**Supplementary material 1: Definition of risk behaviour**

**Supplementary material 2: Two stage modeling approach**

**Supplementary Table 1: Association between death and community-based management in hazard ratio (95% confidence interval), excluding those lost to follow up**

**Supplementary Table 2: Association between death and covariates in the fully adjusted models, hazard ratio (95% confidence interval) (Model 4)**

**Supplementary material 1: Definition of risk behaviour1**

Risk behavior was defined on a scale of 0 to 5. Level 0 did not include any of the following behaviors indicated in levels 1 to 5. Level 1 was confined to verbal threats and shouts to others, but no physically destructive behavior. Level 2 included the destruction of property, but was home limited, and could be persuaded to stop. Level 3 indicated destruction of property regardless of the occasion, which could not be persuaded to stop. Level 4 was defined by continuous destructive behavior to people or property regardless of the occasion, and could not be persuaded to stop. Level 5 was expanded to any violent behavior against people using controlled dangerous weapons, or other dangerous behavior such as arson, blasts, etc., regardless of the occasion.

**Supplementary material 2: Two stage modeling approach**

*Stage 1: growth models for change patterns*

The repeated measures of high-risk behavior and disease stability were treated as binary dependent variables, separately; the repeated measure medication adherence was treated as a continuous dependent variable. With repeated time points *i* at level 1 and individuals *j* at level 2, the change patterns of repeated measures over time were estimated by fitting model (1a) for high-risk behavior and disease stability, and by fitting model (1b) for medication adherence. In both models the intercept $α\_{0}$ and the linear slope $α\_{1}$ were allowed to vary at the individual level by including individual-level random effects, $u\_{0j}$ and $u\_{1j}$, of their estimates, respectively. The dependent variable *Xij* was the value of the community measures at the *i*th assessment for the *j*th individual, and *tij* was the interval from enrollment at the *i*th assessment. In model (1a), the *X* was coded as 1 for low risk behavior or stable condition, 0 for the opposite; in model (1b), the *X* was coded as 0 for refusing to take medicine, 1 for taking medicine less in dose or frequency than prescription, and 2 for adherent, so that a positive slope $α\_{1}$ indicates progress towards to a better direction, and negative slope to a worsened direction. The term $e\_{0ij}$ in model (1b) indicated the first level random effect of the intercept $α\_{0}$.

$$P\_{r}\left(X\_{ij}=1\right)=logit^{-1}[\left(α\_{0}+u\_{0j}\right)+\left(α\_{1}+u\_{1j}\right)t\_{ij}]$$

$\left(\genfrac{}{}{0pt}{}{u\_{0j}}{u\_{1j}}\right)\~MVN\left(0,Ω\_{u}\right), Ω\_{u}=\left(\begin{matrix}σ\_{u\_{0}}^{2}&\\σ\_{u\_{01}}&σ\_{u\_{1}}^{2}\end{matrix}\right)$  (1a)

$$X\_{ij}=\left(α\_{0}+μ\_{0j}\right)+\left(α\_{1}+u\_{1j}\right)t\_{ij}+e\_{0ij}$$

$\left(\genfrac{}{}{0pt}{}{u\_{0j}}{u\_{1j}}\right)\~MVN\left(0,Ω\_{u}\right), Ω\_{u}=\left(\begin{matrix}σ\_{u\_{0}}^{2}&\\σ\_{u\_{01}}&σ\_{u\_{1}}^{2}\end{matrix}\right)$, $e\_{0ij}\~N(0, σ\_{e\_{0}}^{2})$ (1b)

By fitting model (1a) or (1b), each patient could get a specific linear slope,$ α\_{1}+u\_{1j}$, over time for each community management measure. Then the slopes were ordered and equally divided into three groups. If the slope was positive and fell in the upper tertile (decided by the absolute value of the slope), the corresponding community measure was treated as “better” in the progression; if the slope was negative and fell in the upper tertile, the corresponding community measure was considered to be “worse”; otherwise, the progression was considered as “no change”. Three progress variables of each measure are included in Stage 2 analysis as independent variables X.

*Stage 2: multilevel proportional hazard models*

As the 112,576 patients were residing in 146 counties, we used multilevel hazard models to examine the association between risk factors and death. The proportional hazard model (2) can be estimated via the Poisson model with log link by restructuring the data into time intervals corresponding to time points when the events (dead or survived) occur, assuming the hazard to be constant within the observed time intervals.2 After being restructured, time points were level 1 units, patients became level 2 units and counties became level 3 units. The *offset* equals the natural logarithm of the total number of participants at risk at time *t*. The term *β0* is the intercept with random effects *u0jk* and *v0k* in individual and county levels, respectively, with an individual variance $σ\_{u}^{2}$ and a county variance $σ\_{v}^{2}$. The polynomial function $\sum\_{}^{}a\_{h}log^{h}(t)$ is used to indicate the relationship between time and baseline hazards function. In our model, we used a fourth-order polynomial function after experimenting with adding terms of polynomial until the model parameters remain unchanged or similar. The term *X* is the matrix of the independent variables with coefficients matrix *β*.

