Epidemiological Trend, Risk Factors, Prevention and Treatment Strategies of Self-directed Violent Behavior: A Critical Appraisal of Relevant Literature

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Authors’ contributions

This work was carried out in collaboration among all authors who designed the study, performed the statistical analysis and wrote the protocol. Author NAQ wrote the first draft of the manuscript, revised the paper one time and managed the analyses of the study. All authors managed the literature searches, read and approved the final manuscript.

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ABSTRACT

Background: Suicide is an intentional fatal act of self-destruction and largely preventable phenomenon. Early identification of suicide risk factors, proactive preventive steps and therapeutic interventions tend to reduce robustly its epidemiological trends including associated high mortality around the world.

Objective: This review study aimed to critically describe the identified potential risk factors underlying suicide together with a specific focus on its relevant preventive and management strategies.

Methods: A selective e-searches of Google Scholar, PubMed/MEDLINE and Science Direct of relevant English literature (2000-2019) was conducted by using keywords and Boolean operators, and following exclusion and inclusion criteria included 115 most influential articles for this critical review.

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Results: Suicide is a global preventable phenomenon determined by multiple interconnected risk factors and mechanisms embedded in several levels; population (indigenous people and social media), individual (distal predisposing factors), developmental (mediating factors) and proximal (precipitating factors). Evidently suicide needs multimodal intervention approach in terms of universal, selective and indicated prevention.

Conclusion: Suicide is a global heterogeneous phenomenon and needs continuing concerted efforts of multidisciplinary health team and multi-sector stakeholders because its risk pathways and protective factors dynamically changes overtime across the world.

Keywords: Epidemiological trend; violent behavior; suicide; self-destruction.

1. INTRODUCTION

Suicide is an ancient preventable phenomenon and relevant literature described its epidemiological trends [1,2], biopsychosocial and cultural determinants [3-15]. Numerous studies have also identified early warning signs (EWS) of suicide and suicidal attempts, healthcare provider reactions and strategies to prevent rising suicide deaths globally [7,16-18]. On the other hand, several studies have also recognized protective factors such as social and family supports, religious congregation and affiliation reflecting high religiosity, water lithium level and other important protective strategies [2] and evidenced-based drug and nondrug treatment interventions in clinical and nonclinical settings [17,19-22]. The determinants, early warning signs and prevention of suicide might be addressed using universal, selective and targeted/indicated strategies [7,23]. On clinical ground, neuropsychiatric disorders, genetic propensity, previous suicidal attempts, family history of suicide, sexual abuse, trauma and maltreatment, chronic physical diseases, cancers, chronic pain, hopelessness and their psychiatric comorbidities are major contributors to the pool of suicide and suicidal attempts across the world [24-29]. Concerning healthcare systems at three levels of care, barriers against timely access to healthcare and mental health (MH) help-seeking pathways, shortage of mental health (MH) professionals, social stigma, relative lack of Primary Mental Health Care (PMHC) services in the community (hybrid model services), inadequate supply of psychotropics, and lack of proper psychiatric referral system from PMHC to secondary or tertiary mental health care (MHC) system further add considerable variance to the suicide rate and preventable fatalities [7,10,30-34]. Notably, these dynamic risk factors as well as protective strategies of suicidal attempts, ideations and communications and suicides have been linked concisely with individual biopsychosocial styles, healthcare systems, adverse human relationships, communities’ organizations, societies structure, culture and religion, and healthcare policies and practices [29,31-33,35] and, hence, non-drug prevention strategies including barriers at suicide hotspots, firearms restrictions and limiting access to both pesticides and charcoal and improvements especially in surveillance of patients with severe suicidal intents in MH systems have resulted in prevention of suicide [2,19]. In the same vein, the psychotropic drug interventions such as selective serotonin re-uptake inhibitors (SSRIs), use of lithium, clozapine, ketamine, antipsychotics should target collaboratively these etiological models of suicide in order to reduce its incidence, prevalence and burden of disease around the world. This concise review of literature informs us that suicide is a preventable heterogeneous phenomenon with variable epidemiological trends, determined by a variety of biopsychosocial and cultural factors, multiple mental disorders (MDs) and their psychiatric and physical comorbid conditions (Table 1); however, its global burden and diverse devastating consequences can be reduced considerably by the concerted efforts of all stakeholders linked with health, labor, agriculture, education, trade, justice, law, security and defense, politics and the media worldwide.

