m-Health Approaches in Suicide Prevention at the Emergency Department: Some Theoretical and Practical Considerations

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ABSTRACT: *Emergency Departments (EDs) are a critical link in the suicide prevention chain. Indeed, their role is crucial in identifying, admission and clinical management of suicidal patients, as they often serve as an urgent, primary or sole point of contact with the health care system; moreover, they are directly confronted with the high rate of suicidal behavior (SB) recidivism amongst suicidal individuals discharged from EDs. However, suicide prevention at EDs appears as underused and needs to be reinforced in its implementation. A particular care has to be addressed to prepare the post-discharge period, in order to limit risk of social isolation and provide support. In this direction, m-Health approaches may offer an integrative contribution to the prevention strategies well-established in literature: a) They may be considered part of the "caring contacts" strategies post-EDs, and b) By a personalized programming, their applications may provide a support for "safety planning" interventions, designed to identify and manage vulnerabilities and resources of the individual during the suicidal crisis. They rely on a number of coherent theoretical references and could possibly make it feasible as an original perspective to study SB. Nevertheless, m-Health has to be perceived and utilized merely as a tool, which in any case can not substitute clinical evaluation and human presence at the moment of the confrontation with suicidal individual's distress..*

KEYWORDS: *Suicide, Suicide behavior, Prevention, Emergency departments, m-Health*

INTRODUCTION

The role of the Emergency Departments (EDs) in identification, admission and clinical management of suicidal patients (presenting suicidal ideation, SI, and/or having committed a suicidal attempt, SA) is crucial, as EDs often serve as an urgent, primary or sole point of contact with the health care system (Larkin & Beautrais, 2010; Ting et al., 2012; US Department of Health and Human Services Office of the Surgeon General and National Action Alliance for Suicide Prevention, 2012; Betz et al., 2016). EDs represent also a critical link in the suicide prevention chain (Larkin & Beautrais, 2010; US Department of Health and Human Services Office of the Surgeon General and National Action Alliance for Suicide Prevention, 2012; Betz et al., 2016; Miller et al., 2017). They are indeed directly confronted with the suicidal behavior (SB) recidivism phenomenon amongst suicidal individuals discharged

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from EDs, who present a high near-term risk of further SI, SA, and suicide completion (Larkin & Beautrais, 2010; Arias et al., 2015).

Up to 25% of those who made a medically serious suicide attempt (MSSA) and have been seen in the EDs, make another attempt, and 5%-10% eventually die by suicide within 5 years (Beautrais, 2003; Beautrais, 2004). Within 10 years, 28.1% of those who had been admitted for a documented suicide attempt, both MSSA and medically not serious suicide attempt (MNSSA) were readmitted for a further attempt, and 4.6% died by suicide (Gibb et al., 2005). The rates of readmission at the EDs of MSSA and MNSSA patients and their mortality risk from suicide are highest in the first two years after the first admission at the EDs, although readmissions and deaths occurred throughout the 10 years study period (Gibb et al., 2005). Amongst the patients admitted for SI, within 5 years 38% had represented at least once with either a SA or for further SI (Larkin et al., 2008). Most of the studies, that examined risk of suicidal relapses in patients dismissed from EDs tended to include also subjects who were admitted for self-

harms; indeed, self-harms without lethal intent occur frequently in the same patients and they can be a precursor of SB (Pompili et al., 2015). Two systematic reviews published in 2002 (Owens et al., 2002) and in 2014 (Carrol et al., 2014) converged to similar data, showing that one year following the self- harm an overall average of 16% repeated the self-harm behavior and approximately 2% died by suicide. Further, during the year before their deaths, 39% of suicide victims visited the EDs at least once and 39% of them were admitted for self-harm (Gairin et al., 2003). Additional evidence suggests that over a 15 years follow-up, in a large (N=11.583) sample of patients who were presented to the hospital after self-harm, the overall suicide risk in the first year was 66 times higher than the annual risk of suicide in the general population, and this risk progressively increased over the years (Hawton et al., 2003).

