

REVIEW

A systematic review of suicidal behaviour in old age: a gender perspective

Yuen-Ling Fung and Zenobia CY Chan

Aim. This article presents the findings of a systematic review of the literature on suicidal behaviour in old age, specifically examining gender differences.

Background. Numerous studies have reported that older people are at a higher risk for suicide than other age groups in most countries. Rarely do they examine whether there are differences in suicidal behaviour among older males and females.

Design. Systematic review.

Methods. Electronic databases were systematically searched to identify English language reports of research about suicide and suicide attempts in old age. Studies were assessed for inclusion based on inclusion criteria. Key results concerning suicide in old age were extracted and synthesised.

Results. Twenty-two gender-specific studies on suicidal behaviour in old age were identified. All studies were of the quantitative type. Five factors affecting suicide by gender in old age were identified from the selected papers.

Conclusions. Most findings concluded that older males had a higher risk of suicide than older females. Some findings nevertheless revealed that the risk factors for one socio-demographic group may be less relevant to others and that people operate differently in different social contexts. Further in-depth exploration on the gender-specific characteristics in old-age suicide is recommended.

Relevance to clinical practice. Health professionals are encouraged to increase their knowledge of the risk factors leading to suicide in old age in their local contexts and to be able to identify potential victims and render timely and appropriate intervention. They should also be ready to open up their service boundaries and develop collaborative partnerships with local agencies and the general public.

Key words: behaviour, gender perspective, nurses, nursing, older people, review

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Introduction

Suicide is the act of deliberately killing oneself (World Health Organization 2010b); it refers to any death that is a direct or indirect result of a positive or negative act accomplished by the victim which the victim knows or believes will produce such a result (Wu & Chan 2007).

Although suicide appears to be an individual decision to end one's own life, the effects and consequences for family

members are long-lasting. There are at least six bereaved survivors for each suicide (Shneidman 1969); they have higher chances of eliciting complicated responses and usually have a higher suicide rate than their counterparts suffering non-suicide-related bereavement (Jordan 2001).

Old age is the closing period in the lifespan and cannot be defined exactly because it does not have the same meaning in all societies. Older people have limited regenerative abilities

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and are more prone to disease, syndromes and sickness than other adults; in the USA and UK, people become eligible to retire with full social security benefits at age 65 (The Psychology Wiki 2010); however, this age definition does not adapt well to the non-Western situation; the United Nations agreed cut-off is 60+ years to refer to the older population (World Health Organization 2010a). The older population can be further differentiated into the modest old (age 60–79) and the oldest old (80 and over) (United Nations Economic and Social Council 2000). In this review, we will use 60 years of age and older as the general definition of an older person.

Gender refers to the socially constructed roles, behaviours, activities and attributes that a given society considers appropriate for men and women, which may vary greatly between different human societies (World Health Organization 2010c). Life expectancy is different for men and women: global life expectancy at birth is 65.0 years for males and 69.5 years for females for 2005–2010 and 79.4 for males and 85.1 for females in Hong Kong (HK) (United Nations 2007). The figures indicate that females tend to live longer than males, particularly among the oldest old. It might therefore be expected that a greater number of the oldest old suicides would be found among females. However, studies have found that men aged over 75 have the highest suicide rate in almost all developed countries (Szanto *et al.* 2002). Therefore, it is important to have a gender perspective on older suicide to explore further the factors that lead to higher rates of male suicides in old age.

This article presents the findings of a systematic review of the literature of suicide by gender in old age. It is argued that the identified factors would have different impacts on the suicidal behaviour of older males and females. Understanding of the factors related to older suicide is particularly important for the health care professionals and relevant stakeholders who work with older people.

Background

Older people pose a higher risk of suicide than almost all other age groups (Conwell *et al.* 2002). Causes for suicide are multi-factorial, and there are no conclusive findings on the aetiologies of older suicide. There are different findings regarding the suicidal behaviour between male and female elders in different countries.

In Italy, 17% of the 611 people in a sample of the community-dwelling older subjects reported the presence of death wish or suicidal ideation, with females displaying almost twice the percentage of males (Scocco *et al.* 2001).

Barnow *et al.* (2004) examined the relationship between suicidal feeling and mental disorder in 516 older subjects aged from 70–103 in Berlin. They found that the wish to die is strongly associated with the presence of a mental disorder, especially major depressive disorder; while higher age, female gender, subjective assessment of poor physical health and negative living conditions were all only moderately related to death wishes. Parker *et al.* (1997) explored the attitudes of 54 low-income, inner city older people towards suicide in a metropolitan area of the Southern USA. They found no difference in attitudes towards suicide among either race or gender and suggested that attitudes towards suicide may be affected more by socio-economic status than by race or gender. In HK, suicide risk increases with age, to around 30 per 100,000 for those aged over 65 and 50 per 100,000 for those aged over 75 (Chiu *et al.* 2003). The ratio of the male to female suicide rate in older people is 1.3:1 (Yip *et al.* 1998). Good social support from family and friends is a protective factor against suicide in the Chinese family (Yip *et al.* 2003); however, in HK, older married Chinese women have a higher risk of suicide than women who are widowed, single, or divorced (Yip *et al.* 1998). The contradictory findings in HK imply that whether marriage itself is a protective factor might be dependent on the couple's relationship and the role of the husband, rather than the support from family members.

