



Forensic intelligence-led prevention of drug-facilitated sexual assaults.

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ARTICLE INFO

Article history:

Received 15 December 2021

Received in revised form 6 February 2022

Accepted 26 June 2022

Available online 28 June 2022

Keywords:

Forensic intelligence

Forensic sciences

Drug-facilitated sexual assaults

Date rape

Public health

Violence prevention

ABSTRACT

This work explores the potentially broader contribution of forensic science to preventive public health through the proactive view promoted by forensic intelligence. For that purpose, a new working framework is applied as a strategic tool that channelizes forensic intelligence in a more understandable and didactic way for decision-makers, guiding preventive crime processes. Concretely, the implementation of this operational framework focuses on preventing drug-facilitated sexual assaults in the nightlife context. Through a two-stage research scheme, the working framework is used as a study tool for understanding this violent phenomenon and as a strategic thinking and action platform for overcoming it. Forensic intelligence-guided actions significantly enhanced institutional and direct support facing this specific form of sexual violence. Awareness messages targeting potential assailants, witnesses, and victims reached more than half a thousand students from the university and pre-university education through a preventive intervention within the educational system. Moreover, the inter-professional dialogue between forensic science and other health, security, and education disciplines shows the broader proactive role of forensic science beyond the traditional retroactive view limited to courtrooms and intelligence-led policing. This study demonstrates as forensic intelligence becomes applicable for civilians, who participate as decision-makers in intelligence-led preventive processes, anticipating the need for intervention by police and judicial authorities.

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1. Introduction

The traditional and dominant view of forensic sciences is characterized by narrowness and fragmentation, envisaging it as a patchwork of sub-disciplines oriented to the past with the only purpose of assisting the court in a specific crime and helping the penal system [1,2]. Facing with this trend, some authors asks for a change of attitude to accept a broader concept of forensic science beyond producing evidence for courts [3]. In this sense, Ribaux et al. claim that information forensic science provides must not be

restricted only to serve courts but should also support a wider variety of goals [4]. In this line, Raymond et al. insist on reframing forensic science refocusing onto crime prevention while maintaining the service to courts [5,6]. This view adjusts to the idea of forensic science involving three streams: the courts, investigative, and intelligence [7]. Ross et al. hold the necessity of engagement in these three streams to enhancing forensic science efficiency [7]. In this sense, forensic intelligence involves a significant change in traditional understandings of forensic science [8]. It becomes an alternative dimension of forensic science, playing a complementary role to the traditional mission serving to courts [9], and extended focus from the traditional reactive approach of courts to a proactive one [10–13]. Ribaux et al. provide the most famous definition of forensic intelligence as the accurate, timely and useful product of logically processing forensic case data for investigation and intelligence purposes [3]. Another definition by Bruenisholz et al. explains

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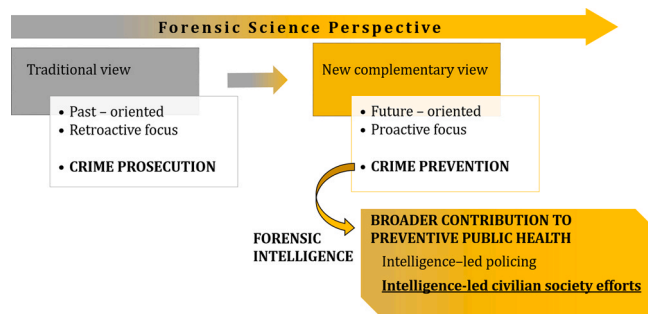


Fig. 1. New complementary view within the forensic science contributing to crime prevention and preventive public health through the proactive forensic intelligence focus.

forensic intelligence as the timely aggregation and processing of forensic case data from different cases, which provides phenomenological knowledge on criminal activity and may support proactive and preventive approaches [14]. In this sense, forensic intelligence is crucial to intelligence-led policing [9], commonly understood as the use of information by decision-makers to inform police strategies and resources [14]. However, the research on forensic intelligence up to date has been usually restricted to its application to police-led-intelligence [3,4,15–21]. Despite this, forensic intelligence perspective has the potential to be generalised [4]. It is an emerging form of intelligence [22], whose meaning and value is yet to be widely understood [5]. Fig. 1 illustrates these different forensic science perspectives and the potential contribution of forensic intelligence to preventive public health. In this defining context, promising contributions would result from exploring a broader forensic intelligence perspective leading preventive public health actions through a more comprehensive inter-professional dialogue: a collaboration involving forensic scientists and civilian decision-makers different from the police.

Drug-facilitated sexual assaults (DFSA) are an excellent option for exploring this broader contribution of forensic intelligence to preventive public health involving civilian decision-makers. DFSA involves assailants taking sexual advantage of victims who cannot consent to sexual intercourse due to the disabling effects produced by psychoactive substances voluntarily or involuntarily used [23,24]. In this way, DFSA is an intersectional phenomenon in which sexual violence and psychoactive substances misuse converge, including alcohol abuse and narcotic and other drug use. Consequently, focusing on DFSA helps visualize the potential contribution of forensic intelligence to preventive public health. Likewise, the DFSA phenomenon mainly affects the youth community. The vast majority of victims are young women assaulted in leisure nightlife contexts, and numerous studies relate this form of sexual violence to college campuses and high school [25–28]. As the main actors within these settings, students and professors become potential decision-makers for implementing forensic intelligence-led processes focused on preventing DFSA. Furthermore, the promising results from this exploration increase thanks to the availability of a new working framework recently developed for improving the study and prevention of the DFSA phenomenon [29]. This operational framework gathers forensic information about DFSA, mainly from forensic studies of alleged sexual assaults attended at sexual assault treatment centers [30–37], or reported to the judicial authorities [38–47]. In this way, the working framework can operate as a strategic intelligence tool, a source of knowledge helpful for orienting preventive decision-making processes. This newly developed working framework combines the ecological model theory [48,49] with the violence triangle theory [50]. As such, it encompasses four ecological influence levels and three violence levels, as illustrated in Fig. 2.