1.1 Aim

This critical review aimed to describe the epidemiology, determinants, prevention strategies and treatment interventions directed towards people vulnerable to engage in self-directed violence (SDV). The significance of the review, first of its kind in Saudi Arabia, is to highlight main findings of suicide research over the past twenty years. This review will help MH professionals in updating their knowledge in different aspects of suicide and effectively manage patients with suicidal behaviors.
<table>
<thead>
<tr>
<th>Determinants</th>
<th>Remarks</th>
</tr>
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<tbody>
<tr>
<td>1. Age</td>
<td>Teens, young adults &amp; elderly: vulnerable to suicide &amp; suicidal attempts</td>
</tr>
<tr>
<td>2. Gender</td>
<td>Males and females are more susceptible to suicide and suicidal attempts, respectively.</td>
</tr>
<tr>
<td>3. Marital status</td>
<td>Suicide is common in single or divorced individuals compared to married persons</td>
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<tr>
<td>4. Family type</td>
<td>Nuclear families are more prone to suicide compared to joint families</td>
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<tr>
<td>5. Villagers/town dwellers</td>
<td>People living in metropolitan cities are less likely to commit suicide compared to villagers</td>
</tr>
<tr>
<td>6. Unemployed</td>
<td>Suicide and suicidal attempts commonly found in jobless people</td>
</tr>
<tr>
<td>7. Illiterate or low education</td>
<td>Uneducated individuals are reported to commit suicide more than educated persons</td>
</tr>
<tr>
<td>8. Smoking</td>
<td>First and second smoking is associated with suicide</td>
</tr>
<tr>
<td>9. Poverty</td>
<td>A vast literature suggests connectivity between poverty and suicide</td>
</tr>
<tr>
<td>10. Financial losses</td>
<td>Trade and accrued financial losses cause suicidal tendencies</td>
</tr>
<tr>
<td>11. Breakup relationships</td>
<td>Relationship discords are linked with suicidal behavior</td>
</tr>
<tr>
<td>12. Death of a loved one</td>
<td>Potentially strong predictor of suicide</td>
</tr>
<tr>
<td>13. Family conflicts</td>
<td>Dysfunctional families raise alarms for suicide and suicidal attempts</td>
</tr>
<tr>
<td>14. Overcrowded stresses</td>
<td>A multitude of stressors lead to suicidal attempts</td>
</tr>
<tr>
<td>15. Stigma</td>
<td>Self-stigma, stigma and discrimination all are strongly associated with suicide</td>
</tr>
<tr>
<td>16. Neighborhood</td>
<td>Hostile neighbors may relate to suicide</td>
</tr>
<tr>
<td>17. Ethnicity</td>
<td>Ethnic background and culture may be the reasons for suicide or vice-versa</td>
</tr>
<tr>
<td>18. Religion</td>
<td>Islam protects followers from suicide and suicidal attempts</td>
</tr>
<tr>
<td>19. Access to means of suicide</td>
<td>Suicide provoking messages on digital devices and Apps (suicide hotspot) provoke suicide</td>
</tr>
<tr>
<td>20. Pollution &amp; climate change</td>
<td>Adverse environmental changes are associated with rising suicide rates</td>
</tr>
<tr>
<td>21. Crop damaging temperatures</td>
<td>Farmers especially in low-income countries tend to commit suicide</td>
</tr>
<tr>
<td>22. Wars, disasters and conflicts</td>
<td>Disastrous events are associated with high suicide rates</td>
</tr>
<tr>
<td>23. Immigration and displacement</td>
<td>Current reports suggest immigration is connected to suicide behavior</td>
</tr>
<tr>
<td>24. Acculturation</td>
<td>Adopting culture of a new nation is stressful and relates to suicidal behavior</td>
</tr>
<tr>
<td>25. Sexual orientation</td>
<td>Lesbian, gay, bisexual, transgender and intersex people commit suicide &gt;in HIC</td>
</tr>
<tr>
<td>26. Inappropriate media reports</td>
<td>Increases suicide and suicidal attempts rate</td>
</tr>
<tr>
<td>27. Isolation &amp; social exclusion</td>
<td>Linked with increased suicide.</td>
</tr>
<tr>
<td>28. Physical diseases &amp; MDs</td>
<td>Both comorbidities linked with high suicidal behavior</td>
</tr>
</tbody>
</table>

Note: All the determinants of suicide and self-deliberate harm have bidirectional connectivity to MDs and serious physical diseases. Universal prevention includes approaches tailored for an entire population without regard to individual risk factors; selective prevention relates interventions directed towards vulnerable group in the population and these are gate-keeping training and crisis helpline; indicated prevention defines assessment and management of MDs including substance use disorders (SUDs) and SDV and follow-up of mentally ill patients with community support.
including suicidal thoughts/ideations and expressions, early warning signs (EWSs) and suicidal attempts. The relevance of the appraisal of suicide is that there is minimal information about multiple perspectives of suicide including pre-suicide behaviors not only in Arabian Gulf countries but also eastern world.

2. METHODS

2.1 Search Strategy

The multiple e-searches of pertinent English language literature on suicide (2000-2019) published in PubMed, Google Scholar and Science Direct publishing houses were conducted. The focus was on full articles in open access journals and articles with abstracts in closed access journals. A cut-off point of last 20 years was chosen in order to comprehensively update suicide by incorporating the most recent published literature. The articles published prior to 2000 were also screened for selecting the most relevant and influential articles on several relevant items of competed suicides and attempted suicides. Keywords and Boolean operators were used for searching the relevant articles; suicide and epidemiological trend and suicide determinants or suicide risk factors and methods of suicide and pre-suicide attempts and prevention strategies and suicide interventions and psychotherapy. Search strategy was modified in accordance to the specific databases.

2.2 Search Results

Hundreds of thousands of articles were retrieved and two authors independently screened retrieved papers for eligibility and included 115 articles most relevant to our research agenda, and mainly based on exclusion (full articles not accessible because of high price tags and inclusion (full articles available free of charge and closed access articles with abstract) criteria. Furthermore, it was sorted out retrieved material and included accessible book chapters on suicide, articles on self-injurious behaviors with no suicidal intentions (non-suicidal self-injuries but self-directed violent behaviors) and articles with abstract in English published in non-English language literature. We also identified articles from the references of selected articles and included only the high quality papers in this critical review. A total number of suicide studies specifically for this review were 115 (Fig. 1). Any discrepancy concerning inclusion or exclusion of any article was discussed with third party for a consensus.

