figure 2) software.[22] A tabletop simulation is a method widely used and validated in the Civil Defence/Civil Protection organizations.[23,24] Having almost no costs, and not requiring the deploying of Forces, it is widely used not only as a first-level simulation, but also to train the chain of command and control (C2).[25,26]

Escape routes and access points have been evaluated in

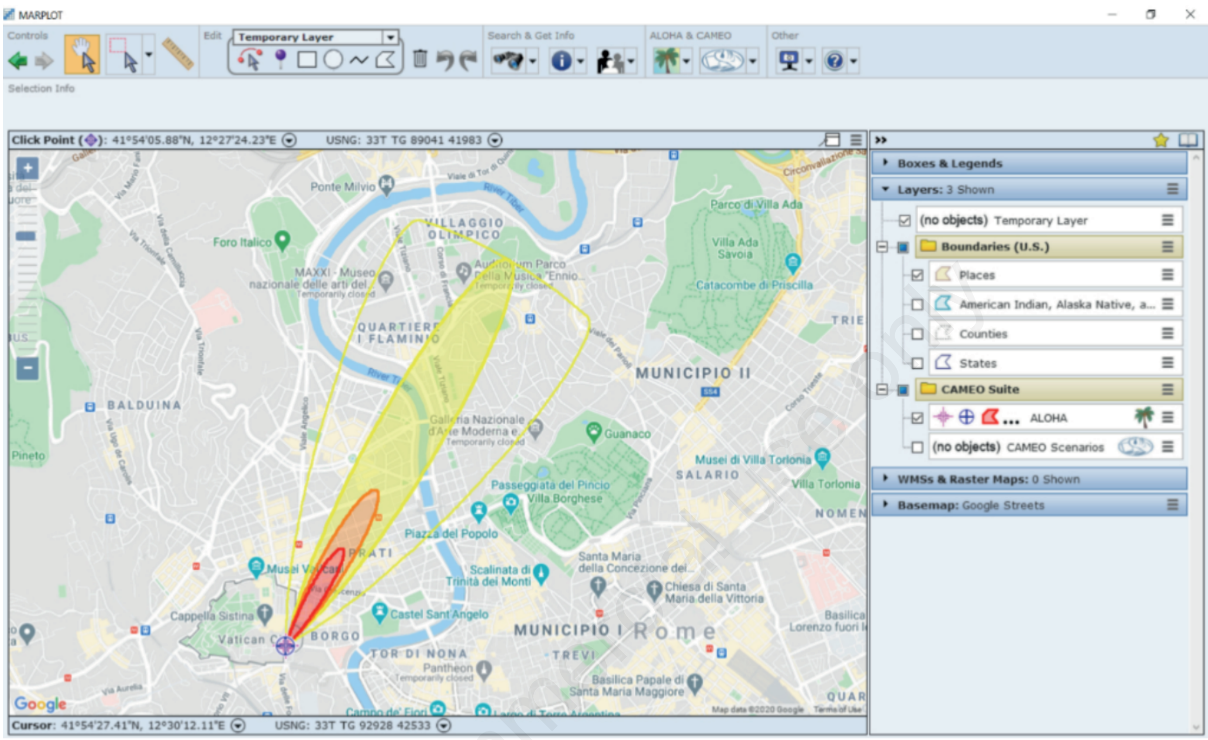
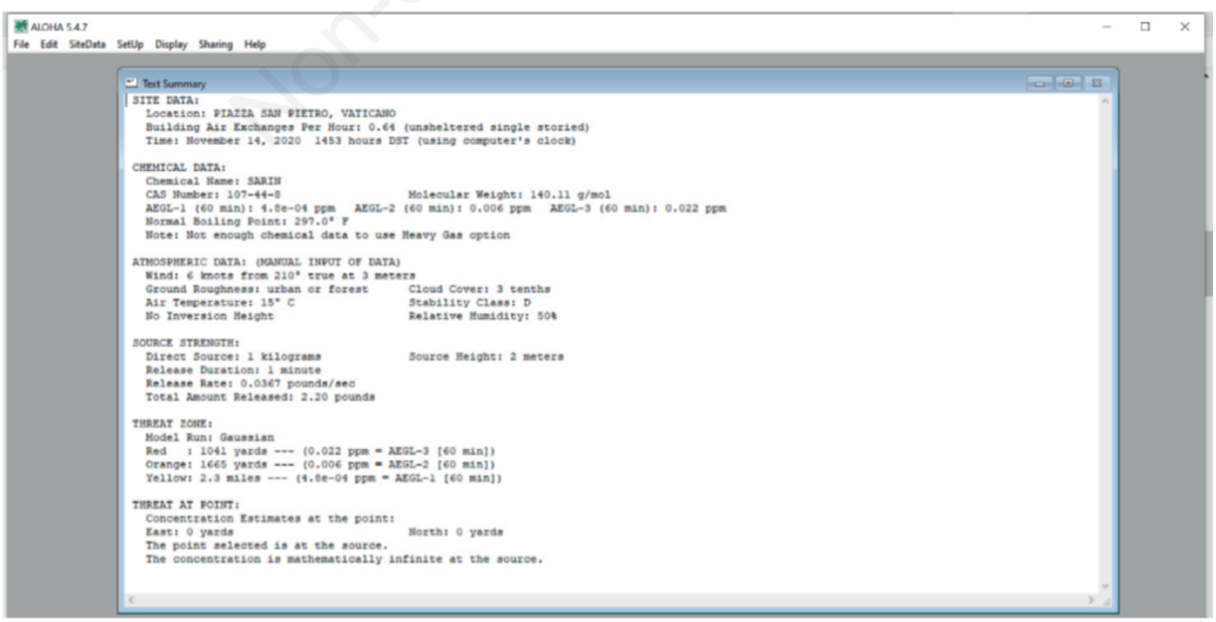