The four concentric rings represent the influence levels, namely macrosystem, exosystem, microsystem, and individual, from outside to inside (Fig. 2a). The macrosystem level encompasses those beliefs, values, and cultural perceptions justifying violence, like rape myths [29]. The exosystem level includes formal and informal social structures contributing to violence, such as gender inequalities during judicial rape prosecution [29]. The microsystem comprises the immediate context where a person lives, develops, and interacts with others, including the interactions themselves—for example, the nightlife context, strongly related to the DFSA phenomenon and characterized by binge drinking and hooking up [29]. Finally, the individual includes personal characteristics, like gender, age, drug use, sexual assault history, or disabilities [29]. The four levels interact to break the ecological balance between the victims, located at the central point of the model, and their environment. Consequently, the victim suffers from three types of violence: cultural, institutional, and direct violence, corresponding to the triangle's corners (Fig. 2a). Cultural violence refers to values and beliefs justifying violence, which happens at the macrosystem level [29]. Structural violence implies hurt inflicted by formal and informal structures, like institutions, occurring at the exosystem level [29]. Finally, direct violence consists of specific damage by people and happens at the microsystem level [29]. In any case, violence is a vicious triangular syndrome, which can start at any corner of the triangle (Fig. 2a) and be transmitted to the two other corners by causal feedback flows [50]. However, in opposition to this violence triangle, forensic intelligence-led actions may favour a reverse triangle, a nonviolent one promoting support instead of violence: replacing structural and direct violence with structural and direct support (Fig. 2b) [29]. This reversibility of violent processes shows a route to articulate preventive efforts facing criminal phenomena like DFSA [29]. In this sense, well-targeted work at the exosystem level can replace institutional aspects conditioning the DFSA phenomenon with institutional support facing this form of violence. Similarly, work targeting the microsystem level can replace direct violent interactions characterizing DFSA with supporting synergies to stimulate cooperation in potential risk situations within the leisure nightlife context. Therefore, this study aims to explore a broader forensic intelligence perspective contributing to preventive public health, facing the DFSA phenomenon as a specific problem. For that purpose, this paper looks to encourage a more comprehensive inter-professional dialogue between forensic sciences and other disciplines, promoting the active participation of civilians as decision-makers in forensic intelligence-led crime preventive processes.

2. Methodology

This study applies the described working framework to channel forensic intelligence and explore broader, innovative forensic science proactive perspective guiding preventive public health actions, concretely facing the DFSA phenomenon by forensic intelligence-led efforts. The implementation of this operational framework involves the participation of the forensic scientist, playing a fundamental role in providing forensic intelligence through the working framework as a source of scientific knowledge. This framework implementation by the forensic scientist happens through a two-stage research scheme, as shown in Fig. 3. Both stages order following the flows between the triangle's corners within the working framework. In this sense, institutional support obtained from the first stage (Institutional vortex in the triangle from Fig. 3) encourage actions for strengthening direct support (Direct vortex in the triangle from Fig. 3) at the second one. This sequence of the two-stage research scheme allows forensic intelligence-led preventive efforts to face DFSA in the educational context. In this sense, apart from the forensic scientist, two other agents are participating in the study: university and pre-university teachers and students. They come from four different educational

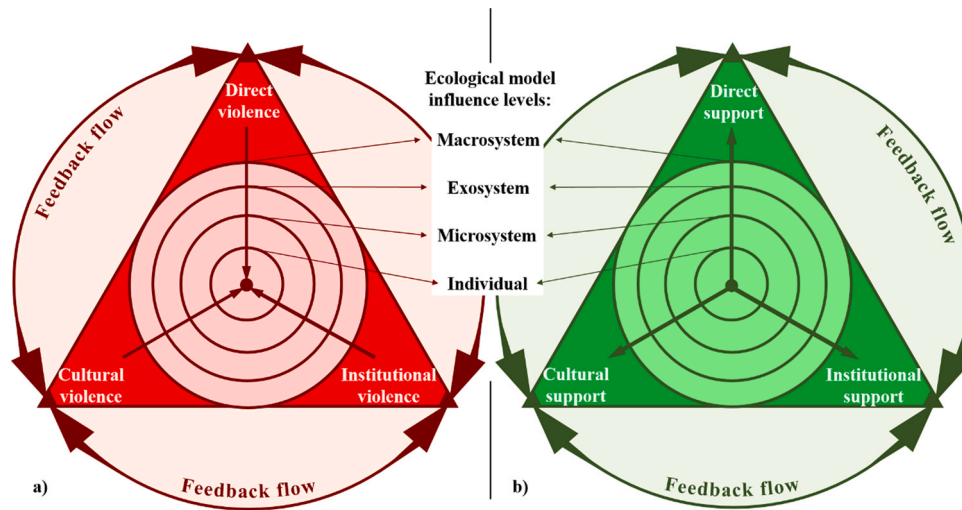


Fig. 2. Working framework for understanding and preventing the victimization of women by DFSA. Fig. 2a shows the vicious triangle of violence, while Fig. 2b illustrates the virtuous triangle promoting support instead of violence [29].

levels, including forensic science post-degrees, pharmacy degrees, and high and secondary school. Concretely, from the University of Alcalá and the High and Secondary School Cardenal Cisneros, both located in Alcalá de Henares (Madrid, Spain).

Both stages of the two-stage research scheme happen at two different levels within the working framework. Firstly, operating at the exosystem level, the earliest stage involves multiple actions targeting several government and educational authorities and aimed to stimulate institutional support facing the DFSA phenomenon. The exosystem level encompasses formal and informal social structures so that working at this level enhance structural support and reduce structural violence [29]. In this sense, efforts at the exosystem level include designing and submitting several proposals for research and teaching innovation projects to different national authorities and academic committees through corresponding open calls [51–53].

Furthermore, other additional actions at the exosystem level include strengthening a closer relationship with local authorities to coordinate active involvement and participation in the study of secondary school centers.