The differing sex-specific findings in suicide suggested that the risk and protective factors for one socio-demographic group may be less relevant for others and that they operate differently. To succeed in preventing older suicide, early detection is essential. Health care professionals should be able to assess and identify older patients who are suicidal with reference to the risk factors and support them with appropriate interventions.

This article presents the findings of a systematic review of the literature on suicidal behaviour in old age from a gender perspective. In this article, the factors affecting suicide according to gender in old age will be identified, followed by discussion on the implications for older suicide prevention, health service providers and research methods and gender sensitivity in health care services.

Aims and methods

Aim

The aims of the systematic review were to examine and describe suicidal behaviour in old age from a gender perspective and to explore its determining factors.

Summary of the research

Systematic reviews aim to collect, critically appraise and synthesise primary studies in a transparent way. In this article, we used systematic review methods to identify relevant research about the factors affecting suicidal behaviour in old age from a gender perspective.

Search methods

A computer-assisted literature search was conducted using the databases and keywords shown in Table 1. In February 2010, a computer-assisted literature search of five electronic databases, MEDLINE, CINAHL, PSYCINFO, EMBASE and COCHRANE (Ovid), was conducted. Searches included the following keywords – old age or elder* and suicide or suicide* attempt or attempt* suicide and gender or sex* difference – to locate studies that had examined the factors affecting old-age suicide from a gender perspective. No limitation on publication date was used. Citations from the reference lists of previously gathered articles were also searched to ensure that significant work would not be missed. It included research that was published in English. Studies were assessed for inclusion based on the inclusion criteria.

Inclusion criteria

Titles, abstracts and manuscripts were included if they met all the inclusion criteria: (1) studies that reported findings on suicide or suicide attempts; (2) studies that contained subjects aged ≥ 60 ; (3) studies that included female and male subjects; (4) studies published in English.

Screening

After completing an initial scoping review of the literature, we found that a large group of studies dealt with mixed age

Table 1 Computer databases and key words used for literature search

Databases
MEDLINE (1950–2010 January)
CINAHL (1993–2010 January)
PsycINFO (1806–2010)
EMBASE (1980–2010 January)
Cochrane (Ovid) (4th Quarter, 2009)
Keywords used
1. Old age or elder*
2. Suicide or suicide* attempt* or attempt* suicide
3. Gender or sex* difference
4. 1 AND 2 AND 3

groups. All studies meeting the inclusion criteria underwent quality assessment. From that scoping review, two research questions guided the full systematic literature review and analysis: (1) Do the target groups contain subjects aged ≥ 60 ? (2) If so, do the research results include female and male analysis? The quality assessment was performed using criteria based on the 10 questions to appraise qualitative research on the critical appraisal skills programme (Public Health Resource Unit, England 2006). Two reviewers independently assessed and extracted studies to be included.

Data extraction and analysis

The initial search identified 2629 articles. After screening titles and abstracts, there remained 32 articles that were retrieved in full text. The full texts of all identified studies were reviewed to determine whether the inclusion criteria had been met. After critical appraisal, 11 of these papers did not adopt a gender-specific analysis of suicide. The remaining 21 articles were selected. Following the same procedure, citations from the reference lists of previously gathered articles were also searched to ensure that significant work would not be missed. One additional article met the inclusion criteria and this article was included in the synthesis (Fig. 1). Twenty-two papers were finally retrieved. Statistically significant results showed differences between males and females in old-age groups at $p < 0.05$, with or without statistical adjustment or adjusted means; if gender-specific analysis of old-age suicide was not reported or if reporting was unclear, they were also recorded in the table containing basic methodological details of the included studies. In this review, we employed a narrative synthesis as there were limited data that could be pooled because of heterogeneity in designs and outcome measures. Data were extracted from studies using the basic data-extracting form, including study design, factors identified/analysed, sample recruitment, differences in

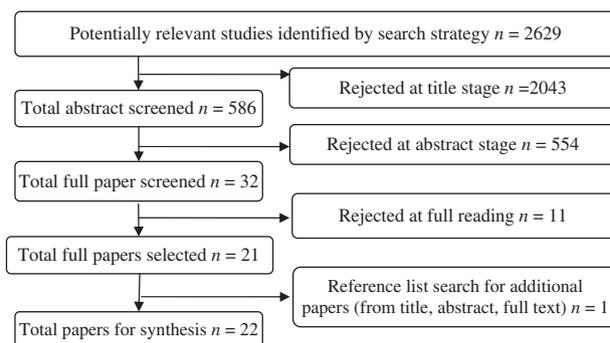


Figure 1 Flow diagram showing systematic review protocol.

suicidal behaviour between male and female older subjects and conclusive findings concerning older subjects.

Results

A total of 22 studies were found to meet the inclusion criteria (Table 2), all of which involved quantitative research. The studies were conducted in the USA ($n = 5$), Italy ($n = 3$), Sweden ($n = 3$), Germany and Denmark ($n = 2$), Japan ($n = 2$), Australia ($n = 1$), Austria ($n = 1$), Brazil ($n = 1$), Hong Kong and Australia ($n = 1$), Hong Kong and China ($n = 1$), Ireland ($n = 1$) and the UK ($n = 1$).

