Means restriction methods for reducing pesticide-ingestion suicides

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Shanghai Mental Health Center—Emory University Collaborative Center for Global Mental Health
1. Background on suicide and pesticide-ingestion suicides
2. Characteristics of pesticide-ingestion suicides in China
3. Mean restriction approaches to decrease pesticide-ingestion suicides
4. Lockbox project in Mei County, Shaanxi Province, China
5. Tough questions for suicide prevention in LMICs
1. Background on suicide and pesticide-ingestion suicides
Figure 3: Methods of suicide in India
The proportions are based on the deaths of 1599 men (≥15 years of age) and 1085 women (≥15 years of age), with rates based on UN national totals of deaths for 2010. ASR=age-standardised suicide death rate per 100,000 population. T=estimated number of suicide deaths in 2010 (thousands).
Method of suicide among 454 male and 441 female completed suicides from the national psychological autopsy study.

Other methods:
- Jumping
- Drowning
- Hanging
- Other poisons
- Medications
- Rat poison
- Pesticides

Percent of cases

<table>
<thead>
<tr>
<th>Method</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pesticides</td>
<td>44</td>
<td>52</td>
</tr>
<tr>
<td>Poison</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>Medications</td>
<td>4</td>
<td>52</td>
</tr>
<tr>
<td>Roping</td>
<td>28</td>
<td>16</td>
</tr>
<tr>
<td>Hanging</td>
<td>16</td>
<td>11</td>
</tr>
<tr>
<td>Hanging</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Hanging</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Jumping</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>
A systematic review by Gunnell et al. in 2007 reported that worldwide intentional pesticide-ingestion is the most common method of suicide accounting for one-third of all suicides (about 300,000 suicides annually). Importantly, it is the pattern of pesticide use and the toxicity of the products, not the quantity used, that influences the likelihood they will be used in acts of fatal self-harm.

In China pesticides are used in 58% of all suicides.
- 75% use pesticides stored in the home
- 58% use category I organophosphates
- 62% receive medical resuscitation that fails

Pesticides are also used in 28.7% of all suicide attempts.
- 84% use pesticides stored in the home
- 82% use category I organophosphates

Given the public health importance of this problem, we know surprisingly little about the characteristics and prevention of pesticide-ingestion suicides.
2. Characteristics of pesticide-ingestion suicides in China
Method of completed and attempted suicide in urban and rural China

<table>
<thead>
<tr>
<th>Method</th>
<th>Completed Suicide Rural (N=742)</th>
<th>Completed Suicide Urban (N=146)</th>
<th>Attempted Suicide Rural (N=10374)</th>
<th>Attempted Suicide Urban (N=4513)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Highly Lethal Methods</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>insecticide/herbicide/rodenticide</td>
<td>96%</td>
<td>88%</td>
<td>41% [4248]</td>
<td>17% [781]</td>
</tr>
<tr>
<td>Other highly lethal toxins</td>
<td>65%</td>
<td>25%</td>
<td>37% [3844]</td>
<td>10% [460]</td>
</tr>
<tr>
<td>Hanging and jumping</td>
<td>3%</td>
<td>1%</td>
<td>&lt;1% [31]</td>
<td>1% [29]</td>
</tr>
<tr>
<td>Other highly lethal methods</td>
<td>21%</td>
<td>53%</td>
<td>3% [322]</td>
<td>3% [145]</td>
</tr>
<tr>
<td><strong>Less Lethal Methods</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medications</td>
<td>7%</td>
<td>9%</td>
<td>1% [51]</td>
<td>3% [147]</td>
</tr>
<tr>
<td>Alcohol, other less lethal toxins</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other less lethal methods</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Resuscitation failure rates

**Completed suicides identified in the community:**

<table>
<thead>
<tr>
<th>method</th>
<th>all deaths</th>
<th>treated by health professional before death</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pesticides and rat poison</td>
<td>519</td>
<td>320</td>
<td>61.7%</td>
</tr>
<tr>
<td>Other methods</td>
<td>376</td>
<td>74</td>
<td>19.7%</td>
</tr>
</tbody>
</table>