Figure 1. Map of the city of Rome with hypothetical site of the attack (St. Peter's Square).


ALOHA 5.4.7
File Edit SiteData SetUp Display Sharing Help
Text Summary

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SITE DATA:
  Location: PIAZZA SAN PIETRO, VATICANO
  Building Air Exchanges Per Hour: 0.64 (unsheltered single storied)
  Time: November 14, 2020  1453 hours DST (using computer's clock)

CHEMICAL DATA:
  Chemical Name: SARIN
  CAS Number: 107-44-8                  Molecular Weight: 140.11 g/mol
  AEGL-1 (60 min): 4.8e-04 ppm   AEGL-2 (60 min): 0.006 ppm   AEGL-3 (60 min): 0.022 ppm
  Normal Boiling Point: 297.0° F
  Note: Not enough chemical data to use Heavy Gas option

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 6 knots from 210° true at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 3 tenths
  Air Temperature: 15° C                 Stability Class: D
  No Inversion Height                    Relative Humidity: 50%

SOURCE STRENGTH:
  Direct Source: 1 kilograms             Source Height: 2 meters
  Release Duration: 1 minute
  Release Rate: 0.0367 pounds/sec
  Total Amount Released: 2.20 pounds

THREAT ZONE:
  Model Run: Gaussian
  Red   : 1041 yards --- (0.022 ppm = AEGL-3 [60 min])
  Orange: 1665 yards --- (0.006 ppm = AEGL-2 [60 min])
  Yellow: 2.3 miles --- (4.8e-04 ppm = AEGL-1 [60 min])

THREAT AT POINT:
  Concentration Estimates at the point:
  East: 0 yards                          North: 0 yards
  The point selected is at the source.
  The concentration is mathematically infinite at the source.
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Figure 2. Tabulated simulations to evaluate the contaminated area.

all calculations, using adequate correction factors for activation times when deemed opportune.

We decided to correct the average timing for two reasons: i) not all the streets in the city are large enough to allow the transit of the trucks carrying emergency and logistic supplies, increasing the average timing; ii) in emergency situations, it's possible to use streets usually not allowed, decreasing the average timing.