Fig. 1. PRISMA chart showing selection of articles
3. RESULTS

3.1 Definitions

Suicide has been defined since long ago, and Durkheim comprehensively described its technicalities and social underpinnings [36,37]. Recently Durkheim's scientific methods and concepts are criticized yet those models provide insights into understanding the complex origins of suicidal behavior (SB). One of the basic flaws of Durkheim's understanding of suicide is that mental illness is not a key determinant of SB. Currently, Durkheim's concepts of anomic, egoistic and altruistic suicide offer a means of comprehending global trends in SBs and suicide rates (SR) concerning nationalists, religious fanatics and political extremists [37]. Johnson (1965) conceptualized the causes of suicide into one cause based on “integration (egoism or altruism) or regulation (anomie or fatalism)”, the two social variables in severe suicide that collectively determine rates of suicide. Altruism and fatalism do not fit into Durkheim’s scheme and egoism and anomy are identical and, hence, his four causes underlying suicide rates could be amalgamated into one cause, responsible for variation in suicide rate [38]. Since then, many new terms are created to precisely describe suicide, SB, SDV, suicidal attempts (SA), suicidal communication (SC) and suicidal ideation (SI) with or without plan, self-injurious behaviors (SIB) and others [39-43]. In a systematic review of definitions of suicide and suicidal behaviors, Goodfellow et al. (2019) identified agency (means), knowledge of a potential fatal outcome, intent, and outcome as four key concepts underpinning suicide definitions. However, intent and outcome remain the most consensual features of SBs, which might be used in tailoring a measurement instrument for looking at the meanings of suicide across the world [44]. Both suicides and suicidal attempts that no intention for die are the self-directed intentional violent behaviors. Anger with suicidal intent may create unpredictable consequences.

<table>
<thead>
<tr>
<th>Terms</th>
<th>Definitions</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>Self-directed violence*</td>
<td>Behavior that is self-directed and intended to cause injury or the potential for injury oneself with or without suicide intent.</td>
<td>Gambling, drug abuse, smoking, rash driving, and parachuting result in injuries or death but are unintentional and not SDV.</td>
</tr>
<tr>
<td>Suicidal SDV</td>
<td>Behavior that is self-directed and deliberately results in injury or the potential for injury to oneself.</td>
<td>There is evidence of implicit** or explicit*** of suicidal intent.</td>
</tr>
<tr>
<td>Non-suicidal SDV</td>
<td>Behavior that is self-directed and deliberately results in injury or the potential for injury to oneself.</td>
<td>There is no evidence of implicit or explicit, of suicidal intent.</td>
</tr>
<tr>
<td>Undetermined SDV</td>
<td>Behavior that is self-directed and results in injury or the potential for injury to oneself.</td>
<td>Evidently suicidal intent is unclear.</td>
</tr>
<tr>
<td>Suicide attempt (SA)</td>
<td>A self-directed potentially injurious behavior with any intent to die as a result of the behavior 1. By other-a person takes steps to injure self but is stopped by another person prior to fatal injury. 2. By self-a person takes steps to injure self but is stopped by self prior to fatal injury.</td>
<td>A suicide attempt may or may not result in injury. 1. Interruption occurs at any point during the act-after the initial thought or after onset of behavior. 2. Is “aborted” suicidal behavior</td>
</tr>
<tr>
<td>Interrupted SDV-by self or by other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suicidal preparatory acts</td>
<td>Preparation beyond ideation or verbalizations (PSI) towards making a suicide attempt, but before potential for harm has begun</td>
<td>These acts (Active SI) include buying a gun, collecting pills or writing a suicide note, or giving things away.</td>
</tr>
</tbody>
</table>

*Analogous to self-injurious behavior (SIB); **implicit - No doubt implied though not directly expressed and inherent in the nature of something; ***explicit- dully expressed without any ambiguity, and leaving no question as to meaning or intent. Active and passive suicidal intent (A&PSI); Unacceptable terms as decided are; completed suicide; failed attempt; nonfatal suicide; parasuicide; successful suicide; suicidality; suicidal gesture, manipulative acts (M.Act) and suicidal threat.
Periodical rage with suicidal thought aggravates potential wish to die. In these cases, the committer may use potentially dangerous weapon implementing intended to die. Persons in the loop of SAs or self-harming behaviors somehow try to find solution for their severe problems. In other words, attempted suicides are “cry for help”. In this line self-harming behavior also constitutes SDV behaviors. Furthermore, SIs and SC are considered early signs of SDV behaviors [45]. Overall, SDV is categorized into non-suicidal and suicidal self-directed violent behaviors and well-defined, reformulated terms concerning suicide discourage researchers not to use its unacceptable terms given in the old literature (Table 2 and Fig. 2). Injury may or may not result from SBs or SDV. Nonetheless, suicide is strongly associated with emotional trauma or injuries that impact loved ones with adverse consequences.