$$y\_{ijk}-offset=\left(β\_{0}+u\_{0jk}+v\_{0k}\right)+\sum\_{h=1}^{4}a\_{h}log^{h}\left(t\right)+Xβ$$

$u\_{0jk}\~N\left(0,σ\_{u}^{2}\right), v\_{0k}\~N(0, σ\_{v}^{2})$ (2)

**Supplementary Table 1. Association between death and community-based management in hazard ratio (95% confidence interval), excluding those lost to follow up # (n=88,625)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 　 | **Model 1 \*** | **Model 2 †** | **Model 3 ‡** | **Model 4 §** |
| **High-risk Behavior** |
| **Progression of high-risk behavior** |  |  |
| No change | Ref. | Ref. | Ref. | Ref. |
| Better | 0.45 (0.41, 0.51) | 0.41 (0.36, 0.46) | 0.42 (0.36, 0.48) | 0.42 (0.36, 0.48) |
| Worse | 1.09 (0.76, 1.57) | 0.84 (0.57, 1.25) | 0.95 (0.59, 1.54) | 0.96 (0.60, 1.56) |
| **Baseline high-risk behavior** |  |  |  |
| High-risk |  | Ref. | Ref. | Ref. |
| Low risk |  | 0.41 (0.31, 0.55) | 0.38 (0.27, 0.55) | 0.38 (0.27, 0.54) |
| **Variance (county), estimate (SE)** | 0.35 (0.06) | 0.346 (0.060) | 0.358 (0.068) | 0.335 (0.065) |
| **Disease Stability** |
| **Progression of disease stability** |  |  |
| No change | Ref. | Ref. | Ref. | Ref. |
| Better | 0.38 (0.34, 0.43) | 0.30 (0.26, 0.34) | 0.30 (0.25, 0.35) | 0.30 (0.25, 0.35) |
| Worse | 1.02 (0.8, 1.3) | 0.92 (0.71, 1.19) | 0.98 (0.71, 1.35) | 1.01 (0.73, 1.38) |
| **Baseline disease stability** |  |  |  |
| Unstable |  | Ref. | Ref. | Ref. |
| Stable | 0.38 (0.34, 0.43) | 0.30 (0.26, 0.34) | 0.30 (0.25, 0.35) | 0.30 (0.25, 0.35) |
| **Variance (county), estimate (SE)** | 1.02 (0.8, 1.3) | 0.92 (0.71, 1.19) | 0.98 (0.71, 1.35) | 1.01 (0.73, 1.38) |
| **Medication Adherence** |
| **Progression of medication adherence** |  |  |
| No change | Ref. | Ref. | Ref. | Ref. |
| Better | 0.77 (0.67, 0.88) | 0.69 (0.6, 0.79) | 0.78 (0.66, 0.93) | 0.78 (0.66, 0.93) |
| Worse | 0.80 (0.70, 0.90) | 0.93 (0.81, 1.06) | 0.85 (0.72, 0.99) | 0.85 (0.72, 1.00) |
| **Baseline medication adherence** |  |  |  |
| Adherent |  | Ref. | Ref. | Ref. |
| Taking reduced doses of medicine or taking it at a reduced frequency than prescribed |  | 1.58 (1.39, 1.8) | 1.27 (1.09, 1.49) | 1.27 (1.08, 1.48) |
| Refusing to take medicine |  | 1.64 (1.45, 1.85) | 1.03 (0.88, 1.20) | 1.02 (0.87, 1.20) |
| **Variance (county), estimate (SE)** | 0.323 (0.055) | 0.299 (0.052) | 0.292 (0.057) | 0.281 (0.055) |

**#**Definition of lost to follow-up: whose last contact date was on or before 31 July 2013, ie, those who were not contacted for more than six months by 31 January 2014.

\* Without adjusting for covariates.

† Adjusting for baseline community management indicator.

‡ Adding other individual covariates, including age at baseline, sex, diagnose, family history of mental disorders, education attainment, occupation, economic status, ethnicity, and marital status.

§ Adding county-level covariates, including GDP per capita, average traveling time to the nearest hospital, and the number of mental health hospitals.