Aims of the selected studies

The selected articles examined different aspects and factors concerning the issue of suicide, including suicide trends in the local context, marital status, psychopathology, religiosity, lethality of suicide, use of anti-depressants and alcohol, rural–urban location, seasonal influence, behaviour before suicide and physical illness.

Sample

The articles included a broad range of samples. The smallest was of 85 suicidal subjects matched with 153 selected randomly from the population (Waern 2003); the largest was 157,827 subjects in a cohort study (Iribarren *et al.* 2000), as well as the data from 25 countries (Pritchard 1996). Five studies did not mention the sample size (Masocco *et al.* 2008, Mello-Santos *et al.* 2005, Pritchard 1996, Yip *et al.* 2000, 2005). The samples were divided into age groups in most of the studies, with age groups ranging from 0–14 to ≥ 85 . Three studies contained only the older age group (Li 1995, Waern *et al.* 2002, Waern 2003).

Methodologies employed

The majority of methodologies employed were autopsy studies ($n = 10$), followed by case–control studies ($n = 4$). Other methodologies included cohort studies ($n = 2$), surveys ($n = 2$), cross-sectional studies ($n = 2$), a descriptive analysis ($n = 1$) and a population-based register study ($n = 1$). The majority of the information was collected from death records and interviews with suicide attempters or people who could provide information on suicide victims.

From these studies, the factors used as a framework for the following discussion are based on the results that have reported different suicidal behaviour between male and female elders. Based on the nature of the risk factors in the

22 included studies, they were categorised into five themes: (1) method and lethality of suicide; (2) behaviour and physical condition before suicide, including history of suicide attempts, use of alcohol and contact behaviour with medical professionals; (3) marital status; (4) socio-demographic factors, including rural–urban area and its relationship with religious and seasonal factors; and (5) depression.

Method and lethality of suicide

Four studies showed that the older males use more lethal means of suicide. Among them, two studies found that hanging was the most frequent method in older male age groups; firearm use was also high in another study. The older age groups and men in particular, accounted for a higher proportion of completed suicides than self-poisoning attempters; this was because of the use of more lethal means, primarily guns, carbon monoxide and hanging (Buckley *et al.* 1996). The oldest old tend to use more determined suicide methods; for men, the most frequent suicide method was hanging (Erlangsen *et al.* 2003) and firearm suicide was more likely to occur in the highest age groups. Victims ≥ 65 were three times more likely to complete firearm suicide than those in the reference group, but women were less likely to use a firearm than men (Kposowa & McElvain 2006).

Another study found that older men acted more decisively on their suicidal intent than older women and this difference was more pronounced with increasing age: suicidal intent and attempt lethality was the strongest in older men compared with the other groups, reflected in the significant sex differences by age group (50–69 vs. ≥ 70) and by suicidal intent (Dombrowski *et al.* 2008).

Behaviours and physical condition before suicide

Several studies showed that there were observable behaviours that could have been identified before the elders completed suicide and that the behaviours were different between males and females. Three studies found that there were differences regarding history and severity of suicidal act between older males and females: in older age groups, repeated attempts appeared to be predictive for suicide in women and severe attempts predictive in men (Bradvik & Berglund 2009); with older male subjects tend to have a higher likelihood of completing suicide than older females (Iribarren *et al.* 2000, Fushimi *et al.* 2006).

One study found that changing behaviour with regard to doctor visits was significantly more prevalent in the suicidal quarter than in other quarters in older people in both sexes: females showed higher contact rates than men in all physician

Table 2 Methodological details of the included studies of older suicide

Author, country and study design	Factors identified/analysed	Sample recruitment	Differences in suicidal behaviour between male and female older subjects	Conclusive finding concerning older subjects
Bradvik and Berglund (2009) Sweden Case-control study	The occurrence of suicide attempts (first, repeated, or severe, by age group)	Records of 100 suicide victims Control: matched subjects with severe depression. Subjects were divided into 10 age groups: 15–24, 25–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, 60–64, 65–69.	Reduced risk for an initial suicide attempt by older age in female suicide victims (Poisson regression, $p < 0.041$) and controls (Poisson regression, $p < 0.020$) and male controls (but not suicide victims). The reduced rate of repeated suicide attempt by age was not found in the male group. In the female suicide group, the rate of severe suicide attempts was reduced in older age (Poisson regression, $p < 0.007$); in the male control group, there was a reduced incidence of severe suicide attempts in old age (Poisson regression, $p < 0.001$).	Repeated attempts appeared to be predictive for suicide in women and severe attempts predictive in men.
Buckley <i>et al.</i> (1996) Australia Case-control study	Prescription of psychotropic drugs by GP	495 randomly selected patients of GPs recorded details regarding doctor/patient encounters. These were compared with patients treated in hospital for self-poisoning with psychotic drugs or died from psychotropic drug overdose. The subjects were divided into five age groups: 15–24, 25–44, 45–64, 65–74 and ≥ 75 .	Male older age groups (female older age group not mentioned) accounted for a higher proportion of successful suicides than self-poisoning attempts. This was because of the use of more lethal means, primarily guns, carbon monoxide and hanging.	The odds ratios for self-poisoning and suicide with psychotropic drugs for those aged ≥ 75 were 0.03 and 0. The risk of self-poisoning among the older may have been overstated, so that some patients may have denied the benefit of adequate treatment.
Clarke <i>et al.</i> (2003) Ireland Survey	Religious Urban-rural location	1395 people of age ≥ 15 were interviewed at 60 stations throughout the Republic of Ireland. The subjects were divided into five age groups: 15–24, 25–34, 35–54, 55–64 and ≥ 65 (highest age group).	In all age groups, females were more religious than males and religiosity was higher among females in rural areas. Suicide rates were higher for males than for females, and for younger than for older age groups.	Distribution of suicide between rural and urban areas was evident in the highest group ($p = 0.0005$), with greater frequency in rural areas. Suicide rates are lower among the older, in whom religiosity is highest. There is an inverse relationship between religiosity and suicide when age and gender are considered, but not according to location.