### 3.2 Epidemiological Trends

Suicide and non-suicidal self-injuries (SDV), major public health problem, are on the rise in teens, youths and elderly population across the world [7,43,46-50]. According to WHO about 800,000 people die globally due to suicide every year. Moreover, suicide is the second leading cause of death among 15-29 year-olds [7]. The incidence and prevalence of suicide dynamically vary in low-, middle- and high-income countries of the world, primarily attributed to their biopsychosocial, cultural and geopolitical determinants [7,47,46-49]. WHO reported 11.4 suicides per 100,000 people, i.e., 840,000 deaths from suicide globally and these estimates most likely underreported because many of the nations reporting suicide deaths to WHO do not have precise suicide reporting systems and many member states do not report suicide death at all [50]. Overall, rising rates of SAs, nonsuicidal behaviors and undetermined SBs are attributed to multifactorial etiologies including immigration [7,50-54]. Thus, diverse risk factors and changing etiologies tend to transform suicide into highly complex, challenging and dynamically unstable condition globally. WHO estimated that about 79% of global suicides occur in low- and middle-income countries [7,49,50]. By extension, 21% of global suicides tend to occur in high-income countries. In sum, suicide is preventable dynamic event with variable global epidemiological trends but, on pessimistic note, suicide cannot be rooted out completely from this chaotic and tumultuous world and, therefore all stakeholders must use continuing intensive efforts to globally prevent tragic deaths by suicide.
In Asian context, suicide contributes 60% to the global one million suicides annually, with China, India, and Japan accounting for more than 40% of this projection. Kazakhstan, Sri Lanka and South Korea are reported having high suicide rates. Young population constitutes majority of suicides and the use of pesticides being the most common methods. Concerning suicide, Asian countries showed male to female ratio much narrower and this ratio may be reverse [55]. Furthermore, Khan and Syed reported 10-20 attempts prior to suicide and, consequently, six people are directly affected by a suicide or a serious suicidal attempt. Accordingly, there may be approximately 60 million people in Asia suffering from the adverse consequences of a suicidal act every year. However, postvention remains a neglected area in Asia, in addition to vast knowledge and research gaps and underreported suicide rates. Moreover, 20% of Asian countries tend not to collect national statistics on suicide and do not report to the WHO. Research on suicide needs to be scaled up to inform policy makers to developing culturally relevant suicide prevention strategies in Asia [56]. Overall suicide occurs variably throughout the lifespan (Table 3) and, hence, larger epidemiological samples with various age groups need to be selected to exactly identify suicide patterns across the world.

3.3 Determinants of Suicide at Several Levels

Biopsychosocial model addresses comprehensively predisposing and precipitating factors of suicide and the determinants of SBs with specific remarks are partly described up in the introduction. Biological risk factors focus on the individual genetic susceptibilities and their

<table>
<thead>
<tr>
<th>Condition</th>
<th>Prevalence Rate (PR)</th>
<th>Remarks</th>
</tr>
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<tbody>
<tr>
<td>1. Suicide</td>
<td>11.4/100,000</td>
<td>804,000 deaths worldwide; M to F suicide ratio higher in HIC than LMIC (3·5 vs. 1·6) and Western vs. Asian/Pacific countries (3·6-4·1 vs. 0·9-1·6)</td>
</tr>
<tr>
<td>2. Suicide</td>
<td>Second leading cause of death in individuals 15-29 age band</td>
<td>Higher rate of suicide in elderly with physical disorders, depression, and anxiety and comorbidities.</td>
</tr>
<tr>
<td>3. Non-fatal SDV</td>
<td>Average 12-month PR</td>
<td>In HIC and LMIC, respectively.</td>
</tr>
<tr>
<td>3.1 Suicidal ideation (SI)</td>
<td>2.0% and 2.1%</td>
<td></td>
</tr>
<tr>
<td>3.2 Suicidal attempt (SA)</td>
<td>0.3% and 0.45</td>
<td></td>
</tr>
<tr>
<td>4. SAs</td>
<td>12-Month rate 15.1% and 20.2%</td>
<td>SAs significantly linked with SIs and plans.</td>
</tr>
<tr>
<td>5. SI &amp; SAs</td>
<td>Life-time prevalence is 12.1-33% and 4.1-3.9%</td>
<td>In adolescents and young adults, respectively. SI and SAs relatively more common than suicide among women</td>
</tr>
<tr>
<td>6. SI in adolescents (13-17 years)</td>
<td>12-month prevalence of SI and SI with plan</td>
<td>16.2% among F and 12.2% among M; 8.3% among F and 5.8% among M; common risk factors were bullying, physical violence, loneliness, relative lack of parental support and alcohol and tobacco abuse.</td>
</tr>
<tr>
<td>7. SI and SA in University students (n=8417, 54.4% F)</td>
<td>22% reported SI, 8.6% SA;</td>
<td>Across 12-Muslim countries, SI and SA were variable, more common among females, and one third required medical attention and SDV occurs despite religious prohibition in Muslim nations. Escape mechanism was the main driver of suicidal behaviors.</td>
</tr>
<tr>
<td>8. Suicidal attempts in OCD patients</td>
<td>SA reported to be ~15%</td>
<td>Linked with previous SA, psychiatric and physical comorbidities and history of hospitalization</td>
</tr>
</tbody>
</table>
contribution to the pool of suicide. The clinical risk factors and MH conditions linked with suicide include depression, anxiety disorders, personality disorders, alcohol and other substance abuse, dementia, family history of suicide, repeated suicidal attempts, physical diseases and cancers, chronic pain, low mental health literacy (MHL)rate, sexually active girls, low religiosity, psychiatric and physical comorbidities [55,62,63]. Suicide is rising in the elderly population, and attributed to gender, means of suicide (hanging, fall from height, drowning and use of firearms), depression (women) and chronic pain diseases among men [62]. A systematic review reported suicide by hanging is the most common method; however, methods vary in the Eastern and western world. Suicide is increasing in the United Kingdom and other countries over thirty years, and Gunnell et al. (2004) highlighted multiple potential strategies to reduce suicide [64]. Both individual and social factors are further embedded in education, marriage, residence and geographical location, employment, financial losses, early life trauma (ELT) such as physical or emotional abuse and neglect, breakup with romantic partner, bullying and shooting in schools and conflicts with friends. Persistent misconceptions, stigma, and taboo about the suicide in various cultures and for some repeated SAs means being not in danger for suicide, the latter is a myth needs to be corrected. A prior suicide attempt is the single most important risk factor for suicide in the general population [7,50]. Realizing the tremendous significance of suicide, WHO included suicide in the Mental Health Gap Action Programme (mhGAP) launched in 2008. The mhGAP provides evidence-based technical guidance to scale up service provision and care in countries for MDs. WHO Member States decided to reduce the suicide rate in countries by 10% by 2020. The suicide mortality rate is an indicator of target 3.4 of the Sustainable Development Goals (SDGs): by 2030, to reduce by 33% premature mortality from non-communicable diseases through prevention and treatment, and to promote MH and well-being [65]. Overall, the diverse biological, psychological, social and cultural factors (Fig. 3) determine the rate of suicide, suicidal attempts, suicide ideations/thoughts, suicidal expression, and methods of SDV behaviors and finally guide prevention strategies and policies directed towards combating suicide around the world [62-76].