Scenario

To create a realistic tabletop exercise (TTX) simulation, we:

- Create a scale map of San Pietro square (realized through System Dynamics model/process initialization), using Google Maps®: topometric information (*e.g.*, Bernini's Colonnade: 320 mt length and 240 mt large, about 30,000 m^2) and estimation of the people present there (the area can host up to 120,000 people, assuming a 4 people/m^2 ratio (Wu-Ming Method; in particular occasions, more than 300,000 people were hosted in during liturgical events).[27,28] Since Angelus on Wednesday (at 12.00 PM) is a rather ordinary event, the number has been lowered to one-third (23,750) and the place does not reach its maximum capability.
- Based on the weather database (background information) about Vatican City in 2022 (months March-May) and on some direct analysis, we estimate the presence of 15 knots of wind (about 27 km/h) from southwest.[29] There is the need, however, to consider that, being an urban environment, winds can change direction and speed considerably.
- Attribution of a risk score (validation of the model) based on the Maurer Index (which takes account of:[30] i) the maximum number of visitors allowed; ii) the number of visitors actually predicted; iii) the presence of important persons; iv) possible problems about public order following the formula [(A + B) ´ C] + D + E = R) and medical transport capacity,[28-30] to have an evaluation of the medical resources needed. This index can be assumed both as the result of the Maurer algorithm and as the result of the formula X=(N´t)(T´n)-1, where "N" is the number of wounded, "t" is the time of "great noria", "T" is the time limit to evacuate the area and "n" is the number of the wounded that could be transported at once on each ambulance). In the simulation carried out in this study, the score given is (35+20)´0.5+10=37.5, in other words, 10 teams on foot, 3 basic life support, 3 advanced life support, and 2 advanced medical points.
- To assume the event as characterized by the "accumulation" model, agreed that in a defined space-time index, the number of individuals present reaches its peak after a period of progressive and limited in-time increment (influx of people in the planned area), then it remains constant for a known period (time of the event) and, at the end of the event, it progressively decreases following a reverse process to the accumulation phase (people outflow from the area).
- To think about the kind of attack (hypothesis formulation/research question determination): considering the information available, it has been decided to imagine an attack with a homemade nerve agent (Figure 1), consisting of organophosphorus esters easily derived from pesticides.
- Evaluate the contaminated area red/yellow/green (archetypes detection) (Figure 2): in order to contaminate the whole area with non-persistent nerve agents a charged vehicle (*e.g.*, drone, envelopes), with a 1 kg charge and a 10 minutes diffusion time, surely much less than the time needed to evacuate the whole square (both spontaneous and security-controlled evacuation). In case of an accident, the whole square should be considered a "Red area". Often a small explosion is triggered before the chemicals are released to bring more people to the scene.
- Use TTX strategy to simulate the chain of emergency and SNS stocks activation (system thinking hypothesis formulation) (Figure 3): the arrival of the firefighters unit would take about 15 minutes (Via Genova-Via della Conciliazione distance covered at 60 km/h speed, consistent with the times provided by the procedures of the Italian fire brigade that prescribe an arrival within twenty minutes of the alarm) and other 15 minutes necessary to identify the toxic agent. As said before, in this study, we created a multiple-set scenario: on the one hand ETS®-like simulation, whose schedule times have been properly corrected using the average of schedule times reported during a 100 triage START performed by 4 medium-competence operators (FR, AV, ED, EDO), on the other hand, the TTX simulation model.
- Estimate the travel times (system thinking hypothesis formulation): between San Pietro Square and the different Emergency and Accident Department (EADs) and between EADs and SNS stockpiles (Table 1). Decontamination times and the noria (travel) to the hospitals, for what regards the rapidity in action, are too long to be worth calculating, measured using medical transport capacity. Travel times and distances between SNS stockpiles and first and second-level EADs, as between EADs and San Pietro Square, have been obtained via Google Maps® and adapted to a fully-loaded vehicle weighing more than 3.5 t. Travel times have been measured con-