In spite of the data, suicide prevention at EDs appears as underused and needs to be strengthened in its implementation (Larkin & Beautrais, 2010; Knesper, 2010; Betz et al., 2016; Miller et al., 2017; Bridge et al., 2017). A particular care, in analogy with psychiatric hospitals aftercare strategies for suicidal patients, has to be addressed to the post-discharge period, in order to provide support and limit risk of social isolation (Pompili & Baldessarini, 2015).

"Caring Contact" and Multifaceted Interventions in Suicide Prevention at EDs

One of the most extensively studied intervention of prevention among suicidal patients who presented at EDs is maintaining an active contact with them after their discharge; the evidence for this type of intervention is strong enough to be a standard of care (Hogan, 2016). In a systematic meta-analysis on studies investigating the effect of interventions to prevent SB relapse in patients admitted to EDs for a SA or self-harm (Inagaki et al., 2015), the selected trials were classified into four categories based on the type of the intervention offered: 1) Active contact and follow-up group; 2) Psychotherapeutic interventions; 3) Pharmacological interventions; and, 4) Miscellaneous. Specifically, the category of "Active contact and follow-up" was subsequently divided into five subgroups: a) Intensive care plus outreach: intensive follow-up with scheduled visits (Allard et al., 1992), home visits by community nurse to improve compliance and assure continuity care (Van Heeringen et al., 1995), intensive interventions based on a problem-solving approach performed by a community psychiatric nurse during hospitalization and post-hospitalization period (Van der Sande et al., 1997), outreach consultations based on assertive intervention performed by a specialized nurse (Morthorst et al., 2012); b) Brief intervention with long-term follow-up (the SUPRE-MISS trial, undertaken by the World Health Organization) (Fleischmann et al., 2008, Bertolote et al., 2010); c) Letter/Postcard contact to suicide attempters discharged from EDs (Carter et al., 2005, Carter et al., 2007, Beautrais et al., 2010, Hassanian-Moghaddam et al., 2011; Carter et al., 2013); d) Telephone contact (Motto 1976; Motto & Bostrom 2001; Cedereke et al., 2002; Vaiva et al., 2006) and telephone contact in elderly people (De Leo et al., 1995; De Leo et al., 2002); e) Composite letter/postcard and telephone contact (Kapur et al., 2013). Although with a number of differences for each single study, overall only this category of "Active contact and follow-up" has been shown to reduce the risk of a repeat SA

at 12 months (Inagaki et al., 2015). This result, consistent with a previous critical review performed in patients discharged from inpatient psychiatry departments and EDs (Luxton et al., 2013), highlight that caring contacts with suicidal patients following their EDs visit reduce the SB recidivism.

Experts clinical guidelines in prevention of suicide at the EDs recommend a complete panel of activities that include suicide risk screening and assessment, ED-based interventions, and post-ED resources (Capoccia & Labre, 2015; Suicide Prevention Resource Center, 2015; Betz & Boudreaux, 2016; Betz et al., 2016). Safety planning interventions, consisting in establishing personalized plans with warning signs, list of coping strategies and emergency contacts, are included (Stanley & Brown, 2012; Betz & Boudreaux, 2016; Betz et al., 2016). In the recent multicenter Emergency Department Safety Assessment and Follow-up Evaluation (ED-SAFE) study among 1376 adults with SI or SA enrolled in 8 EDs in United States, a multifaceted intervention delivered during and after the ED visit (including suicide risk screening, brief interventions in ED and a series of telephone calls after ED discharge) resulted in a 5% absolute decrease in the proportion of patients subsequently attempting suicide with a relative risk reduction of 20% compared with treatment as usual and a 30% decrease in the total number of SA over a 52-week follow-up period (Boudreaux et al., 2013; Miller et al., 2017).

m-Health Interventions

m-Health, according to the WHO's definition, is the "use of mobile and wireless communication devices to support healthcare objectives" (Lal & Adair, 2014). Concerning SB prevention at EDs, m-Health-based interventions seem to represent an emergent and promising domain (Aguirre et al., 2013; Larsen, 2015; Larsen et al., 2016a; Kreuze et al., 2016; Siegel, 2016; Franco-Martin et al., 2018). On the one hand, they may be considered part of the "caring contacts" strategies post-ED, by maintaining and/ or reinforcing a patient supporting network both in the medical context and in the personal sphere. On the other hand, by a personalized programming, they may provide a support to store data issued from "safety planning" interventions: individualized step-by-step approaches to empower patients help-seeking during suicidal crises, tailored on its current needs and resources (Stanley & Brown, 2012; Kennard et al., 2015; Betz & Boudreaux, 2016; Pauwels et al., 2017; Andreasson et al., 2017).

