Article title: The Impact Mechanism of Government Regulation on the Operation of Smart Health Senior Care Service Platform: A Perspective From Evolutionary Game Theory

Journal name: International Journal of Health Policy and Management (IJHPM)

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Citation: Xiao M, Liu H. The impact mechanism of government regulation on the operation of smart health senior care service platform: a perspective from evolutionary game theory. Int J Health Policy Manag. 2025;14:8646. doi:10.34172/ijhpm.8646

Supplementary file 1. Replication Dynamic Equation

Stability analysis of the platform

The expected benefits for platform parties choosing reciprocal and opportunistic strategies (E_{21} and E_{22}) are:

$$\left\{\begin{array}{l} E_{21} = xz(\rho_2 R_{b3} + R_{b1} + \rho_2 R_{b4}) + x(1-z)(\rho_2 R_{b3} + R_{b1}) + (1-x)z(R_{b1} + \rho_2 R_{b4}) + \\ \quad (1-x)(1-z)R_{b1} \\ E_{22} = xz(-\mu_1 P_{b1} + (1-\mu_1)R_{b2}) + x(1-z)(-\mu_1 P_{b1} + (1-\mu_1)R_{b2}) \\ \quad + (1-x)zR_{b2} + (1-x)(1-z)R_{b2} \\ \overline{E_2} = yE_{21} + (1-y)E_{22} \end{array}\right\} \tag{5}$$

Therefore, the evolutionary game replication dynamic equation of platform strategy is:

$$\begin{aligned} F(y) &= dy/dt = y(1-y)\ (E_{21} - E_{22}) \\ &= y(1-y)(R_{b1} + \rho_2(xR_{b3} + zR_{b4}) - R_{b2} + \mu_1 x(R_{b2} + P_{b1})) \end{aligned} \tag{6}$$

$$F'(y) = (1-2y)(R_{b1} + \rho_2(xR_{b3} + zR_{b4}) - R_{b2} + \mu_1 x(R_{b2} + P_{b1})) \tag{7}$$

Assuming $W(z) = R_{b1} + \rho_2(xR_{b3} + zR_{b4}) - R_{b2} + \mu_1 x(R_{b2} + P_{b1})$, when

$z^* = \dfrac{-R_{b1} + R_{b2} - \mu_1 x(R_{b2} + P_{b1}) - \rho_2 x R_{b3}}{\rho_2 R_{b4}}$, proposition 2 holds.

Proposition 2: When $0<z^*<z<1$, y=1 is the evolutionarily stable point; when $0<z<z^*<1$, y=0 is the evolutionarily stable point.

Proof: The function W(z) exhibits a monotonic increase over the interval. When $z=z^*$, $W(z)=0$, $F(y)=0$, indicating regardless of the probability that the platform chooses reciprocity or opportunism, the platform's strategy will remain unchanged over time. When $0<z^*<z<1$, $F'(y)|_{y=0}>0$, $F'(y)|_{y=1}<0$, $y=1$ exhibits stability; when $0<z<z^*<1$, $F'(y)|_{y=0}<0$, $F'(y)|_{y=1}>0$, $y=0$

exhibits stability.

Stability analysis of senior care service enterprises

The expected benefits of senior care service enterprises choosing positive and passive cooperation strategies (E_{31} and E_{32}) are:

$$\left\{\begin{array}{l} E_{31} = xy(\rho_3 R_{h3} + R_{h1} + \rho_3 R_{h4}) + x(1-y)(\rho_3 R_{h3} + R_{h1}) \\ \qquad + (1-x)y(R_{h1} + \rho_3 R_{h4}) + (1-x)(1-y)R_{h1} \\ E_{32} = xy(-\mu_1 P_{h1} + (1-\mu_1)R_{h2}) + x(1-y)(-\mu_1 P_{h1} + (1-\mu_1)R_{h2}) \\ \qquad + (1-x)yR_{h2} + (1-x)(1-y)R_{h2} \\ \overline{E_3} = zE_{31} + (1-z)E_{32} \end{array}\right\} \tag{8}$$

Therefore, the evolutionary game replication dynamic equation of senior care service enterprises strategy is:

$$\begin{aligned} F(z) &= dz/dt = z(1-z)(E_{31} - E_{32}) \\ &= (1-z)\,z(R_{h1} + \rho_3 x R_{h3} + \rho_3 y R_{h4} - R_{h2} + x\mu_1 P_{h1} + \mu_1 R_{h2} x) \end{aligned} \tag{9}$$

$$F'(z) = (1-2z)(R_{h1} + \rho_3 x R_{h3} + \rho_3 y R_{h4} - R_{h2} + x\mu_1 P_{h1} + \mu_1 R_{h2} x) \tag{10}$$

Proposition 3: When $0 < x^* < x < 1$, z=1 is the evolutionarily stable point; when $0 < x < x^* < 1$, z=0 is the evolutionarily stable point.

Proof: The function W(x) exhibits a monotonic increase over the interval. When $x=x^*$, $W(x)=0$,$F(z)=0$, indicating regardless of the probability of senior care service enterprises choosing positive or passive cooperation changes, senior care service enterprises' strategy will remain unchanged over time. When $0<x^*<x<1$, $F'(z)|_{z=0}>0$, $F'(z)|_{z=1}<0$, z=1 exhibits stability; when $0<x<x^*<1$, $F'(z)|_{z=0}<0$, $F'(z)|_{z=1}>0$, z=0 exhibits stability.