Table 2 (Continued)

Author, country and study design	Factors identified/analysed	Sample recruitment	Differences in suicidal behaviour between male and female older subjects	Conclusive finding concerning older subjects
Conwell <i>et al.</i> (1996) USA Psychological autopsy study	Age Axis I diagnosis	141 persons committed suicide with DSM-III-R axis I diagnoses The subjects were divided into four age groups: 21–34 (young), 35–54 (middle), 55–74 (young-old) and 75–92 (old-old).	Age-by-gender interaction was a significant predictor of major depression ($\chi^2 = 6.67$, $df = 1$, $p = 0.01$) and more specifically of a single episode of major depression ($\chi^2 = 6.73$, $df = 1$, $p = 0.01$). The frequency of these diagnoses rose with age at death in men, but remained unchanged in women. The prevalence of death and unipolar major depression rose with age at death in women but remained unchanged in the male victims.	Older age predicted that at death, the victim was significantly more likely to have been suffering from any mood disorder.
Deisenhammer <i>et al.</i> (2007) Austria Autopsy study	Course of contact rates with physicians	317 subjects who had committed suicide between 1998–2002. Quarterly contact rates with physicians during the respective last year of life were compared Subjects were divided into three age groups: ≤ 40 , 41–60 and ≥ 61 (higher age group).	In all age groups, females showed a significant increase in contact frequencies with psychiatrists and neurologists up to the quarter immediately preceding the suicide quarter, followed by a sharp and significant decline in the last three months before suicide; males remained more or less unchanged over the year. In all physician groups, women had higher contact rates than men. Contact rates increased with higher age ($p < 0.001$).	Changing doctors was significantly more prevalent in the suicidal quarter than in other quarters ($p \leq 0.05$, $p \leq 0.01$ & $p \leq 0.001$ vs. suicide quarter), predominantly among suicide victims ≥ 61 .
Dombrowski <i>et al.</i> (2008) USA Cross-sectional study	Suicidal intent and attempt lethality between older males and females	125 adults with major depression and a suicide attempt. The subjects were divided into two age groups: 50–69 (younger age) & ≥ 70 (older age).	Suicidal intent and attempt lethality was the strongest in older men compared with the other groups, reflected in the significant sex by age group (50–69 vs. ≥ 70) by suicidal intent interaction ($F_{1,101} = 6.64$, $p = 0.002$). Attempt lethality was lower in older (≥ 70) than in younger (50–69) women. Older men act more decisively on their suicidal intent than older women, and this difference is more pronounced with increasing age.	The impact of the burden of physical illness, living alone, lifetime substance disorders or Mini-Mental State Examination score did not differ according to sex.

Table 2 (Continued)

Author, country and study design	Factors identified/analysed	Sample recruitment	Differences in suicidal behaviour between male and female older subjects	Conclusive finding concerning older subjects
Erlangsen <i>et al.</i> (2003) Germany & Denmark Autopsy study	Suicide trends among the old and the oldest old	17,729 persons aged ≥ 50 who committed suicide in Denmark from 1972–1998. The subjects were divided into three age groups: 50–64 (middle-aged), 65–79 (old), ≥ 80 (oldest old).	Highest suicide rate was found in the oldest old men. Never-married, divorced, and widowed men and women had higher suicide rates. However, there was an increased suicide rate for oldest old persons who are married, for both sexes. For men, the most frequent suicide method was hanging; for women it was self-poisoning.	Suicide trend among middle-aged and older adults decreased and was stable among the oldest old. The oldest old tend to use more determined suicide methods, with 42% in the 65–79 years age group and 52% in the ≥ 80 age group using hanging. The preventive effect of marriage seems to be ceasing with increasing age.
Erlangsen <i>et al.</i> (2004) Germany & Denmark Population-based register study	Loss of a partner	1,987,527 persons aged ≥ 50 living in Denmark during 1994–1998. The subjects were divided into three age groups: 50–64 (middle-aged), 65–79 (old–old), ≥ 80 (oldest old).	The oldest old men experience the highest increase in suicide risk immediately after the loss (1.5-fold; 95% CI 1.0–2.23–6) compared to middle-aged men who are still married. During the first year after the death of a partner, the suicidal risk of oldest old men increases from 1.8 (95% CI 1.4–2.2) to 10.0 (95% CI 6.6–15.3); the increase is from 0.7 (95% CI 0.4–1.1) to 2.1 (95% CI 0.9–4.6) for oldest old women. Oldest old men seem to suffer more from the loss and need longer time to recover than women.	The majority of older persons who commit suicide are widowed. Only a small proportion of the oldest old who commit suicide have experienced a recent loss of partner.
Fushimi <i>et al.</i> (2006) Japan Survey	Factors underlying suicide in Akita, Japan	138 actual suicides compared with 105 suicide attempters who were members of the Akita Prefectural Medical Association during 1 July 2001 to 30 June 2002. The subjects were divided into eight age groups: <19, 20–29, 30–39, 40–49, 50–59, 60–69, 70–79, ≥ 80 .	In the actual suicide group, a significant difference was identified in terms of gender: 73.9% males and 26.1% females ($\chi^2 = 26.9$, $df = 1$, $p < 0.001$). In the attempted suicide group, 41% males and 59.1% female. The number of male subjects exceeded the number of female subjects in the completed suicide group, and most of the suicide completers were middle-aged or older.	Male older subjects tend to have a higher likelihood of completing suicide.