Fig. 3. Determinants of SDV behaviors at different levels
3.4 Early Warning Signs of Suicide

Early warning signs (EWSs) are important indicators of imminent suicidal behaviors and, therefore, their early recognition has considerable impact on prevention of suicide. The suicidal threatening pathways include expression of wanting to die, strong feelings of hopelessness, worthlessness, and helplessness, living without purpose, trapped in various stressful troubles including financial and legal, acute psychosis and chronic unbearable pain [77,78]. Furthermore, suicides also communicate EWSs in terms of being a constant burden to others, looking means to kill oneself and abuse of alcohol or other drugs. Suicides tend to be anxious, highly agitated and reckless, express chronic sleep difficulties, often show isolated or withdrawal behavior, extreme mood swings and give away belongings or treasured objects [79]. Most of these EWSs including early life traumas (ELTs) are encountered in all age groups of people from teens to elderly [80,81]. In a nutshell, the EWS are mostly rooted in severe psychopathologies primarily depression and psychosis. Suicides tend to communicate EWSs to the nearest family members and consulting MH professionals whose role is to take such patients seriously and intervene appropriately.

3.5 Muslim Culture and Suicide

Although cultural literature concerning suicide abounds worldwide, it is beyond the scope of this review. Islam, the second largest religion, helps to prevent suicide by two ways, directly by prohibiting it as declared in Holy Quran and indirectly, by lowering the causes of suicide such as psychiatric disorders and alcohol and other substance abuse and thus maintaining mental well-being of Muslim world in particular but general population at large [82,83]. In Islam, suicide is strictly prohibited. The Holy Quran mentions “…[do not] kill (or destroy) yourselves, for surely God has been Most Merciful to you” [84]. Prophet Muhammad (PBUH) said “He who commits suicide by throttling shall keep on throttling himself in the Hell Fire (forever) and he who commits suicide by stabbing himself shall keep on stabbing himself in the Hell-Fire.” [85]. Of note, a Muslim must remember Allah (SWT) during times of suffering and pain, and must have faith and hope in Allah’s mercy and compassion to ease the suffering rather than taking one’s life. Despite suicide being prohibited and considered as a great sin by Muslims, it should not be viewed as wrong or right because a person with psychosis who is not fully capable of making correct decision is not held accountable for suicidal behaviors. Most Muslim scholars agree that it is God alone who will judge the actions of each individual. This may help to reduce the guilt feeling that may affect the mentally ill patients after attempting suicide. Although the Prophet Mohammed did not pray at the funeral of a man who killed himself, he did not forbid his companions from praying at the funeral; this indicates a possibility to forgiveness. In a review article, an epidemiologist reported increasing suicide among young females of Middle Eastern region attributed to selected methods, psychiatric disorders, marriage and male dominant role [86]. However, most studies have reported higher male to female ratio concerning suicide. Conversely, suicidal attempts are preferentially reported among females across the world. The caveat of this review is that it did not include males and, therefore, results will apply to female population in Middle East region [86]. In an updated review, Malakouti reviewed 13 articles with a focus on the epidemiology of SB in the general population of the Eastern Mediterranean Region (EMR). The incidence of suicide ranged from 0.55 to 5.4/per 100,000 whereas the lifetime prevalence of attempted suicide, suicidal plan and thought were 0.72-4.2%, 6.2-6.7% and 2.9-14.1%, respectively. The epidemiological trends of suicide and its relevant components in EMR may not reflect true projections attributable to multiple factors including socio-cultural, religious and legal barriers, lack of registries and limitations of public surveys [87]. A retrospective 1-year study involving records of inpatients (n=165) with nearly fatal deliberate self-harm (n=47 fulfilled criteria of DSH), majority of patients used two methods-hanging and jumping-for DSH, and important risk factors were adult males, widowed or divorced and psychotic disorders [13]. In sum, Islam strictly prohibits suicide, promotes mental health and wellbeing of people through advocating diverse therapeutic religious and traditional practices around the world.