On the other hand, the second stage operates at the microsystem level within the working framework (Fig. 3). The microsystem comprises the immediate context where a person develops and interacts with others, including the human interactions themselves. Consequently, proper educational, preventive efforts at the microsystem level, evidence-based and well targeted, can stimulate direct support instead of direct violence [29]. Likewise, to better target preventive efforts at the microsystem, the implemented actions at this level follow the Routine Activity Theory, according to assaults happen when motivated assailants approach potential victims in the absence of witnesses capable of intervening to help and support

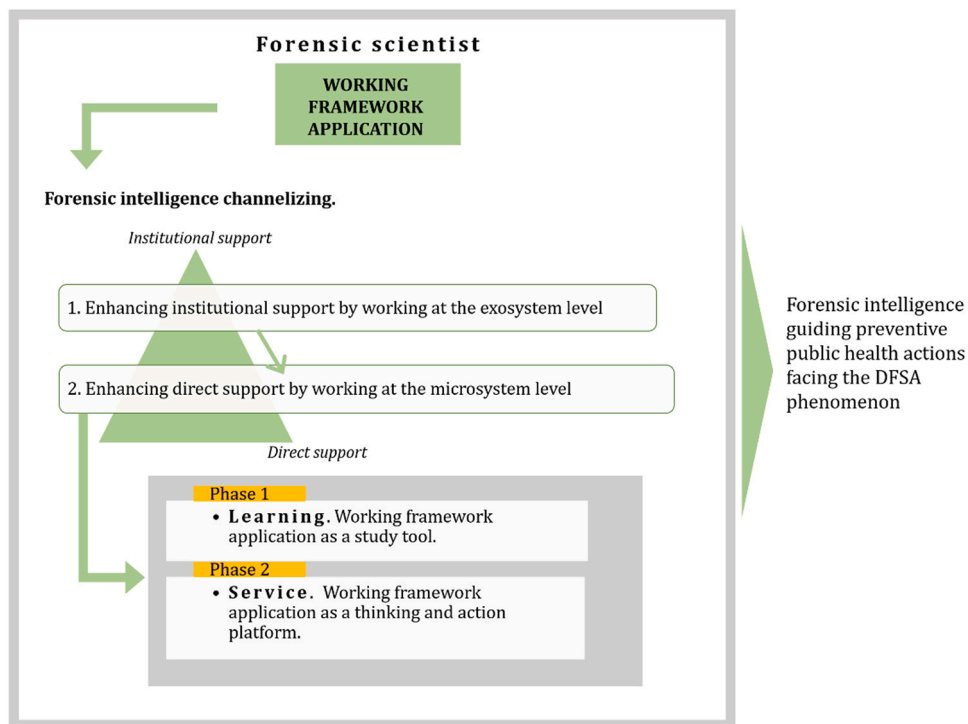


Fig. 3. Two-stage research scheme based on applying the working framework as a strategic tool channelizing forensic intelligence.

victims [54]. Following this broad view of the assault situation, the second stage pursues to raise awareness of potential assailants, victims, and witnesses, the three human elements of the routine activity theory. Furthermore, this study's second stage consists of two chained phases adjusted to the two-step process of the service-learning methodology (Fig. 3), an educational approach that seeks to generate community services led by students as fruitful, socially valuable results from their learning. Likewise, each phase within the second stage uses the working framework differently. The first phase, consistent with the learning step of the service-learning methodology, applies the working framework as a study tool for understanding the DFSA phenomenon (Phase 1 in Fig. 3). In turn, the second phase, in line with the service step of the service-learning methodology, uses the working framework as a strategic thinking and action platform for overcoming this sexual violence problem (Phase 2 in Fig. 3). Furthermore, from the strategic intelligence viewpoint, this study includes other teaching tools as strategic resources in addition to the service-learning methodology. These tactical elements combine the flipped classroom and the peer-to-peer communication techniques with the layered learning model. In this sense, the combination of multiple educative resources in stage number two's second phase looks for the involvement of students in forensic intelligence-led decision-making processes focused on preventive actions facing DFSA. At this point, several reasons make first-year pharmacy degree students a suitable group for implementing this exercise, exploring the forensic intelligence proactive perspective guiding preventive public health actions. These students have an adequate age to raise awareness of high school students avoiding generational communicative barriers. Moreover, lines of interest of the teaching innovation projects fit the curricular skills of pharmacy students [55,56], a requirement for implementing the service-learning methodology [57]. The Committee of Research Ethics of the University of Alcalá approved the project framing this study (reference code MSCBS-PNSD-2018I032). The study describes this broader forensic intelligence proactive perspective guiding public health actions facing the DFSA phenomenon within the educational context. For that purpose, it measures the scope of the activities performed, paying attention to the volume of authorities reached and students reached and mobilized as preventive agents, the favoured preventive effects, and further interest remarks observed during the implementation.

3. Results

3.1. Institutional and direct support enhancement facing the DFSA phenomenon

The application of the working framework under the guidance of the forensic scientific channelized the forensic intelligence for guiding decision-making processes through an ordered two-stage scheme that enhanced first institutional support facing the DFSA phenomenon and then direct support. This schematic sequence fitted the triangular feedback flows between the three corners of the triangle within the working framework. As such, firstly, forensic intelligence-led actions strategically targeting the exosystem level encouraged institutional support. Subsequently, during the second stage, forensic intelligence-led efforts targeting the microsystem level encouraged direct support.