Table 2 (Continued)

Author, country and study design	Factors identified/analysed	Sample recruitment	Differences in suicidal behaviour between male and female older subjects	Conclusive finding concerning older subjects
Ichimura <i>et al.</i> (2005) Japan Cross-sectional study	Depression and other mental disorders	235 consecutive suicide attempters admitted to the Tokai University Hospital Emergency Medical Center from January–December 2000. Subjects were divided into two groups: depression and other disorders. The subjects were divided into three age groups: 18–44, 45–64, ≥65.	By comparing the two groups, the percentage of aged patients ($p < 0.001$), males ($\chi^2 = 11.0$, $df = 1$, $p = 0.001$) and married patients ($\chi^2 = 26.0$, $df = 3$, $p < 0.001$), the frequency of 'methods other than poisons' ($\chi^2 = 12.4$, $df = 1$, $p = 0.001$), and 'serious condition' ($\chi^2 = 12.2$, $df = 1$, $p = 0.001$), were significantly higher in the depression group.	There was a higher mean age in the depression group than in the other group of suicide attempters. Intensive psychiatric treatment may lead to the prevention of committed suicide in older male patients with depression who have attempted suicide.
Iribarren <i>et al.</i> (2000) USA Cohort study	Socio-demographic, medical predictors of attempted suicide and of completed suicide	87,257 women and 70,570 men from a health maintenance organisation in northern California, USA and aged 15–89 years old at baseline in 1977–1985 with follow-up for hospitalisations and mortality through the end of 1993. The subjects were divided into four age groups: 15–24, 25–44, 45–64, 65–89.	Incidence rates of hospitalisation for suicide attempts were higher for women than men (men to female ratio = 0.65), and highest in the youngest group among women and in the older age group among men.	There was a greater incidence of hospitalisation for suicide attempts in women than in men, and a greater incidence of completed suicide in men than in women.
Kposowa and McElvain (2006) USA Autopsy study	Method and place of suicide	643 suicide victims. Reference category: Individuals aged 13–29. The subjects were divided into four age groups: 30–44, 45–55, 55–64, ≥65.	There were no remarkable differences between the sexes in terms of place of death. Firearm suicide was more likely to occur in the highest age groups. Victims ≥65 were three times more likely to commit firearm suicide than those in the reference group; women were 75% less likely to use firearm suicide than men and firearm was the second mode of suicide among women. There were no gender differences for suicide by hanging, and suicides in the oldest age groups were less likely to employ hanging as a mode of death than the reference group.	Firearm and drug suicides were concentrated at later ages; hanging was less associated with advanced age.

Table 2 (Continued)

Author, country and study design	Factors identified/analysed	Sample recruitment	Differences in suicidal behaviour between male and female older subjects	Conclusive finding concerning older subjects
Li (1995) USA Cohort study	Widowhood	6266 white married and 3486 white widowed persons aged 60 years in 1963 were evaluated based on a 12-year follow-up survey in Washington County. The subjects' age: ≥ 60 .	Death rate for suicide: the widowed men were more than three times more likely to commit suicide than married men (109.2 vs. 33.4/100,000 person-years, $p < 0.01$); the difference between widowed women and married women was small (21.5 vs. 22.5/100,000 person-years, $p > 0.09$). Never-married (43.6 per 100,000) and widowed (43.96 per 100,000) older men had higher standardised mortality rates than those who were married (17.7 per 100,000) or divorced/separated (23.84 per 100,000). Divorced/separated older women had the highest rate of suicide at 10.7/100,000; the rate was lowest for those who were married (5.02 per 100,000).	Widowed men should be one of the prior targets of a suicide prevention and intervention programme for the older.
Masocco <i>et al.</i> (2008) Italy Autopsy study	Marital status	Italian Data Base on mortality (ICD-9 revision): E950-959, collected by the Italian Census Bureau from 2000-2002. Compared with: death from natural causes (ICD-9 revision: 0-280; 320-799). The subjects are divided into three age groups: 25-44, 45-64, ≥ 65 .	Among males, rates in the 65-74 age range and the ≥ 75 range increased by 23.4 and 14%, respectively, whereas rates among females in the same age ranges decreased by 20 and 30%. The highest rates are still seen among the older, with males aged ≥ 75 having the highest rate.	Being married appears to be a protective factor for suicide, but the impact of being never-married, divorced/separated or widowed varies with age and gender. The differences between married and non-married women were less consistent than in men, especially for older women.
Mello-Santos <i>et al.</i> (2005) Brazil Descriptive analyses	Suicide rate in Brazil	Brazilian suicide data relating to 1980-2000. The subjects were divided into eight age groups: 5-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, ≥ 75 .	In age-standardised suicide rates, males had higher suicide rates, ranging from 5.4/100,000 in 1999 to 7.7 in 1998 and 1.4/10,000 in 2001 to 2.4 in 1998 in females. The highest rate of suicide was for those aged 75-84, although there was a pronounced decrease from 47.3 in 1998 to 12.52 in 2002 in males and from 7.22 in 1998 to 1.65 in 2002 in females.	Individuals aged ≥ 65 represent the stratum with the highest suicide rate over the 20 years.
Pavia <i>et al.</i> (2005) Italy Autopsy study	Suicide in Southern Italy	367 suicides occurred in the region of Calabria (Italy) from 1998-2002. The subjects were divided into seven age groups: 0-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84, ≥ 85 .	Older males aged 75-84 had the highest suicide rate.	