Recent experiences (Bush et al., 2015; Larsen et al., 2016b; Berrouiguet et al., 2016; Jang et al., 2017) indicated that m-Health mobile applications may be installed across the various portable devices for the patients (who have presented to the EDs with SI or having committed a SA, and who have been clinically judged apt to be dismissed) at the moment of his discharge from the EDs. These applications may programmed to: a) establish some regular contacts between the patients and the EDs caregivers (via calls, SMS, WhatsApp), according to the specific requirements and preferences of the patient; b) create some personalized lists, characterized eventually by attractive and dynamic interfaces, including warning signs and mechanisms for coping; pre-selected contacts with relevant people of patient's network (both personal and caregivers-related, including the access to the 24h/24h number of the EDs) may also be determined to be used in case

of emergency. The multidisciplinary staff who characterizes the emergency services facilitates the practical feasibility. Good acceptability from the patients have also been described (O'Brien et al., 2016).

Other preliminary experiences more focused on research (Selby et al., 2013) suggested the possibility of determining a detailed assessment of the temporal dynamics risk of the patient through algorithms realized based on a self-evaluation logbook (by taking into account the type and the intensity of the SI, the contributory/triggering factors as well as the protective factors and the emotional status). The applications based on the elaboration and interpretation of these data, once perfected, may contribute to an individualized screening and assessment of the suicidal risk, in the context of the recommended multifaceted prevention interventions (Boudreaux et al., 2013; Miller et al., 2017).

m-Health use in mental healthcare is an expanding area conceived for monitoring symptoms and improving outcomes in several psychiatric disorders, involving mood disorders, anxiety disorders, schizophrenia, eating disorders, and personality disorders (Lal & Adair, 2014; Anthes 2016). These approaches are particularly diffused in the substance use disorders domain across various substances, populations and settings; scientific validations are nevertheless available in a minority of cases (McClure et al., 2013, Kiluk & Carroll, 2013, Marsch et al., 2014; Anthes 2016). A rigorous test in a large cohort of young people of a publicly available evidence-based application (Digital-Alcohol Risk Alertness Notifying Network for Adolescent and Young Adults [D-ARIANNA]), estimating an overall risk score of binge drinking, showed a population-level benefit at 2 weeks (Carrà et al., 2016); the possibility of an high personalized risk communication for informed decision-making and an easily disseminating of this application are of particular interest (Carrà et al., 2016). A very recent systematic review and meta-analysis found a moderate but significant benefit on effectiveness of web/text-based interventions for smoking cessation as compared with routinely used approaches (Crocamo et al., 2018); according with the literature, communication media characteristics may facilitate these approaches for large-scale public health interventions (Crocamo et al., 2018).

m-Health approaches in people with addiction are paradigmatic in exemplifying a number of advantages that may be generalized to other mental health problematics, included SB, both in the assessment and in the intervention processes. At the clinician's level, communication with the patient may be improved and clinical decision refined, by the possibility of collecting a great quantity of specific data and the individualization of the intervention (Wood et al., 2014). At the individual's level, they may be largely accessible, offer information in an engaging manner, ensure a greater sense of privacy, and reduce stigmatization or embarrassment (Wood et al., 2014). Finally, these approaches are conceived to increase the patient reflexivity on their own, support its empowerment and improve its involvement, which represent in themselves possible therapeutic goals (Marzano et al., 2015). In this direction, the assessment and the intervention potential of m-Health approaches may enable them to integrate, also in SB prevention domain, the development of a proactive "P4 medicine": predictive, preventive, personalized and participative (Hood & Flores, 2012).