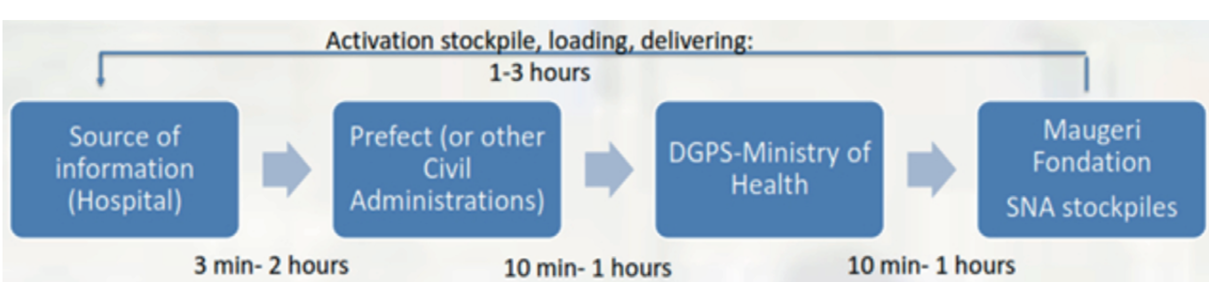

Figure 3. The activation procedure of National Stockpile Antidotes by an emergency department.

sidering the average traffic of Wednesday, ignoring any eventual ways/traffic lights/limited traffic areas. It's been estimated an average travel time (excluding the SNS stock of Civitavecchia) of 16±7 minutes (to which we have to add the vehicles loading and unloading times, the hospital pharmacy processing time of the orders, *etc.*) with a time limit of 30 minutes in which the vehicles must reach the EADs to be really useful; at the same time, the average time for the patients to get to the hospitals is about 24±8 minutes. The stock of the 7th Regiment "Cremona" has been excluded because, considering the average times, it could be assumed as a second-level stock, meanwhile, the airlift warehouse of Catania S23 and the rail-transportable warehouses of Florence S26 and Naples S29 could be considered as third level stocks.

- Get an overview of the number of people involved (system thinking hypothesis formulation): wounded, dead, transportable patients to EADs.[31,32] In particular, it has been seen the "San Carlo effect" (named after the homonym square in Torino, where a "self-made" chemical attack took place in June 2017, during the Champions League final game between Juventus-Real Madrid): because of that episode, steps were taken to provide appropriate ways out and specific "calm places", in other words, low-density occupational areas, without barriers, in order to reduce the crowd of people (and consequent wounded) in case of need of fast escaping from the square, and an artificial voice called Emergency Voice Alarm Communication (an oral communication system able to enter the square audio system), useful and necessary to reduce the panic in case of accident.
- Assess the additional number of victims during the salvage operations (system thinking hypothesis formulation): patients alive during the ambulance loading but dead before arriving at the EADs (about 150 patients/minute).

The regional agency medical emergency (ARES 118), in case of a suspect chemical incident, will activate the security procedures for the operators and the affected population, immediately require the support of one of two local anti-poisoning centers (in "A. Gemelli" hospital and the Policlinico Umberto I) and activates the local Fire Department, that recognizes the attack nature and defines the intervention area. The first response will come from military and paramilitary personnel already placed in the area. Subsequently, a long call from the Prefecture of Rome, Fondazione Maugeri (National Centre of Toxicologic Information) and the Ministry of Health to activate the regional coordination of the national strategic stocks for chemical emergencies will enable the antidotes stocked in provincial, regional, and national deposits.[33]

During this simulation, we hypnotized an influx of about 50 thousand people (25 thousand aged >60 years, with possible cardio-respiratory simultaneous diseases, 10 thousand in the age group 25-60 years, 15 thousand aged <15 years), of which the 50% later contaminated by the gas Sarin. According to the Kaplan-Meyer curve of survival to Sarin exposure, a possible attack would cause the death of about 20 thousands people in less the 30 minutes (the 40% of people currently present: 10 thousand aged >60 years, 5 thousand in the age range 25-60 years, 5 thousand aged <10 years), with mortality per minute of 708 people, of which only 108 people can be helped with the resources currently available (ambulances, public transport, *etc.*). Moreover, according to reported studies, after arriving at EADs, only 8 thousand people would be able to survive without assistance thanks to an intoxication with nerve gas under the threshold value, meanwhile, on the other side, there would be 40,000 people potentially savable with an early pharmacological treatment. In agreement with

Table 1. Distance and travel time (±5% of total time) between Emergency and Accident Department and National Stockpile Antidotes. Speed: 40 Km/h.