**Deliberate self-harm behaviors treated in emergency rooms:**

<table>
<thead>
<tr>
<th>method</th>
<th>cases treated</th>
<th>number who died</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pesticides and rat poison</td>
<td>1619</td>
<td>100</td>
<td>6.2%</td>
</tr>
<tr>
<td>Other methods</td>
<td>1919</td>
<td>21</td>
<td>1.1%</td>
</tr>
</tbody>
</table>
Comparison of the characteristics of medically serious suicide attempts that ingest pesticides with those that use other methods

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Pesticide (N=468)</th>
<th>Other Method (N=149)</th>
<th>Adjusted Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Characteristics of the attempt</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>considered ≤ 5 min before attempt</td>
<td>43.5%</td>
<td>16.5%</td>
<td><strong>3.83 (2.29-6.39)</strong></td>
</tr>
<tr>
<td>other person present during attempt</td>
<td>30.8%</td>
<td>12.1%</td>
<td><strong>3.69 (2.09-6.52)</strong></td>
</tr>
<tr>
<td>high objective suicidal intent</td>
<td>48.5%</td>
<td>69.8%</td>
<td><strong>0.37 (0.24-0.56)</strong></td>
</tr>
<tr>
<td><strong>Mental illness at time of the attempt</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>any current mental illness</td>
<td>33.3 %</td>
<td>54.4 %</td>
<td><strong>0.37 (0.25-0.56)</strong></td>
</tr>
<tr>
<td>mood disorders</td>
<td>22.4%</td>
<td>37.6%</td>
<td><strong>0.43 (0.28-0.67)</strong></td>
</tr>
<tr>
<td>ever sought any type of professional psychological support or treatment</td>
<td>10.3%</td>
<td>36.2%</td>
<td><strong>0.16 (0.10-0.27)</strong></td>
</tr>
<tr>
<td>used psychiatric meds in last month</td>
<td>4.7%</td>
<td>28.9%</td>
<td><strong>0.10 (0.05-0.18)</strong></td>
</tr>
</tbody>
</table>
PSYCHIATRIC DIAGNOSES IN 161 MALE AND 456 FEMALE ATTEMPTED SUICIDES

- Other Disorders: 63%
- Organic Disorders: 25%
- Psychotic Disorders: 18%
- Alcohol Disorders: 12%
- Affective Disorders: 7%
- NO DIAGNOSIS: 6%

SEX
- Male: 57%
- Female: 43%
Psychiatric diagnosis in 454 male and 441 female completed suicides from the national psychological autopsy study.

- **Non-diagnosis:** 50%
- **Psychotic Disorders:** 40%
- **Affective Disorders:** 30%
- **Alcohol Disorders:** 20%
- **Organic Disorders:** 10%
- **Other Disorders:** 5%

**Sex:**
- **Male:** 136 cases
- **Female:** 130 cases

**Diagnosis:**
- Non-diagnosis: M: 66, F: 66
- Psychotic Disorders: M: 34, F: 36
- Affective Disorders: M: 42, F: 42
- Alcohol Disorders: M: 36, F: 33
- Organic Disorders: M: 6, F: 6
- Other Disorders: M: 6, F: 4
<table>
<thead>
<tr>
<th>REGION</th>
<th>rural suicide rate</th>
<th>% rural households that often store pesticides</th>
</tr>
</thead>
<tbody>
<tr>
<td>East</td>
<td>15.1</td>
<td>25.0%</td>
</tr>
<tr>
<td>West</td>
<td>18.4</td>
<td>28.7%</td>
</tr>
<tr>
<td>Central</td>
<td>19.1</td>
<td>30.5%</td>
</tr>
</tbody>
</table>

The map indicates regions with varying rural suicide rates and the percentage of rural households that often store pesticides.