**Supplementary Table 2. Association between death and covariates in the fully adjusted models, hazard ratio (95% confidence interval) (Model 4)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Adjusted for High risk behavior** | **Adjusted for Disease stability** | **Adjusted for Medication adherence** |
| **Disorder-specific factors** |
| **Diagnose** |  |  |  |
| Schizophrenia | Ref. | Ref. | Ref. |
| Schizoaffective disorder | 0.83 (0.49, 1.40) | 0.77 (0.44, 1.34) | 0.78 (0.47, 1.30) |
| Paranoiac psychosis | 1.25 (0.41, 3.78) | 1.30 (0.41, 4.10) | 1.44 (0.51, 4.07) |
| Bipolar affective disorder | 0.81 (0.54, 1.20) | 0.71 (0.47, 1.08) | 0.75 (0.52, 1.09) |
| Psychotic disorder due to epilepsy | 1.51 (1.04, 2.18) | 1.42 (0.96, 2.09) | 1.47 (1.04, 2.09) |
| Disorders of intellectual development with psychosis | 0.75 (0.52, 1.08) | 0.76 (0.52, 1.10) | 0.79 (0.56, 1.12) |
| **Family history of mental disorders** |  |  |
|  No | Ref. | Ref. | Ref. |
|  Yes | 0.99 (0.72, 1.36) | 1.08 (0.77, 1.51) | 0.92 (0.68, 1.24) |
| **Socioeconomic position** |
| **Education** |  |  |  |
|  High school or above | Ref. | Ref. | Ref. |
|  Primary or middle school | 1.39 (1.05, 1.84) | 1.43 (1.07, 1.91) | 1.39 (1.07, 1.82) |
|  No formal education or illiterate | 1.40 (1.03, 1.91) | 1.38 (1.01, 1.90) | 1.50 (1.12, 2.01) |
|  Unknown \* | 1.74 (1.17, 2.57) | 1.54 (1.02, 2.31) | 1.66 (1.15, 2.41) |
| **Occupation** |  |  |  |
| Employed †, students or retired | Ref. | Ref. | Ref. |
| Unemployed | 1.39 (1.05, 1.84) | 1.43 (1.07, 1.91) | 1.39 (1.07, 1.82) |
| Farmer ‡ | 1.40 (1.03, 1.91) | 1.38 (1.01, 1.90) | 1.50 (1.12, 2.01) |
| Unknown \* | 1.74 (1.17, 2.57) | 1.54 (1.02, 2.31) | 1.66 (1.15, 2.41) |
| **Economic status §** |  |  |  |
|  Non-poverty | Ref. | Ref. | Ref. |
|  Poverty | 1.02 (0.85, 1.22) | 0.99 (0.82, 1.20) | 1.07 (0.90, 1.27) |
|  Unknown \* | 1.04 (0.84, 1.28) | 1.03 (0.83, 1.27) | 1.02 (0.84, 1.24) |
| **Cultural and societal factor** |
| **Ethnicity** |  |  |  |
|  Han | Ref. | Ref. | Ref. |
|  Minority | 1.64 (0.60, 4.48) | 1.61 (0.57, 4.55) | 2.01 (0.79, 5.14) |
| **Social support** |
| **Marital status** |  |  |  |
|  Married | Ref. | Ref. | Ref. |
| Unmarried ¶ | 1.32 (1.14, 1.53) | 1.32 (1.13, 1.53) | 1.32 (1.15, 1.52) |
| Unknown \* | 1.10 (0.77, 1.57) | 1.11 (0.77, 1.61) | 1.06 (0.76, 1.49) |
|  **Health systems and context factors** |
| GDP per capita | 1.00 (1.00, 1.00) | 1.00 (1.00, 1.00) | 1.00 (1.00, 1.00) |
| Average travelling time to the nearest hospital | 1.16 (0.92, 1.46) | 1.20 (0.95, 1.51) | 1.14 (0.92, 1.42) |
| No. of mental health hospitals | 1.00 (0.99, 1.01) | 1.00 (0.99, 1.01) | 1.00 (0.99, 1.01) |
| **Other adjustable covariates** |
| **Sex** |  |  |  |
| Male | Ref. | Ref. | Ref. |
| Female | 0.70 (0.61, 0.81) | 0.73 (0.63, 0.84) | 0.68 (0.6, 0.77) |
| **Age at baseline** | 1.05 (1.04, 1.05) | 1.05 (1.04, 1.05) | 1.04 (1.04, 1.05) |

Abbreviation: GDP, gross domestic product;

\* Unknow was included in the model analysis.

† Including professional/technical personnel, managerial personnel, industrial worker.

‡ Including agriculture, forestry, animal husbandry, fishery.

§ Determined by whether they were above or below the poverty line as determined by the local government according to the local socioeconomic status.

¶ Including widowed, separated, divorced, and never married.

1. Liu Y, Liu X, Wen H, et al. Risk behavior in patients with severe mental disorders: a prospective study of 121,830 patients managed in rural households of western China. *BMC Psychiatry* 2018; **18**(1): 134.

2. Yang M, Goldstein H. Modelling survival data in MLwiN 1.20. University of London: Centre for Multilevel Modelling Bedford Group for Lifecourse and Statistical Studies Institute of Education; 2003.