Table 2 (Continued)

Author, country and study design	Factors identified/analysed	Sample recruitment	Differences in suicidal behaviour between male and female older subjects	Conclusive finding concerning older subjects
Preti and Miotto (1998) Italy Autopsy study	Seasonal influence	31,771 males and 11,984 female suicide subjects registered in Italy from 1984–1995. The subjects were divided into three age groups: 14–24, 25–64, ≥ 65 .	More men committed suicide than women in all age groups. Only among those aged ≥ 65 can a clear seasonal asymmetry be observed in both sexes, with a higher number of deaths in spring than in any other season, and in summer than in winter or autumn. Among males, suicides by violent methods show a significantly positive relationship with indicators of temperature and exposure to the sun, and a significant negative relationship with indicators of humidity and rainfall. Female suicides by violent methods show the same trends as male suicides, whereas non-violent suicides show no relationship with climate variables.	For both genders, a clear seasonality in the distribution of suicides, with a unimodal distribution and a peak in summer, can be found only in the older age group. Violent suicides in both genders show evidence of a seasonal trend, with a clear recurrent circannual rhythm.
Pritchard (1996) UK Autopsy study	Suicide in China and in developed countries	Standardised data in 25 countries extrapolated from the World Health Organization's mortality statistics mainly in 1992, with special attention to the neighbouring states of China for which data is available, i.e. Hong Kong, Singapore, the Republic of Korea (South) and Sri Lanka. The subjects were divided into seven age groups: 15–24, 25–34, 35–44, 45–54, 55–64, 65–74, ≥ 75 .	Chinese women killed themselves far more frequently than men, with a male:female ratio of 0.77; from the age of ≥ 55 onwards, however, the male suicide rate was higher. The female suicide rate for all of China was the second highest in the world with a rate of 198 suicides/1,000,000 women. Rural female subjects had the highest recorded female suicide rate in the world.	The rural/urban divide has an even stronger cultural influence upon suicide rates than gender.
Waern (2003) Sweden Retrospective case-control study	Alcohol use	85 suicidal subjects Control: 153 randomly selected members of the population. Subjects' age group: ≥ 65 .	Suicide occurred far more often in rural than in urban China for both sexes. A lifetime history of alcohol use disorder in 35% of male suicide cases and 2% in the control group; such history was present in 18% of female suicide cases, and 1/69 of women in the control group. The estimated risk of suicide in women with alcohol use disorder was only half that observed in men (OR = 9.5, 95% CI 1.1–84.2)	Alcohol use disorder is a strong predictor of suicide risk in older men and women.

Table 2 (Continued)

Author, country and study design	Factors identified/analysed	Sample recruitment	Differences in suicidal behaviour between male and female older subjects	Conclusive finding concerning older subjects
Waern <i>et al.</i> (2002) Sweden Case-control study	Physical illness	Consecutive records of people (46 men and 39 women) who committed suicide in Scandinavia aged ≥ 65 Control: living participants from the tax register (84 men and 69 women). Subject's age group: ≥ 65 .	In the suicide group, serious illness or disability was more common in men than in women (65 vs. 44%, $p = 0.05$), and men had a higher overall burden of physical illness than women (mean score 9.0 vs. 8, 95% CI, 0.2–4.1); such associations were not seen in women.	Visual impairment (OR 7.0, 95% CI 2.3–21.4), neurological disorder (OR 3.8, 95% CI 1.5–9.4), and malignant disease (OR 3.4, 95% CI 1.2–9.8) were associated with increased risk for suicide. Physical illness is associated with suicide in older people.
Yip <i>et al.</i> (2000) Hong Kong & Australia Autopsy study	Rural and urban areas	Suicide deaths coded in range E950–E959 of ICD-9 for the period of 1991–1996 in Australia and in Beijing. The subjects were divided into seven age groups: 15–24, 25–34, 35–44, 45–54, 55–64, 65–74, ≥ 75	Rural male suicide rates were higher than those of their urban counterparts across all age groups. In Australia and Beijing, males aged ≥ 75 had the highest suicide rate among all the groups with rates of 32/100,000 & 58.8/100,000, respectively. Older and rural teenage males had the highest suicide rates in Australia, and for females, suicide rates in urban areas were significantly higher than in rural areas, with rates of 6.7 and 5.4, respectively ($p < 0.05$).	The rural suicide rate in Beijing for both genders was higher than for their urban counterparts. The older had the highest suicide rate.
Yip <i>et al.</i> (2005) Hong Kong & China Autopsy study	Trends of age, gender and region (urban/rural) in suicide in China	Mortality statistics provided by China's Ministry of Health for the period of 1991–2000. The subjects were divided into seven age groups: 10–19, 20–29, 30–39, 40–49, 50–59, 60–69, ≥ 70 .	The average suicide rates for men and women in rural and urban areas all showed decreasing trends, the age-specific rates among the two regions and genders revealing that there were discrepancies in the patterns of changes. In rural areas, the suicide rate of the older age groups fluctuated, especially for older males, remained at high levels for the period from 1991–2000.	In urban areas, the two older age groups (60–69 and ≥ 70) showed the largest significant decrease in suicide rates.