3.1.1. Institutional support enhancement by strategic actions targeting the exosystem level

The earliest actions developed during the first stage of the research scheme, targeting the exosystem level, significantly enhanced institutional support facing the DFSA phenomenon. In this sense, when applying the working framework as a forensic intelligence strategic tool (Fig. 3), institutional support increased in two main

ways. Fig. 4 shows the results obtained. On the one hand, regarding financial aid. As such, three forensic intelligence-inspired research proposals about the DFSA phenomenon received economic funding after submitting them to several educational and government authorities at local and national levels. Regarding economic support by local authorities, the University of Alcalá funded two Teaching Innovation Projects designed to increase social awareness about the severity of the DFSA phenomenon between the university and pre-university students in the local area (projects reference codes: EV/UAH951 & EV/UAH1024) [58,59]. Moreover, intelligence-led strategic work at the exosystem level also resulted in economic support to these earliest projects by institutions at a national level. The Spanish Government's Ministry of Health, Social Services, and Equality sponsored the initiative facing the DFSA phenomenon, significantly increasing economic funding for awareness and research activities (project reference code: MSCBS-PNSD-2018I032) [60]. In turn, such government sponsorship reinforced, even more, the institutional support by the University of Alcalá, who officially recognized the initiative as an Institutional Impact Activity (AI3) [61].

On the other hand, in addition to the financial aid, enhancing institutional support by strategic actions targeting the exosystem also resulted in a more robust local government collaboration. In this sense, within the framework of the awarded projects, a new agreement was established with local authorities. This agreement encouraged the collaboration between the university and local schools to coordinate raising awareness efforts facing the DFSA phenomenon. Concretely, it improved coordination and teamwork with the High and Secondary School Cardenal Cisneros, an essential step for raising awareness of students from pre-university levels. Altogether, these earliest outcomes enhancing institutional support facing the DFSA phenomenon were critical for subsequently increasing direct support by actions targeting the microsystem level.

3.1.2. Direct support enhancement by strategic actions targeting the microsystem level

Following the feedback flows between the triangle's corners within the working framework (Fig. 3), institutional support enhancement in the study's first stage later stimulated direct support in the second stage. The direct support enhancement facing the DFSA phenomenon strategically targeted specific actions to the microsystem level, which encompasses the immediate context where a person lives, develops, and interacts with other people, including the human interactions themselves. For that reason, direct support enhancement stimulated the replacement of those personal violent interactions characteristic of DFSA in the leisure nightlife context by supporting synergies addressed to stimulate empathy and cooperation between young people. Study observations reveal that combining the next five elements resulted in a key aspect for achieving this purpose. Fig. 5 illustrates such critical elements characterizing direct support enhancement.

- i. *Well-targeted awareness efforts based on the Routine Activity Theory.* According to the Routine Activity Theory, assaults happen when motivated assailants contact potential victims in the absence of witnesses capable of intervening to help and support victims [54]. Applying this theoretical approach was essential for considering all the three human elements involved in DFSA situations and articulating awareness messages specifically targeting assailants, victims, and capable witnesses.
- ii. *Mobilizing a great number of young students from university and pre-university levels.* This broader forensic intelligence perspective guiding preventive public health actions within the educational context succeeded in mobilizing a great volume of young people from the university and the pre-university levels. Concretely, strategic actions for enhancing direct support facing the DFSA phenomenon mobilized 561 young people, 301 coming

Enhancing institutional support facing the DFSA phenomenon by working at the exosystem level.

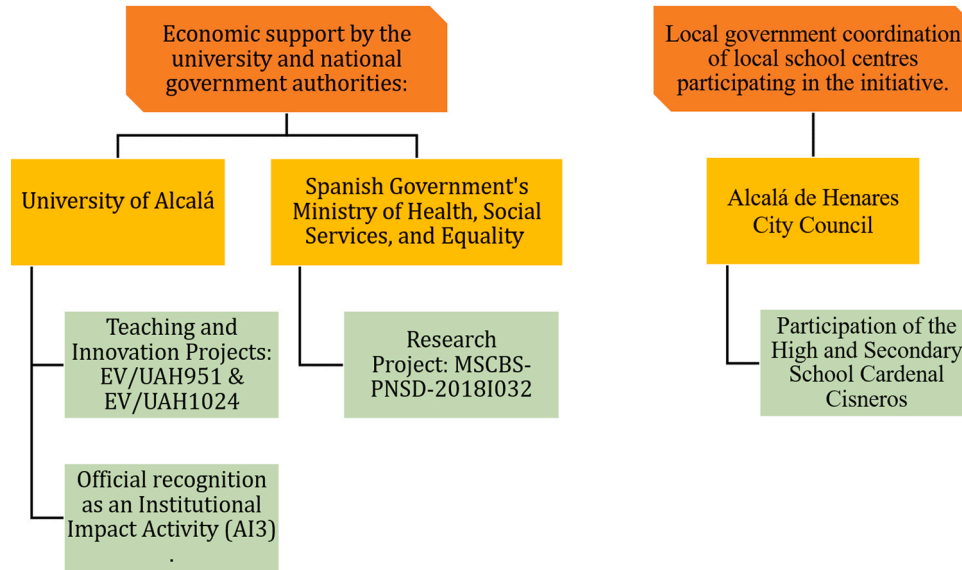


Fig. 4. Results obtained from institutional support enhancement by strategic actions targeting the exosystem level.

Enhancing direct support facing the DFSA phenomenon by working at the microsystem level.

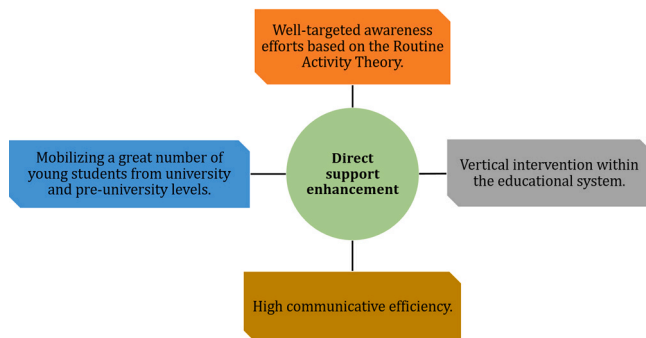


Fig. 5. Four key elements for replacing personal violent interactions characteristic of DFSA in the leisure nightlife context by supporting synergies between young people.