3.6 Interventional Strategies and Suicidal Behaviors

3.6.1 Non-pharmacological interventions

There are several psychosociocultural models that help considerably reduce suicide globally. In a comprehensive review on suicide, Larsen & colleagues (2016) identified 123 apps, each one
with an evidence-based strategy or best-practice guidelines. About 40% apps contained one interactive suicide prevention item, which included social and family supports (n = 27), safety planning (n = 14) and the imminent crisis support (n = 13), the latter linked with the strongest evidence. Apps tended to focus on a single suicide prevention strategy (mean = 1.1), although safety plan apps provided several techniques (mean = 3.9). According to this review, access to lethal means and encouraging risky behavior in a crisis were potentially dangerous contents [88]. Social media play an important role in suicide prevention especially by appropriate reporting of suicide, engaging individuals with severe SBs, informing through online various stakeholders to deal with individuals having suicidal ideation and providing an anonymous, accessible and non-judgmental forum for sharing their joint experiences. Robinson et al. (2016) identified a number of challenges such as potential difficulties controlling user behaviour and accurately assessing risk, privacy and confidentiality and the possibility of contagion. Of note, social media has a great potential for suicide prevention, though needs additional research into its safety and efficacy [89].

Psychotherapies have definite role in the prevention of suicidal behaviors. In fact psychotherapeutic interventions explore in depth the SB and emphasize on change-oriented strategies to encourage positive behaviors, cope with suicidal impulses and emotional-cognitive signatures of SBs [90,91]. Dialectic Behaviour Therapy (DBT) has been used in patients with SB and borderline personality disorder (BPD), and found to promote self-efficacy, interpersonal effectiveness, emotional regulation and to reduce the repeated SB compared to treatment as usual (TAU) and expert community care [92]. Cognitive behavior therapy is also effective in the reduction of SB, with larger effects in individual adults provided suicide is an explicit treatment focus [93,94]. The mentalization-based therapy (MBT), based on psychodynamic tenet, teaches the patient with BPD as to how conceptualize thoughts and feelings, was also found to be effective in reducing SBs among patients with BPD. Concerning adolescents, a meta-analysis of studies addressing self-harm found an overall effect of treatment vs. TAU. The most promising interventions were CBT, DBT, MBT and family therapy. The successful interventions linked to a family component offered in multiple sessions [95]. Stigma and taboo against mental disorders and especially suicide posit major challenges that need to be discussed with the patients having suicidal ideations anytime during interview or psychotherapeutic sessions. Furthermore, well-developed social support network, strong reasons for living, responsibility for young children, religiosity in terms of frequent attendance of religious service, detailed discussion of religious views on suicide, social support from the religious community, extraversion and optimism, effective coping and problem solving are some of the effective means for reducing suicide and other suicidal behaviors. Overall, psychotherapeutic interventions along with strong social and family supports are effective in preventing suicidal behaviors linked to various psychiatric disorders and diverse overwhelming social problems.

3.7 Perspectives-Policies and Digitalization

Mental health policies concerning SBs tend to help reduce suicide and SAs rooted in psychiatric disorders. The MH policies must target individual and structural risk factors of suicide; use of alcohol and other drugs, access to healthcare services, access to means of suicide including gun control, pesticide, jumping from heights and hanging, and social media report of suicide. In addition, raising awareness of public about mental health in general (mental health literacy) and suicide in specific terms at community level will further reduce prevalence of SAs, SIs, SCs and suicide [2,19,29,31-33,35,63]. Technological advances have helped globally in developing various health monitoring devices. For example, Smartwatches indicate the bodily changes especially emotional and cognitive prior to stress and suicidal attempts and suicide, which are proactive strategic steps to prevent suicide. Similarly using high tech devices, restricted access to means and encourage help-seeking interventions that increase the likelihood of intervention by health experts are associated with a reduction in yearly suicide rate [15]. High tech equipment also help 24-hrs observation and surveillance of those in- and out-patients at risk of committing suicide and SAs. In addition, intranet links-primary, secondary and tertiary MH care services (multilevel strategies) further help in prevention of suicide [96]. Multilevel healthcare strategies assist in early detection of vulnerable patients, speedy referral to MH hospitals, and voluntary or involuntary hospitalization with 24-hour observation and surveillance. Most importantly, web- and mobile-based suicide
prevention programs are developed globally to help patients at risk of suicide [97]. Other ways of reducing suicide include 24-Hours suicide hotline or a national suicide prevention lifeline and widely established community mental health teams (CMHTs). In this context, WHO has developed a suicide prevention tool that worked effectively at community level [98]. This instrument has the following items; suicide prevention through communities; initial preparation with key elements including defining broad goals; organize first meeting with community stakeholders for mapping exercise; creating a community action plan; mobilization of the media; monitor and evaluate community action plan; and community feedback meeting. Overall, this tool is very comprehensive and if applied in its entirety in community settings around the world will help substantially in reducing suicide rate. Indigenous communities are prone to suicidal behaviors and their participation in specific community programs provide them protection from suicide [99].