groups and a significant increase in contact frequencies with psychiatrists and neurologists up to the quarter immediately preceding the suicide quarter, followed by a sharp and significant decline in the last three months before suicide; while males showed a pattern of contacting more than one general practitioner per quarter significantly more often in the suicide quarter than during the preceding year, more frequently contacted 'any physician' and generally increased contact with general practitioners over the year before completing suicide. Such 'doctor shopping' behaviour may reflect an intensified patient search for adequate help (Deisenhammer *et al.* 2007).

Two studies found that alcohol use and the presence of serious illness were strong predictors of suicide risk in older people, with significant difference found between males and females: a history of alcohol dependence or misuse was observed in 35% of the older men who died by suicide and in 18% of the women (Waern 2003); the presence of serious physical illness was associated with suicide with male suicide being more likely in those with serious illness or disability and higher scores for burden of physical illness (Waern *et al.* 2002).

Socio-demographic

There were different findings on the suicide risk between males and females in different contexts. Three studies found that older males aged ≥ 75 had the highest rate in the local context (Yip *et al.* 2000, Mello-Santos *et al.* 2005, Pavia *et al.* 2005). Three studies further compared suicides in rural and urban areas in local contexts. Among them, two studies examined the differences in rural areas in China, and the findings were different between males and females in these two studies: the older females had a higher suicide risk (Pritchard 1996); but the suicide rate of the older male age groups fluctuated and remained at a high level for the period of 1991–2000 (Yip *et al.* 2005). Another study compared the differences between rural and urban areas in Beijing and Australia: the rural males aged ≥ 75 had the highest suicide rate in Beijing and Australia; for females, suicide rates for urban areas were significantly higher than those in rural areas in Australia (Yip *et al.* 2000).

One study compared the suicide rate in terms of religiosity and rural–urban location, concluding that there was an inverse relationship between religiosity and suicide when age and gender were considered, but not according to location: suicide rates were lower among older people, in whom religiosity is highest and more frequent in rural areas, which also had greater religiosity among females (Clarke *et al.* 2003).

One article studied the seasonal factors affecting suicide in the local context, with male violent suicides showing a significantly positive relationship with indicators of temperature and exposure to sun: for both genders in the old-age group, a clear seasonality in the distribution of suicides was observed, with a unimodal distribution and a peak in summer; violent suicide in males and females was shown to have a positive relationship with climate variables, while non-violent suicide in females showed no relationship with climate variables (Preti & Miotto 1998).

Marital status

Studies found that marital status could dramatically influence the risk of suicide, with the highest risk in widowed men. Four studies found that marriage was a protective factor in older men, but its preventive effect seems to cease with increasing age: the suicide risk for widowed men was 3.3 times as high as for married men (Li 1995); never-married and widowed older men had higher suicide rates than those who were married and divorced/separated (Masocco *et al.* 2008); never-married, divorced and widowed men and women had higher suicide rates, but there was an increased suicide rate for married oldest older persons for both sexes (Erlangsen *et al.* 2003); the majority of older persons who complete suicide are widowed, although only a relatively small proportion of the oldest old who complete suicide have experienced a recent loss of partner and in absolute terms, the oldest old men experience the highest increase in suicide risk immediately after the loss compared with middle-aged men who are still married (Erlangsen *et al.* 2004). Two studies reported different findings on the influence of women's marital status: the risk of suicide for widowed women did not increase compared with that for married women (Li 1995); divorced/separated older women had the highest rate of suicide, the lowest being for those who were married (Masocco *et al.* 2008).

Depression

Two studies found that suicide and attempted suicide were most closely related to depression, especially in males: one study compared suicidal attempters in terms of depression and other mental disorders and found that a higher percentage of males in the depression group of suicide attempters than in groups with other mental disorders (Ichimura *et al.* 2005); another study found a relationship between ageing, major depressive illness and suicide, one where the risk for suicide apparently rose with age among individuals with the disorder and older men were especially vulnerable (Conwell *et al.* 1996).

Discussion

This study attempted to present the findings of suicidal behaviour with gender difference in old age from the selected papers. Previous studies targeted specific risk factors in studying suicide in old age, while our review added additional information on factors affecting suicide according to gender in old age. The findings of the systematic review support the claims of variations in the rates and types of suicidal behaviour between males and females in old age. The results indicate that social and cultural factors influence the pathway to suicide. The implications for older suicide prevention, health care service providers, research methods and gender sensitivity in health care services were also discussed.