- from the university and 260 from the secondary and high school. Moreover, some of them became active preventive agents that favoured social raising awareness facing DFSA in their immediate surroundings, stimulating empathy and cooperation in risk situations within the leisure nightlife context.
- iii. *High communicative efficiency.* The significant mobilization of so many young people and their commitment to enhancing direct support facing DFSA resulted from a high communicative efficiency between students from different academic levels. This result was possible by combining the layered learning model and the peer-to-peer communication technique, which strengthened a rewarding dialogue between young people of similar ages. Indeed, the high communicative efficiency allowed upper-level students to influence their lower-level colleagues positively. Thus, the formers became an example and an inspiration source for the mobilization of the latter.
 - iv. *Vertical intervention within the educational system.* Resulting from the inspiration and commitment encouraged by the high communicative efficiency, students from lower courses replicated similar raising awareness actions. Consequently, a ripple effect

started among different teaching levels, focused on enhancing direct support facing the DFSA phenomenon, which resulted in a vertical intervention within the educational system. Successive jumps happened between teaching levels: starting from the university context, with the participation of post-degree and degree students, and finally reaching the pre-university context, involving high and secondary school students. Moreover, this ripple effect also resulted from applying the service-learning methodology. Students from upper levels developed their service phase as an integral part of the learning phase of students from lower levels.

3.2. Ripple effect facing the DFSA phenomenon from within the educational system

As a result of the forensic intelligence-led strategic thinking, combining the four previously described elements triggered a ripple preventive effect facing the DFSA phenomenon within the educational system. It promoted a high scope awareness exercise, reaching more than half a thousand university and pre-university young people from four academic levels and even more, mobilizing a part of them as active prevention agents. Concretely, thirty-six students got active involvement, designing and carrying out community preventive services as awareness agents, contributing to enhance direct support facing the DFSA phenomenon in their area of influence. The concatenated implementation of the service-learning methodology allowed interlinking students from different educational levels. Thus, through an inspiring exercise of young social responsibility, the upper-level students' service phases were essential to the lower-level students' learning phases. Fig. 6 illustrates this interrelation between the four reached academic levels. The verticality within the educational system shows the high scope of this forensic intelligence-led prevention exercise, which materialized in the four big waves of raising awareness next described. However, since this intelligence-led exercise contributed to shaping young people as public awareness agents facing DFSA, actually the number of individuals reached by preventive messages was potentially larger than those students registered within the educational context.

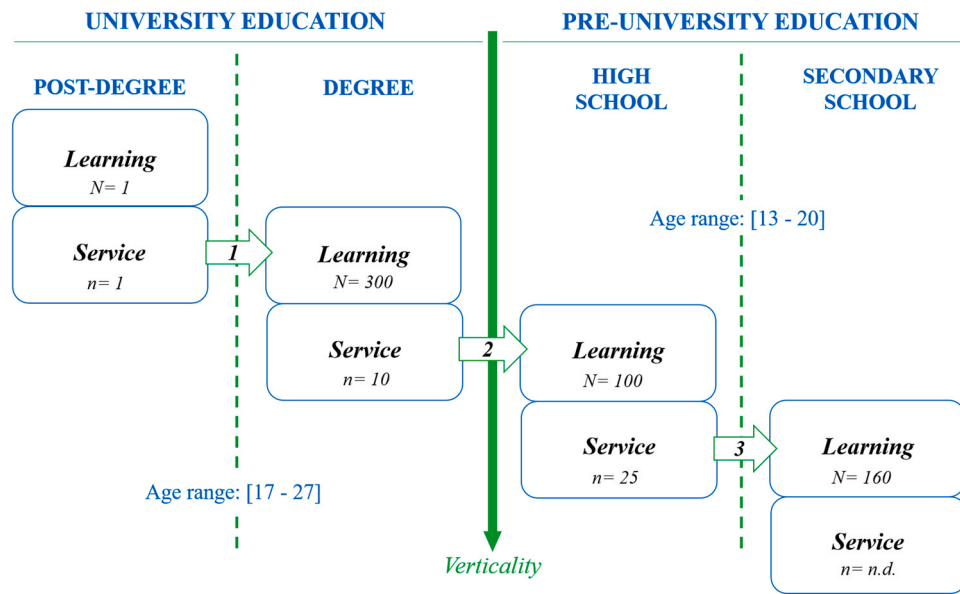


Fig. 6. The four educational levels reached and their interrelation. *n.d.*: not determined. *N*: number of young students reached by the learning process. *n*: number of young students composing the workgroups for preventive services.

3.2.1. Wave n° 1: university post-degree students raise awareness of degree students

The ripple effect within the educational system started at the post-degree level (Fig. 6: arrow n° 1). A doctoral student in Forensic Sciences raised awareness of around three hundred-degree students ranging from seventeen to twenty-two years old through a briefing about the DFSA phenomenon and its severity in the leisure nightlife context. Subsequently, the degree students' learning phase continued driven by the thematic lines in the working framework, which operated at this point as a guide for studying the DFSA phenomenon. In this way, the working framework showed great applicability as a source of forensic and criminological knowledge for learning about the approached issue. University professors supervised students during this knowledge acquisition phase. Likewise, encouraged by an inter-professional dialogue with the forensic scientist, the professors led degree students to design community services facing the DFSA problem, mainly preventive actions targeting pre-university education.

3.2.2. Wave n° 2: university degree students raise awareness of high school students

A workgroup of ten first-year pharmacy students designed and articulated preventive actions facing the DFSA phenomenon targeted younger high school students, reaching one hundred young people from a local centre ranging from sixteen to twenty years old (Fig. 6: arrow n° 2). This community service phase adjusted to the action lines defined by the working framework at the microsystem level, targeting to raise awareness of potential assailants, victims, and capable witnesses. Thus, at this point, the framework operated as a strategic intelligence tool helpful in designing and articulating well-targeted, evidence-based preventive actions aligned with the Routine Activity Theory. Likewise, the fact that degree students raised awareness of high school students meant a substantial jump between academic levels, providing this forensic intelligence-led exercise with a notorious verticality within the educational system. Like what previously happened within the university, now high school teachers led their students to learn about the DFSA problem and design preventive community services.