- Inner Mongolia
- Shaanxi
- Shanxi
- Henan
- Hubei
- Xinjiang
- Gansu
- Qinghai
- Ningxia
- Tibet
- Sichuan
- Yunnan
- Chongqing
- Guizhou
- Guangxi
- Hainan
- Hunan
- Guangdong
- Heilongjiang
- Jilin
- Liaoning
- Beijing
- Tianjin
- Hebei
- Shandong
- Jiangsu
- Shanghai
- Anhui
- Zhejiang
- Jiangxi
- Fujian
- Xinjiang
- Tibet
Proportion of the population that reside in cities or towns
In 2006 there were 131 million rural-urban transient workers, 25% of the total rural workforce.
Suicide Rate in China 1987-2006

> 1 million less lives lost to suicide over the 20 years

>100,000 less suicides per year in 2006 than in 1987
In most low- and middle-income countries (LAMIC) with large agricultural populations, patterns of pesticide use and access to pesticides are a more important determinant of the rates and demographic characteristics of suicide than the prevalence and treatment rates for mental disorders.
The characteristics of pesticide-ingestion suicides in China point to the need for four types of interventions that need to be integrated into the overall suicide prevention effort.

1. Banning of the most toxic compounds;
2. Decreasing access to pesticides in the home;
3. Community education about the lethality of these chemicals and about appropriate storage;
4. Improved training and increased access to necessary drugs and equipment for rural primary care health providers.
Clinical Management
of Acute Pesticide Intoxication:
Prevention of Suicidal Behaviours

World Health Organization

Management of Mental and Brain Disorders
Department of Mental Health and Substance Abuse
3. Mean restriction approaches to decrease pesticide-ingestion suicides
Targets of Suicide Preventive Interventions

(Mann, et al., *JAMA*, 294(16), 2064-2070, 2005)

SUICIDAL BEHAVIOR

Stressful Life Event

Mood or Other Psychiatric Disorder

Suicidal Ideation

FACTORS INVOLVED IN SUICIDAL BEHAVIOR

Impulsivity

Hopelessness and/or Pessimism

Access to Lethal Means

Imitation

Suicidal Act

PREVENTION INTERVENTIONS

A. Education and Awareness Programs
   - Primary Care Physicians
   - General Public
   - Community or Organizational Gatekeepers

B. Screening for Individuals at High Risk

Treatment

C. Pharmacotherapy
   - Antidepressants, Including Selective Serotonin Reuptake Inhibitors
   - Antipsychotics

D. Psychotherapy
   - Alcoholism Programs
   - Cognitive Behavioral Therapy

E. Follow-up Care for Suicide Attempts

F. Restriction of Access to Lethal Means

G. Media Reporting Guidelines for Suicide

Circled letters refer to relevant prevention interventions listed on right.
Means restriction as a suicide prevention strategy

• Relative importance of means restriction in overall suicide prevention strategy depends on proportion of suicides by ingestion, jumping, firearms, charcoal and so forth (which are amenable to restriction) versus hanging (which is less amenable to means restriction, other than for in-hospital hanging)

• Need to monitor methods of suicide in different demographic groups because methods vary by age, gender, and sub-cultural group.

• There are several examples of relatively rapid changes in the methods used in a community so on-going, up-to-date information on the methods employed in fatal and non-fatal suicidal behaviour is needed to monitor the effectiveness of means restriction efforts.

• Lethality of the methods used in attempted suicide may affect the ‘overlap’ between attempted and completed suicide and, thus, affect the overall pattern of completed suicides in the country
Mediating factors that influence the outcome of different methods of means restriction

- Potential degree of ‘substitution’ to an alternative method following restriction of one method and the relative lethality of the alternative method

- Proportion of ‘impulsive’ (low-intent) suicides among all non-fatal and fatal suicidal acts

- Access to and coverage of emergency psychological services and other preventive interventions in the target community

- Access to effective resuscitation services (which affect the case fatality ratios).

- These mediating factors can change over time so they need to be assessed and monitored in parallel with the monitoring of methods employed in suicidal behaviour.
Figure 3  Age standardized suicide rates for males and females, Sri Lanka 1975–2005
Other than an outright ban, what methods are available for restricting access to pesticides?