Limitations of the review

In this systematic review, only the results of previously published articles in English were used. This study's limitations also result from being an interpretation of other researchers' interpretations. The selected studies came up with different research designs and outcome measures, and the majority of the samples included other age groups and the definition of old-age groups was not consistent or even missing in some studies. In some studies, there was incomplete age-gender analysis in risk factors in the old-age groups and some conjecture findings might have been reported on the old-age groups. These may impact on the conclusions drawn from their findings. Finally, no qualitative study was identified in this systematic review, which may have reduced the comprehensiveness of the results.

Implications for older suicide prevention

Older suicide is a complex issue. The identified factors affecting older suicide indicate that it is not solely a medical or social problem. The combined efforts of various stakeholders are required to tackle this issue effectively; 50.2% of suicide victims had no contact with a doctor during the quarter before death (Deisenhammer *et al.* 2007). It implies that reliance on medical professionals alone is inadequate in managing older suicide. Co-operation among local general practitioner, nurses, mental health professionals, the public and administrators in implementing suicide prevention programs in older people in Matsunoyama demonstrated success in reducing the suicide rate in older people (Chiu *et al.* 2003). However, the risk factors for one socio-demographic group may operate differently in different contexts. The stakeholders should be familiar with the features of indigenous elders

and tailor-make older suicide strategies in their local contexts accordingly.

Prevention is better than cure. It is believed that older suicide is preventable if the triggers of the individual problems can be identified and supported with appropriate interventions. To combat suicide successfully in older people, a public health approach to prevention and management is needed. This implies that the stakeholders need to open up their service boundaries by developing collaborative partnerships with the public and local agencies. This could ensure early detection of at-risk elders by the public or front-line workers, followed by timely intervention by the relevant service providers.

Implications for health service providers

The findings can be used by health service providers as a framework basis of suicide prevention and management in old age. Most suicide victims had made contact or were known to a health care professional before their death because of a physical illness (Deisenhammer *et al.* 2007), previous suicide attempts (Fushimi *et al.* 2006, Bradvik & Berglund 2009), or hospitalisation (Iribarren *et al.* 2000). Contacts of the potentially suicidal with health care professionals are opportunities for intervention. Health service providers are encouraged to improve their knowledge and to better understand the risk factors of suicide among older patients. Such risk factors could be detected via active interaction with older people. It is recommended that the background information of older people, including residential address, marital status, medical history, history of mental illness or suicide attempts, use of alcohol and their social support system could be collected during their first contact with the health service providers. Such information would help to identify potential victims and may have implications for the need to refer to secondary health care management. With increased alertness to older suicide, risky elders can be identified and detected early. Timely intervention can be rendered to the needy.

Implications for research methods

The quantitative research in the 22 studies provided useful information and findings on suicide according to their aims or hypothesis. However, such monographic understanding of this complex issue is inadequate and cannot be fully applied to different contexts. The aetiologies of older suicide are multi-factorial and cannot be neatly fitted into either one of the causes. The qualitative approach seeks to contribute a better understanding of people's lived experience and pursue

subjective meaning for the people concerned (Flick *et al.* 2004). As it is impossible to ask suicide subjects to reveal what triggers their acts, follow-up work on studying elders who have attempted suicide could give us some hints. To understand this issue more thoroughly, qualitative research would be a viable and practical method allowing an in-depth exploration of suicide attempters and their motivations.

Implications for gender sensitivity in health care services

The studies revealed differences between females and males in suicide rates and lethality. Older males aged ≥ 75 had the highest rate in the local context (Mello-Santos *et al.* 2005, Pavia *et al.* 2005, Yip *et al.* 2000) and acted more decisively, using more lethal means of suicide (Buckley *et al.* 1996, Dombrowski *et al.* 2008, Erlangsen *et al.* 2003, Kposowa & McElvain 2006). Repeated attempts appeared to be predictive for suicide in women and severe attempts predictive in men (Bradvik & Berglund 2009, Fushimi *et al.* 2006). Because of longer life expectancy in females than in males, health care service providers would be expected to encounter more female suicide attempters than males, because the males might succeed at their first suicide attempt. The strategy to increase stakeholders' accessibility to these hidden males has yet to be further explored.

Conclusion

Suicide is a preventable death, and older suicide is a complex issue. This study combined the findings of 22 studies, synthesising important factors that could be found in older

suicide and with a focus on the gender differences. There are many factors that have been shown to be associated with suicide in older people, most findings concluding that older males have a higher risk of suicide than older females. However, there is little research to support whether or not a clear gender difference exists in older suicide, as the findings were not consistent across all 22 studies. Some studies have reported different findings on the same factors between male and female suicide in different contexts. Apart from the different biological make-up of males and the females, factors such as culture, socio-demographics and marital status might contribute to these differences, but their possible roles have not yet been fully explored.

Relevance to clinical practice

A highly vigilant collaboration among multiple disciplines is required in the management of older suicide. For the purposes of early detection and prevention of suicidal behaviour in old age, education on the screening of at-risk elders and recognition of the related suicide risk factors in the primary health care setting are needed.

Contributions

Study design: Y-LF, ZCYC; data collection and analysis: Y-LF, ZCYC and manuscript preparation: Y-LF, ZCYC.

Conflict of interest

There is no conflict of interest.

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