3.2.3. Wave n° 3: high school students raise awareness of secondary school students

Twenty-five students designed and carried out community preventive services facing the DFSA problem in the educational pre-university context. Their efforts reached around one hundred and sixty secondary education students from their same academic centre, ranging from thirteen to fifteen (Fig. 6: arrow n° 3). Concretely, these twenty-five high school students replicated the same work scheme previously applied by undergraduates, led by forensic intelligence and targeting awareness messages to the Routine Activity Theory's three human elements. This replication highlights the significant inspirational effect and high communicative efficiency of the awareness actions previously developed within the forensic intelligence-led ripple effect.

3.2.4. Wave n° 4: secondary school students raise awareness of other colleagues

Expanding the generated ripple effect facing the DFSA phenomenon from within the educational system, some secondary students also designed and developed their own community services for raising social awareness about this specific form of sexual violence. Most of these prevention services involved composing and exposing different graphic materials for visualizing the DFSA phenomenon and preventive messages facing this issue, as well as drug use and violence against women in the nightlife context. Posters, cards, or pamphlets were located at key areas into the school building, such as at the entrance, allowing wide dissemination of preventive messages. Forensic intelligence also was behind this last knowledge dissemination, leading the entire preventive process from its beginning at the post-degree university level.

3.3. Preventive and raising awareness effects facing the DFSA phenomenon

In addition to the number of people reached by the forensic intelligence-led preventive strategy, the favoured preventive and raising awareness effects deserves particular attention. Actions targeting the microsystem promoted positive changes facing the DFSA phenomenon at this level of the working framework. Interestingly,

Positive influencing on potential assailants, victims, and witnesses by actions targeted at the microsystem level.

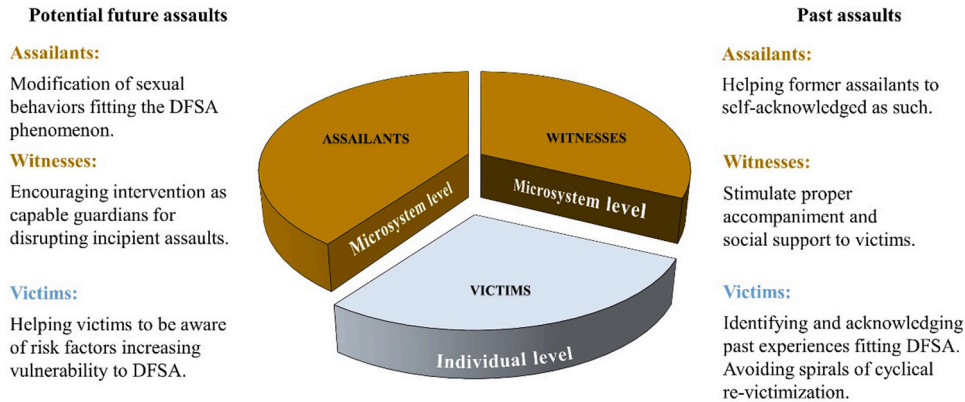


Fig. 7. Positive influence on potential assailants, victims, and witnesses facing the DFSA phenomenon, aligned with the personal elements of the routine activity theory.

these promoted effects differed from each other both from a temporary and a personal view. On the one hand, from a temporary view, these changes involved a double perspective focused on preventing possible future DFSA experiences and the self-acknowledgment of incidents of this form of sexual violence already happening in the past. In this sense, the awareness efforts helped not only to avoid future assaults but also to identify past experiences fitting the DFSA phenomenon. On the other hand, this double temporary view was combined with the perspective of the Routine Activity Theory concerning the involvement of assailants, victims, and witnesses. This broader perspective favoured an integral awareness, reaching each one of the involved personal elements, not limiting it only to victims or assailants, but including both of them and also witnesses. Fig. 7 illustrates this multi-pronged approach of the promoted effects, circumscribing them to the applied working framework.

Regarding promoted effects facing future DFSA experiences, preventive and awareness messages potentially helped possible assailants to modify predatory sexual behaviours characteristic of DFSA. Particularly, opportunism or taking advantage of the disability suffered by someone to consent to sexual interrelation because of voluntary drug use. For example, when looking for people too drunk to consent to sex or encouraging someone to get drunk with the same purpose. Likewise, concerning possible future witnesses of DFSA experiences, awareness messages potentially helped young people identify risk situations of DFSA and intervene as capable guardians for disrupting incipient assaults. Moreover, a specific awareness focus on the figure of possible future witnesses also contributed clarified how to deal with victims of DFSA and support them properly. Finally, regarding possible future victims of DFSA, preventive and awareness messages potentially helped them identify and evade sexual predatory behaviours by potential assailants and look for proper support of capable witnesses. Furthermore, educational efforts also encouraged preventive changes in possible future victims by affecting the individual level of the working framework, concretely, concerning practices such as binge drinking or combining multiple drugs, for example, the concurrent use of alcohol and hypnotic or sedative drugs. Other messages that potentially helped victims about what to do after a recent DFSA highlighted the need not to wash the body or change clothes before medical examination and go fast to an attention centre to collect biological matrices, like blood and urine. On the other hand, concerning assault past experiences, awareness messages potentially helped any possible former assailants to self-identify as such, promoting an in-depth reflection about their predatory sexual behaviours and the need for repairing the damage caused to victims. In turn, regarding witnesses of past DFSA, educational messages

potentially helped third persons to identify themselves as witnesses of this kind of situation in the past, enhancing their spirit of solidarity about looking for victims and supporting them. Finally, concerning victims, awareness messages potentially helped them to self-acknowledged as such, report the crime to authorities, and seek adequate help to face any possible psychological damage from the assault.