3.8 Pharmacological Interventions

Suicidal behaviors are integral components of numerous mental disorders and patients especially with depression mostly communicate suicidal symptoms. A number of meta-analyses of randomized controlled trials concerning depression found that both fluoxetine and venlafaxine decrease SIs in young and older individuals [100]. A couple of studies in adolescents and older with depression reported SSRIs being more effective in reducing SI than either venlafaxine or bupropion [101,102]. Gibbons et al. (2012) reported further that young patients (age 18 to 24) respond to antidepressant treatment but their SI do not always improve [100]. Old literature concerning adolescents (age<25) treated with antidepressants suggested that their suicidal behavior either worsen or new SI/SAs tend to emerge [103]. As a result, the US Food and Drug Administration (FDA) issued a Black Box Warning in 2004 about the possibility of increased suicidal behaviors associated with antidepressants in youth. Consequently, both the diagnosis of depression and antidepressants prescriptions for youth has declined [104]. Conversely, overdoses of psychotropics and suicide among adolescents have increased [105]. Pharmacoepidemiological studies showed that sales and prescriptions of SSRIs are inversely correlated with suicide rates in youth and adult population [106]. The methodological differences regarding pharmacoepidemiological studies and RCTs conducted in youth population might explain the inconsistency between the protective effect of antidepressants and increased incidence of suicidal behaviors in youth. Overall, the use of SSRIs in youth with depression and suicidal behaviors produced consistent results regarding substantial improvement in depression but discrepant findings related to suicide, SAs, SCs and SI.

The pharmacological interventions such as lithium other than antidepressants used in mood disorders have shown reduction in SB [107]. Several studies reported that lithium content in water is inversely correlated with regional suicide rates [108]. Other studies found exposure to lithium is linked with a lower suicide and SA rate compared to antiepileptic agents [109,110]. Notably, meta-analyses of 48 RCTs concerning mood disorders further substantiated the protective role of lithium against suicide compared to placebo and reduction in DSH relative to carbamazepine [111]. Although the exact mechanisms of lithium to decrease SBs are unknown, it possibly acts by multiple ways; reducing episodes of mood disorder, impulsivity and aggression [112]. Another known antisuicidal drug is clozapine, an atypical antipsychotic, has been used effectively in resistant schizophrenia, and found to decrease SAs and emergency referrals for SIs compared to olanzapine in patients with chronic schizophrenia or schizoaffective disorder [113]. Many studies showed that patients with chronic schizophrenia treated with clozapine (and citalopram) have one-third the incidence of suicide and attempted suicide compared to patients treated with other antipsychotics [114,115]. In a systematic review, Zalsman et al. (2016) reported that clozapine and lithium are less specific antisuicidal in patients with schizophrenia and mood disorders, respectively [19]. Overall, lithium and clozapine have some degree of antisuicidal effect when used with or without other psychotropic medications in mood disorders and schizophrenia, respectively.

Ketamine, a glutamatergic, dissociative, anesthetic agent with rapid onset of action (lasts three days), has been used effectively among patients with severe depression and resistant-depression. A systematic review and meta-analysis showed antidepressant rapid response of ketamine in patients with MDD, bipolar disorder and resistant depression [116]. Preliminary studies have shown that single and repeated doses of ketamine (a derivative of
3.9 Local Landscape

Suicide is relatively uncommon in Muslim countries around the world. This is because of Islamic Law (Shariya) and Quranic guidance completely prohibit SDV behavior resulting in injuries or death. Therefore, suicide is rarely seen in Saudi Arabia. Local e-searches of relevant databases found limited studies on SBs in Saudi Arabia. A retrospective autopsy study of 160 suicides from Dammam reported males (81.9%) to females (18.1%) ratio 4.5:1, most of them were adults between the age of 30 to 40 years, Indians (41.3%) followed by Saudis (20.6%) constituted the largest share, hanging (83.1%) and shooting (5%) were the commonest methods used by suicides. Most were unskilled workers with mental illnesses (19%) and family difficulties (10%). Other findings reported were suicide notes in 5% of cases and abuse of alcohol (5.6%), amphetamine (2.5%) and cannabinoids (1.9%) found in blood analysis. Overall suicide was substantially decreased, 2.6% in 2003 to 1.2% in 2007 [128]. Another study conducted in Dammam used similar methods found more or less similar results but the trend of suicide rate was unstable from year 2000 to 2003, in 2000 there were 33 cases, with fewer in 2001, more in 2002, and the fewest in 2003[129]. Another study that explored the records of 133 suicides who used hanging as a method found that the peak of suicide was in the month of June and the trend reflected a decrease in suicide rate over a period of half decade (2003-2007) [130]. A study also from Medico-Legal Center Dammam identified 221 suicides over a decade (1986-1995) reported similar findings as described up with few differences; hanging was followed by jumping from height and then gun shooting and suicide trend increased from first five years to second half of decade, and the yearly average suicide rate was 1.1/100,000[131]. In a two-years retrospective study of 145 suicides (not suicidal attempters) reported that majority were males (122, 84.1%), male to female ratio was 5.3:1 and about 39% of them were in their third decade with non-Saudis (116, 80%) topping the list followed by Saudis (20, 20%) and the most of suicides were Indians (65, 45%) and hanging was the most common method (110, 75.9%) with regional variations of suicides in Dammam [132]. Overall, similar findings have been reported in most of retrospective studies from Dammam.