- Promote secure storage in homes, fields or a centralised community location
- Establish a Minimum Pesticide List
- Promote Integrated Pest Management (IPM) programs
- Apply a tax to pesticides that increases with pesticide lethality
- Limit usage of pesticides in each village or community to a small number of licensed individuals who would apply pesticides for all community members
- Training pesticide retailers to recognise potentially suicidal individuals
- Limit sale of pesticides to single-use amounts
4. Lockbox project in Mei County, Shaanxi Province
Objectives of the project

1. Develop an effective monitoring system for assessing rates of suicides and suicide attempts in the 10 townships in Mei County, Shaanxi Province

2. Install 10,000 lockboxes for pesticides in homes that frequently store pesticides in 2 townships

3. Provide an educational campaign to encourage householders to employ the boxes for 2 years

4. Monitor compliance with the use of the lockboxes for 3 years

5. Compare the before versus after rates of completed and attempted suicide in the 2 intervention townships with that in 8 control townships
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<thead>
<tr>
<th>REGION</th>
<th>Suicide Rate</th>
<th>% Rural Households that Often Store Pesticides</th>
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The map shows the distribution of rural suicide rates and the percentage of rural households that often store pesticides across different regions in China. The regions are color-coded to indicate their respective suicide rates and pesticide storage rates.
2 adjacent townships where lockboxes were installed with combined population of 51,441 in 11,923 households

Heng Qu Township
Huai Ya Township

MEI COUNTY
电话: 800-810-1117
Impressions from the study

- It is unrealistic to think that there will be 100% compliance with such a measure. Increasing safe storage of pesticides from 0% to 20% is still a positive outcome that should, if all other factors are constant, result in reduced suicidal behavior.

- Understanding the factors that affect willingness of rural residents to lock the lockboxes and implementing corresponding ongoing educational or other initiatives is essential to the success of such initiatives.

- The potential danger of having the pesticides in a highly visible, accessible location (if in an unlocked lockbox) needs to be measured as part of the evaluation of these initiatives.

- Means restriction needs to be part of an overall suicide prevention strategy, NOT a stand-alone program.
Integrating pesticide-related initiatives into the national suicide prevention plan for China

GOAL 1: Promote psychological well-being, resilience and community ‘connectedness’
GOAL 2: Promote broad-based support for suicide prevention
GOAL 3: Decrease access to and lethality of means for suicide, particularly pesticides
GOAL 4: Enhance social support networks for high-risk groups
GOAL 5: Promote community-based screening programs to identify high-risk individuals
GOAL 6: Increase awareness and change attitudes about mental health problems and suicide
GOAL 7: Improve availability and quality of mental health services
GOAL 8: Develop specific services for high-risk individuals and others affected by suicide
GOAL 9: Expand scientific evidence base for the prevention and management of suicide
GOAL 10: Improve and expand surveillance of suicidal behavior
GOAL 11: Develop sources of sustained funding for suicide-related services and research
5. Tough questions for suicide prevention in LMICs
TOUGH QUESTIONS FOR SUICIDE PREVENTION ADVOCATES IN LMICs

• Given the limited access to mental health services—particularly in rural areas—and the reluctance of community members to use mental health services, is focusing on expansion of mental health services the best way to reduce suicides?

• Given the lack of country-specific evidence about the relative value of different interventions, how much should we depend on results from high-income countries to determine intervention priorities?

• How much of the effort should be placed on improving the quality of the monitoring systems for suicides and attempted suicides?

• Given the disconnect between level of intent and case-fatality, do we need to change methods of identifying ‘high-risk’ individuals?

• What should the relative balance of resource allocation be on universal (i.e., community based), selective (i.e., at high-risk groups) and indicated (i.e., on persons who have attempted suicide) preventive measures?

• What role should means restriction play in the overall intervention package?
Every country will need to make its own decisions about how it mobilizes and expends personnel, funds, and other resources for the prevention of suicide.

BUT

I believe that at this point in time it is a serious mistake for China, India and other LMICs to expend 80% of the limited resources available for suicide prevention on individual-focused, mental health approaches.
Thank you for listening