	SNA R 12 (Via Portuense, 332)	SNA S 25 (Via dei Carri Armati, 13)	SNA S 30 (Largo Acquaroni 24, Civitavecchia)
AOU "Umberto I" (Viale del Policlinico, 155)	7 km 12 minutes	7,2 km 11 minutes	76,5 km 115 minutes
IRCSS "A. Gemelli" (Largo A. Gemelli, 8)	9 km 15 minutes	15,6 km 25 minutes	71,3 km 120 minutes
Ospedale Pediatrico "Bambin Gesù" (Piazza S. Onofrio, 4)	4 km 7 minutes	13,5 km 22 minutes	72,3 km 120 minutes
AO "San Giovanni-Addolorata"	5 km 8 minutes	6 km 10 minutes	71,3 km 107 minutes
AO San Camillo (Via Portuense, 332)	0 km 0 minutes	16,2 km 25 minutes	71,3107 minutes
OCA San Giovanni Calibita Fatebenefratelli (Via Ponte dei 4 Capi, 1)	4 km 7 minutes	6,7 km 11 minutes	75,5 km 130 minutes
AOU Policlinico Tor Vergata (Viale Oxford, 81)	17,4 km 29 minutes	12 km 20 minutes	89 km 148 minutes
Ospedale Policlinico Casilino (Via Casilina, 1040)	13,5 km 23 minutes	8 km 14 minutes	8,5 km 14 minutes
PO "Sandro Pertini"(Via Monti Tiburtini, 385)	11 km 18 minutes	3 km 5 minutes	82,5 km 137 minutes
OCA "Madre G. Vannini"(Via di Acqua Bulicante, 4)	9,5 km 17 minutes	6 km 10 minutes	81 km 135 minutes
PO "Sant'Eugenio" (Piazzale Umanesimo, 10)	7 km 12 minutes	15 km 24 minutes	75 km 127 minutes
Ospedale "Aurelia Hospital"(Via Aurelia, 860)	10,3 km 15 minutes	20 km 33 minutes	65 km 108 minutes
PO "San Filippo Neri"(Via G. Martinotti, 20)	11 km 18 minutes	15,5 km 25 minutes	72 km 123 minutes
AOU "S. Andrea"(Via di Grottarossa, 1035)	16 km 26 minutes	17 km 28 minutes	74 km 126 minutes
PO "Santo Spirito" (Lungotevere in Sassia, 1)	4,3 km 7 minutes	9 km 15 minutes	74,3 km 126 minutes
PO "G.B. Grassi" (Via Giancarlo Passeroni, 28)	30 km 30 minutes	50 km 60 minutes	73 km 82 minutes

SNA, National Stockpile Antidotes; AOU, *Azienda Ospedaliera Universitaria* (University Hospital Company); IRCSS, *Istituti di Ricovero e Cura a Carattere Scientifico* (Scientific Hospitalization and Treatment Institutions); AO, *Azienda Ospedaliera* (Hospital Company); OCA, *Ospedale Classificato Accreditato* (Accredited Classified Hospital); PO, *presidio ospedaliero*.

what was said before, every single minute of delay in the arrival of both patients and antidotes would produce the death of 708 people, of whom 100 people were at least savable: that means that in the first 30 minutes, 11,240 people minimum are potentially savable.

Within 2 days after the arrival at EADs, 6,000 of 20 thousand people hospitalized died due to primary and secondary issues related to the attack.

Results

National Stockpile Antidotes activation procedure

The activation procedure of SNA by an ED is somewhat intricate as shown in Figure 3.

Travel times Strategic National Stockpile-Emergency and Accident Departments

Table 1 reports time intervals extrapolated considering all emergency activation times and the above-mentioned correction criteria. Travel times and distances between SNS stocks and first and second-level EAD, obtained through Google Maps® and adapted for a fully loaded truck weighing more than 3.5 t. Times of travel have been calculated based on Wednesday's average traffic, without considering possible ways/traffic lights/limited traffic areas on the way. Furthermore, we estimated the timing of the activation procedure, simulating the calls according to the METHANE indications,[33] considering the time the fire brigades need to detect and confirm the chemical, and the plausible delays occurring in emergency situations (phone box out of service, *etc*). From the first call of the hospital to the activation of the closest SNA warehouse, the estimated time varies between 1h 30m to 7h. However, we hypothesize that the full activation will require a maximum of 2h 30m in usual conditions. The PEIMAFs of each structure have been analyzed, although not all were rapidly available for quick reference; in some cases, they had to be officially requested. Sometimes they were purposely kept classified for security reasons.