In a cross-sectional 1-year study, Alhabeel and colleagues estimated the prevalence of suicide with identification of the risk factors for suicidal and non-suicidal self-injurious behaviors among patients with depression. A convenience sample of 557 out- and inpatients diagnosed with mood disorders was selected from 3 treatment settings in Riyadh, Saudi Arabia. Eligible patients completed data on sociodemographic variables and the Columbia suicide severity rating scale risk assessment version. The reported prevalence of SAs in the previous week was 36.8%, interrupted SAs 29.8%, aborted SA 34.8% and SIB without suicide intent 7.7%. Concerning SI, 47.2% reported suicidal thoughts, 36.6% suicidal thoughts with methods but without a specific plan and 35.4% suicidal intent without a specific plan. Male sex, joint family type, literate education, being in employment, smoking and physical co-morbidities were significantly associated with all types of suicide behavior [41]. In Islamic countries, and primarily in KSA and other Gulf countries, Sharia is the definitive
Islamic law or doctrine derived from Islamic religious sources including the Holy Quran, Sunnah of the Prophet Mohammad (PBUH), independent deduction of Islamic laws through religious scholars’ juristic consensus (ijma) and reasoning by analogy (Qiyas) [133]. According to Sharia, suicide is stigmatized and condemned and considered to be a criminal act. Allah says explicitly in the Holy Quran: “And do not kill yourselves. Surely, Allah is Most Merciful to you” [Surah An-Nisa (the women)]. In another verse of the Holy Quran, Allah says: “And do not throw yourselves in destruction” [85,133,134]. In sum, Islamic laws (Sharia) and Hadith of Prophet Mohammed (PBUH) protect the life of a Muslim as suicide is strictly prohibited. Therefore, the incidence and prevalence of suicidal behaviors are relatively lesser in Islamic countries of the world. India.

4. DISCUSSION

This critical review of suicide - a self-directed violent behavior- described its epidemiological trends, biopsychosocial determinants, early warning signs, cultural perspectives, prevention strategies and psychological and pharmacological interventions. The epidemiological trends of SDV behaviors vary considerably across the world attributed mainly to a variety of risk factors and methodological differences [1-18,23]. The rising rate of suicide globally but specifically in the Eastern world affecting youth population is of grave concern and might be due to a variety of collective risk factors including mainly poverty, global economic downturn, and geopolitics, the latter is constantly changing dynamically creating international competitions for land expansion, mini-pocketed wars in some rich resource countries and most importantly climate change [14,135]. Biopsychosocial and cultural risk factors and psychophysical disorders concerning SDV behaviors are critical described throughout this paper; however, their implications are wider globally and most importantly these determinants must be addressed while targeting SDV behaviors [1-18,23,136]. It is no surprise that determinants of suicide crowd in an individual life trajectory and this will definitely require specific multimodal intervention including pharmacological [19,100-123] and psycho-therapies [88,90-95], social media, campaigns, policies and guidelines [2,7,15,19,31-33,35,63,89,96-99,136], medical therapeutic devices [88,125,127], social and family supports [88] and culturally sensitive therapies [82-85,133,134,136]. The recognition of early warning signs of SDV behaviors and preemptive specific interventions tend to decrease robustly SBs among patients with MH problems [77-81].

This critical review has some limitations. Two biases in terms of publication and selection are very obvious, though efforts are made to include most influential and latest articles published in open access journals to present an update on self-directed violent behavior. The strengths of this narrative review are that it is first of its kind in Saudi Arabia and would help MH professionals and physicians globally as how to address patients with suicidal behaviors at all levels of healthcare. This review emphasized on religious interventions directed towards SDV behaviors in Muslim world in specific but generally across the globe. Although this review identified that cultural literature on suicide in religious Holy scriptures and international Islamic scientific journals is abundant, further research is needed in self-directed violent behaviors not only in Saudi Arabia but also other Arabian Gulf countries. Finally, a dozens of local studies reported data about epidemiological trends, risk factors, methods of suicide, suicidal behavioral patterns, and management strategies more or less compatible with international data on SDV behaviors.

5. CONCLUSION

In a nutshell, the term of suicide as a global heterogeneous phenomenon has variable epidemiological trends, a variety of biopsychosocial and cultural risk factors, early warning signs and effectively managed by specific multimodal pharmacological and psychotherapeutic interventions with better outcome. Self-directed violent behaviors need continuing concerted efforts of multidisciplinary healthcare team at all levels of healthcare delivery and multi-sector stakeholders because its determinant risk pathways, early warning signs and protective factors dynamically change overtime across the world.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.
COMPETING INTERESTS

Authors have declared that no competing interests exist.

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