From the "Interpersonal-Psychological Theory of Suicide" to the Connectedness

From a theoretical point of view, m-Health approaches in SB prevention refer to the "Interpersonal-Psychological Theory" of Suicide (IPTS), the "impossible situation", and the *connectedness* conceptualizations. In these models it is described, with a particular reference to the suicidal individual, the essential intrapsychic place occupied by both perceiving himself as a part of something meaningful outside oneself and being able to communicate and interact with it. The consequent resource of having the possibility of relying on the existence of a network caring and maintaining positive feelings is also at the base of the "caring contacts" strategies.

The "Interpersonal-Psychological Theory of Suicide" (IPTS) (Joiner, 2005; Van Orden et al., 2010) postulates that the most dangerous kind of desire for suicide is nurtured from the simultaneous presence of two interpersonal constructs: the "thwarted belongingness" (feelings of not belonging to one's social group) and the "perceived burdensomeness" (perception of being a burden for significant figures of the entourage). The "thwarted belongingness", in particular, is comprised of two facets, which are loneliness ("I feel disconnected from others") and the absence of reciprocally-caring relationships ("I have no one to turn to", "I don't support others"). A necessary component to act on this desire for suicide is represented by the "acquired capability for suicide" that stems from repeated exposure to painful/fearful events, the most significant of which is a prior SA (Joiner, 2005; Van Orden et al., 2010). The IPTS has been increasingly studied over the last years and its theoretical dimensions received empirical support in various populations, including a community-dwelling population visiting a psychiatric ED for SI or SA (Baertschi et al., 2017).

The "impossible situation" is conceptually close to the IPTS. It postulates that individuals who committed suicide or a MSSA differ from individuals who committed a MNSSA not only because of higher level of suicide intent and higher lethality level, but also for loneliness, problems in self-disclosure, less help-seeking behaviours, and communication difficulties (Levi et al., 2008; Horesh et al., 2012; Levi-Belz et al., 2103; Levi-Belz e al., 2014; Gvion et al., 2014; Levi-Belz & Beautrais, 2016); communicational difficulties are also associated with higher lethality in the case of average/high mental pain (Levi-Belz et al., 2103). Therefore, the proposed model of serious SB posits that a situation becomes "impossible" when the person with high level of mental pain is unable to communicate his/her distress (Levi et al., 2008; Levi-Belz et al., 2103; Gvion et al., 2014). From this perspective, serious SB can be considered as an extreme and dramatic way of communication and interaction, in line with some previous works (Stengel, 1964; William, 2001).

The IPTS and the "impossible situation" evoke the more general notion of *connectedness*. Lack of *connectedness* to others has been variously defined in literature, but it commonly refers to poor integration into a social network, lack of social support (and/or perceived social support), and perceptions of social isolation (and/or one's subjective sense of connection to others) (Kaminski et al., 2010; Daniel &Goldston, 2012). The role of the absence of *connectedness* as a relevant risk factor for SB across the

lifespan and thus as a possibly useful target in prevention strategy interventions, has been largely described over the last years: widely among teenagers (King & Merchant 2008; Kaminski et al., 2010; Czyz et al., 2012; Carroll et al., 2014; Whitlock et al., 2014; Arias et al., 2015; Ghassemi et al., 2015; Opperman et al., 2015, Arango et al., 2016), but also amongst adults and elderly people (Purcell et al., 2012; Lourey et al., 2013; Van Orden et al., 2013; Conwell, 2014), sexual minorities (Duong & Bradshaw, 2014) and ethnical minorities (Hill, 2009).