4. Discussion

The developed work shows an innovative, without known precedent exploration of a broader forensic intelligence perspective that guided public health actions for DFSA prevention within the educational system. Such a novel approximation to the little-explored forensic science contribution to preventive public health revolved around applying a new working framework previously developed for improving DFSA understanding and prevention [29]. This framework application involved two ordered stages connected by the feedback flow between the corners of the triangle within the working framework (Fig. 1b). At the earliest stage, strategic actions targeting government and educational authorities at the exosystem level enhanced institutional support facing the DFSA phenomenon. Subsequently, in the second stage, the generated institutional support enhanced direct support. In this sense, working at the microsystem level enhanced direct support by more than half a thousand young students facing this form of sexual violence in the leisure nightlife context. Furthermore, this second stage implemented the working framework's double applicability. Firstly, applying it as a study tool for understanding the DFSA phenomenon and, after that, using it as a strategic thinking and action platform for overcoming this sexual violence problem. Consequently, the implemented forensic intelligence-led procedure comprising two ordered stages enhanced institutional and direct support facing the DFSA phenomenon. On the one hand, local and national government and university educational authorities provided institutional funding and improved coordination with local high and secondary school centres. On the other hand, concerning direct support enhancement, university and pre-university students became aware and mobilized as active preventive agents facing DFSA. In this sense, from an intelligence perspective, considering the application of the working framework as a strategic thinking and action platform, certain elements were crucial tactical resources for mobilizing young students. The service-learning methodology and the peer-to-peer communication technique significantly improved the transmission of preventive messages within the youth community. It had a powerful inspirational force and triggered a vertical ripple effect within the educational system, mobilizing students. At this point, beyond raising awareness

about the problem, these resources also empowered young students as new social awareness agents. Similarly, since young people are more affected by DFSA [26–28], awareness and mobilizing them contributed to shaping active prevention agents. Moreover, because university campuses are significantly affected by DFSA, from a strategic viewpoint, it was a proper context for starting an intervention within the educational system to prevent this phenomenon. The awareness and preventive messages reached around five hundred sixty students from four different educational levels, starting at the post-degree and degree levels and reaching the high school and secondary school education. The developed efforts potentially replaced behaviours and violent interactions characterizing DFSA situations with preventive and supportive synergies, stimulating cooperation, empathy and sexual respect, and healthy leisure dynamics far from binge drinking and other drug abuse. Moreover, considering the three Routine Activity Theory personal elements, the developed efforts raised awareness of potential assailants, witnesses, and victims of DFSA situations already lived in the past and those potentially happen in the future.

On the other hand, the working framework played a critical role in the forensic scientific contribution. It showed forensic intelligence more understandably for didactic purposes, becoming a valuable channel for transmitting forensic knowledge. In this way, through the working framework, the forensic scientist provided professors and students with information helpful in guiding decision-making processes focussed on increasing institutional and direct support facing the DFSA phenomenon. From a strategic location within the study scheme (Fig. 3), the forensic scientist participated in a collaborative inter-professional dialogue, acting as a focal point of helpful information for decision-making, designing and articulating those actions developed in the two study stages. This proactive application of forensic knowledge to crime prevention and public health enhancement, which is hand in hand with forensic intelligence, shows a wider perspective of forensic science. It allows us to picture a broader forensic science contribution, beyond the traditional and dominant view characterized by narrowness and fragmentation, envisaging it as a patchwork of sub-disciplines oriented to the past with the only purpose of assisting the court in a specific crime [1]. However, this study's forensic intelligence conception opens a new perspective for forensic intelligence in itself. Two main reasons explain this broader view. On the one hand, research in this field usually restricts forensic intelligence contributions only to police-led intelligence [3–5,16–21]. Nevertheless, the forensic intelligence perspective has the potential to be generalized [4]. It is an emerging form of intelligence [22] whose meaning and value are yet not widely understood [5]. In this sense, beyond its usual role in police-led intelligence situations, this work explores the potential collaboration between forensic intelligence and other professions related to security, a hopeful relationship already observed by other authors [15,22,62,63]. This study sheds light on the potential contribution of forensic intelligence to preventive public health. Some authors highlight that such productive cooperation remains yet insufficiently unexplored [64]. Concretely, in this study context, the DFSA is an intersectional phenomenon in which sexual violence and psychoactive substances misuse converge, including alcohol abuse and narcotic and other drug use. For that reason, this study's forensic intelligence-led actions focused on preventing DFSA and encouraging institutional and direct support facing this phenomenon are significant contributions to public health. At this point, it is essential to remark that the youth community's high participation, interest, and commitment indicate the high social demand for public health interventions facing the DFSA phenomenon in the youth nightlife context. In this work line, this study adds to the set of experiences according to forensic intelligence can influence policy decisions and social actions on diverse phenomena, inspire political agendas, reshape professional practices, support project allocations, and

educate people [15,65,66]. On the other hand, the second reason for opening a new perspective for forensic intelligence emerges from expanding, even more, the conception of forensic intelligence as a continuum informing law enforcement investigations, military intelligence, and prosecution in the criminal justice system [67]. Indeed, other authors have already pointed out that forensic intelligence can take a longer-term proactive approach to inform decision-making and strategic policy [67]. In this sense, observations from this study reinforce the idea that, beyond police forces, a broader diversity of audiences is potentially interested in forensic intelligence for using it in a socially responsible way, such as government bodies or citizen movements [15]. Consistent with this line, this work proposes a further extension of the forensic intelligence, directly applied by the civilian society in decision-making processes for sexual crime prevention and young people health promotion. Professors and students participated as decision-makers guided by forensic intelligence, anticipating both the crime and the need for law enforcement and courtrooms intervention, thus significantly reducing social costs.

Forensic intelligence perspective is future-oriented and proactive, focused on exploring long-term solutions [14,68]. Such view allows a widened preventive contribution of forensic science, expanding its role and integrating it into proactive security studies [69,70]. By providing critical phenomenological knowledge, forensic intelligence becomes a source of evidence valuable for supporting proactive crime prevention and health promotion strategies, including those coming from citizen responsibility initiatives [14,15]. This broader forensic intelligence perspective might contribute to revitalizing efforts to achieve challenges concerning sustainable development's social dimension, a need repeatedly remarked by international authorities [71,72]. In this line, the forensic intelligence-led efforts facing the DFSA phenomenon in this study align with goals for strengthening substance abuse prevention [71] and eliminating all forms of violence against all women [71].