On the basis of what was said above, the situation in Italy is presented on the one hand with perfect coordination between different units involved in maxi-emergencies assessment (*e.g.*, ARES 118, firefighters, Italian Red Cross, *etc.*) even if without the existence of specific multi-departments operating plans, on the other hand, the non-specialized staff involved in maxi-emergencies seems to lack the necessary preparation, even if it represents the "front-line" in case of activation.

In fact, several problems pointed out during the international emergencies occurred seem to not affect Italy, at least (theoretically) for what concerns the existence of elements of resilience: the presence of a single central control unit, the redundancy of communications (but this is an aspect that differs region by region since we have non-connected systems in the surrounding areas), the corpses assessment (each ambulance has/should have all the necessities for the purpose, the existence of PEIMAFs, the abundant disposal of health operating tools (particularly, for what regards triage tags, patient bracelet recording systems for continuous patients identification (identity, diseases, hospitals, prognosis and diagnosis) based on the recognition of barcodes/QR codes in order to protect the privacy of patients, are increasingly widespread through the use of pc/tablets/smartphones).

Anyway, it's not always easy to distinguish between competencies, materials, and vehicles "potentially" and "really" at disposal, especially due to a lack of a significant number of simulations done, and, in particular, the lack of organized simulation pieces of training in real emergency conditions/worst situations ever: as evidenced by the images of emergency services reported during several accidents happened in Rome's San Giovanni underground station in 2002.

Discussion

Considering the evidence-based practice excluding toxicological studies, the levels of evidence (LOE) in this field could not be higher than IIa (non-randomized clinical trial), therefore the strength of recommendations (SOR) cannot exceed grade B.

Despite a good amount and distribution of potential advanced medical points and emergency departments, the undermining and overcrowding of such structures is already an issue in ordinary conditions and could be stretched over the limit in case of massive, injured influx. In the case of a C attack, the SNA activation will be a major variable: we find that their activation times and territorial distribution do not appear to be excessive. The real bottleneck would be the time needed to recognize the nature of the attack, the subsequent specialized activation, in these cases delegated to Fire Departments, and the recognition of the chemical substances employed. The authors agree with the need for security; however, we believe that at least basic knowledge of emergency procedures and internal regulations should be mandatory. Training and practice are scheduled in all structures, although their execution is not always strictly enforced. Finally, each PEIMAF analyzed, while consistent and adequately built for internal purposes, fails in integrating with other hospital structures.

In conclusion, this study, even if based on the most recent international scientific literature and with a statistical significance (reproducibility of the study) of 90%, has two major limits:

1) Low predictability for the nature of the attack and the weather forecast, which could produce very different scenarios. For example, changing the C attack (botulinum instead of nerve gas, or different kinds of nerve gases) or stochastic factors, like the wind direction/intensity, the number of contaminated people could vary, even if the nature of the attack is the same;
2) Quality of international literature: studies like this are usually missing in the scientific literature for two main reasons: i) public security and national defense: if studies like this were widely accessible, a potential terrorist could use them and other non-confidential information to plan a more complex/effective attack; ii) (un)fortunately, these kinds of attacks happen rarely, that's why it's not possible to compare simulations with "case report" studies, and even in case of attacks, for the reasons explained in point 1), they would be enough different from each other to not be scientifically and rigorously comparable. For this reason, considering the evidence-based practice, the LOE (except for toxicological studies) couldn't be higher than level IIa (non-randomized controlled clinical study) and, consequently, SOR couldn't be higher than grade B.

Conclusions

At present knowledge there is a lack of a standardized protocol active in the whole city, therefore, no cross-hospital organization can be performed. This is not due to inadequacy of the plan, rather it is a product of an "insular" approach to the matter: every PEIMAF author has authority over his own plan. The institution of a central department with the job of integrating the single hospital emergency plans into a whole-city emergency plan would be a giant leap towards a more responsive system in Rome.

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