In an "Ideation-to-Action" Framework

m-Health approaches in SB prevention are in line with some recommendations stated in the 2014 Lancet Psychiatry issue focused on SB (Hawton 2014; O'Connor & Nock, 2014), dedicated to the necessity of looking at the underlying core factors of suicidal potential in a different way and to develop new prevention strategies. Evidence-based interventions in suicide prevention, under their different population, institutional and individual aspects (Mann et al., 2005; WHO, 2012), are, indeed, primarily based on the state-of-the-art knowledge about risk factors (Schwartz-Lifshitz et al., 2012; Aleman & Denis, 2014; Hogan, 2016). SB emerges as the by-product of a multifactorial process that integrates at various level of complexity, several neurobiological, psychological, socio-economic and cultural factors, which have been framed in some comprehensive models having the heuristic interest of generalising and testing hypotheses in the pathogenesis of SB to detect high vulnerable subjects (Hawton & van Heeringen, 2009; van Heeringen & Mann, 2014; Turecki & Brent, 2015). In the "stress-diathesis model" the risk for the expression of SB is not merely determined by a unique stressor, consisting in the onset or acute worsening of a psychiatric disorder or of a psychosocial crisis, but also by a combination of specific vulnerability factors constituting the appropriate terrain (Mann et al., 1999; Mann 2003; Mann & Currier 2010; van Heeringen & Mann 2014). A sequencing of these vulnerability factors into distal and proximal ones, with several socio-demographic variables playing a role of moderators between them, has been conceptualised in the "neuro-developmental model", which emphasizes the concept of an individual vulnerability life-trajectory, interacting and managing environmental influences at any moment (Turecki et al., 2012; Turecki & Brent, 2015). Nevertheless, identifying the risk factors alone is not sufficient to improve prevention (Schwartz-Lifshitz et al., 2012; Glenn & Nock, 2014). The 2014 Lancet Psychiatry issue focused on SB (Hawton, 2014; O'Connor & Nock, 2014) strongly required to: 1) Inspire to psychological models to understand the processes involved both in the development of SI and in translating these ideas into suicidal acts; and, 2) Develop pragmatic interventions. By both their reference to the IPTS and the "impossible situation", two models taking into account the psychological components in an "ideation-to-action" framework, and their proposal of practical strategies, m-Health approaches in this domain seem to be coherent with official requirements.

m-Health Research Perspectives

It has been postulated that m-Health research could provide new ways of exploring human behaviours, including SB (Marzano et al., 2015; Vahabzadeh et al., 2016). The complexity of the SB and its dynamic nature makes it difficult to test pathogenetic hypotheses and assess the outcomes of prevention actions. m-Research could allow the creation of detailed data collections, included information about their dynamic relationships (Tourus et al., 2015). In analogy with algorithms dedicated to the temporal dynamics risk assessment (Selby et al., 2013), similar algorithms may be created specifically for the variable or the psychological construct that have to be studied. By this way, it could enable to make stronger assumptions on causal inferences between the different variables as compared to those resulting from transversal or longitudinal studies (Ben-zeev et al., 2012).

CONCLUSION

m-Health approaches in suicide prevention at EDs may offer an integrative contribution to the well-established prevention strategies. This is particularly relevant for the "caring contacts" interventions, defined as "efforts to bridge the gap between ED visit and outpatient care" (Betz et al., 2016), and the "safety planning" interventions, designed to identify and manage personal vulnerabilities and resources of the individual during the suicidal crisis. The modern-day connectivity via a technological platform initiated and monitored through the EDs may help in providing both a sense of *connectedness* and the means to respond in a personalized manner to the immediate needs of the individual to help him better manage the existential condition as regards to the possibility of SB in order to prevent it. These approaches rely on a number of coherent theoretical references, evoking Durkheim's theorization stated in 1897, and could possibly make it feasible in an original perspective to study SB. The current and future focus of m-Health care on suicide prevention will be to enhance self-esteem, empowerment of the individual, psycho-education, and facilitate access to care. Finally, we hypothesize that m-Health approaches will also help in maintaining the individual in their respective environments and prevent institutionalization of suicidal people.

However, m-Health interventions on suicidal behavior raise some delicate considerations and have to be used with a critical view. The connected devices will be omnipresent and integrated in the individual's daily activities: on the one hand, they should play more and more the role of a mediator of the various daily activities and, on the other hand, they could also be assimilated to a permanent intrusive monitoring. It will be important to have an attentive approach to the psychosocial changes that such interventions could generate as well an ethical approach as regards to the security and confidentiality of the individual, because of the possibility of recording and stocking an immense quantity of personal data. They also intrinsically bear a paradox: these devices, which can be seen in some ways as conveying a progressive distancing of the communication and the "real" interaction with other individuals, are offered here with the aim of facilitating precisely this interaction. For this reason, they must be seen by patients and caregivers as nothing else but tools, which will in no case replace clinical assessment and human interaction in the therapeutic relationship.

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