Finally, besides the information resulting from forensic casuistry, the knowledge provided by the working framework also included data from criminological studies [25,28,73–83]. In this sense, forensic science and criminology work on crime as a study object. However, both disciplines suffer from a significant lack of knowledge sharing each other, which supposes a severe weakness in responding to crime [2]. Likewise, as with forensic science, there is also a call of attention for greater criminology involvement in crime prevention policy development [84–87]. Criminology is being encouraged to become more public-oriented and build a broad and forward-looking evidentiary base for innovation in justice policy [86], promoting social justice and human rights [88]. Based on these calls for change affecting both disciplines and their lack of knowledge sharing, some authors noted the need for a criminological and forensic synthesis [89]. This thinking line states that the reconstruction of both disciplines forces their reconfiguration into a structure of dynamic integration [83,88]. To the extent that the working framework applied in this study compiles knowledge coming from forensic science and criminology, it favours an interdisciplinary dialogue between both disciplines. In this sense, this work shows as forensic science and criminology shake hands within the broader forensic intelligence perspective previously described. Nowadays, few proposals favour this interdisciplinary dialogue between forensic science and criminology. However, there is a parallelism between some of these proposals and the working framework applied in this study. This framework has dual functionality: it is a study tool gathering forensic and criminological information for understanding a criminal phenomenon and a strategic thinking and action platform for overcoming it. In this sense, other methods proposed for favouring the interdisciplinary dialogue between forensic science and criminology also gather and analyse relevant information from both areas about a specific crime phenomenon to develop later well-

targeted, evidence-based preventive solutions [90]. Therefore, the working framework applied herein becomes a meeting point for both disciplines, encouraging sharing of knowledge and crime prevention.

5. Conclusions

A broader contribution of forensic sciences to crime prevention is possible through the proactive view of forensic intelligence beyond the traditional role characterized by the retroactive perspective limited to courtrooms. The new working framework recently developed for improving the understanding and prevention of the DFSA phenomenon helps encourage this wider forensic science contribution. This operational framework works as a strategic forensic intelligence tool channelizing scientific knowledge from forensic data in a more understandable and didactic way for decision-makers. Moreover, this working framework has a dual utility valuable for encouraging forensic intelligence applicability, being applicable both as a study tool for understanding violent phenomena and as a strategic thinking and action platform for overcoming them. As a representative exercise of this broader contribution of forensic science to preventive public health, this study applied this strategic forensic intelligence tool to overcoming the DFSA phenomenon in the leisure nightlife context. In this way, forensic intelligence-led actions implemented from within the educational system significantly enhanced institutional and direct support facing this form of sexual violence. Firstly, institutions provided economic resources and increased coordination for awareness interventions targeting young people. Secondly, awareness messages regarding potential past and future experiences of DFSA from the assailant, witness, and victim viewpoint reached more than half a thousand students from four different educational levels from the university, high school, and secondary school. Likewise, professors and students participated as decision-makers guided by forensic intelligence in designing and articulating preventive processes. Therefore, this forensic intelligence-led civilian exercise encourages citizen participation. Civilian society members become decision-makers, anticipating both the crime and the need for law enforcement and courtrooms intervention. Moreover, this exploratory exercise also promoted higher young commitment to preventing crime. As such, the intervention within the educational system inspired and mobilized a considerable volume of young students as preventive agents facing the DFSA phenomenon in their surroundings. Consequently, this inter-professional dialogue between forensic science and other disciplines related to health promotion, security, and education can revitalize efforts to achieve global challenges concerning sustainable development's social dimension, a need repeatedly remarked by international authorities. Finally, the working framework also becomes an appropriate meeting point for forensic science and criminology, providing a bridge that favours the interdisciplinary dialogue between crime-forensic disciplines. Through this knowledge sharing, both fields can support and strengthen each other, joining forces as a promising and more efficient step forward for studying and preventing crime.

Formatting of funding sources

This work was supported by the National Drugs Plan of the Ministry of Health, Social Services and Equality (Spain) [MSCBS-PND-2018I032 & MS-PNSD-2021I052]; the University of Alcalá (Spain) [UAH/EV951, UAH/EV1024 & UAH/EV1282], the University Institute of Research in Police Sciences (Spain) [IUICP/PI2019/006], and the University of Alcalá General Foundation (Spain) [Project Youth in Action Overcoming Global Challenges].

Funding sources were not involved in study design; in the collection, analysis, and interpretation of data; in the writing of the report; and in the decision to submit the article for publication.

CRediT authorship contribution statement

Pablo Prego-Meleiro: Definition, Conceptualization, Methodology, Investigation, Writing – original draft. **Carmen García-Ruiz:** Writing – review & editing, Supervision, Funding acquisition. **Miguel Sanz-Pareja:** Visualization, Supervision. **Irantzu Recalde Esnoz:** Visualization, Supervision. **Ma Gloria Quintanilla:** Funding acquisition, Writing – review & editing. **Gemma Montalvo:** Writing – review & editing, Supervision, Project administration, Funding acquisition.

Acknowledgments

We would like to thank the National Drugs Plan of the Ministry of Health, Social Services and Equality for financial support for the projects MSCBS-PNSD-2018I032 and MS-PNSD-2021I052. Similarly, we thank the University of Alcalá for supporting the projects UAH/EV1024, UAH/EV951 and UAH/EV1282. Moreover, we thank the Education Science Institute of the University of Alcalá and the Alcalá de Henares City Council to facilitate the coordination between different educational levels. Finally, we thank the University of Alcalá General Foundation for supporting Youth in Action Overcoming Global Challenges project. Prego-Meleiro thanks the University of Alcalá for a predoctoral grant. Recalde thanks the Ministry of Universities for the predoctoral grant FPU19/02402.

Declarations of interest

None. The authors affirm that there are no conflicts of interest.

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