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BACKGROUND

The overall nationwide prevalence of nonalcoholic fatty liver disease (NAFLD) in China was estimated to be 29.2%<sup>[1]</sup>. Nonalcoholic steatohepatitis (NASH) is the progressive form of NAFLD with higher risk of liver-related mortality and morbidity and has become one of China’s public health problems.

There are no target drugs of NASH and the diagnosis rate of NASH is low. In conclusion, NASH would bring a great burden to the society.

OBJECTIVES

The aim of this study was to estimate the total economic burden of NASH and advanced NASH in China.

METHODS

Study Design

A Markov model was built to estimate the economic burden. The Markov health status included NASH, liver fibrosis, compensated cirrhosis (CC), liver cancer, liver transplantation (LT), liver-related death, and other death (see Fig.1). The time horizon was 50 years with 1-year cycle for each transition. The model was built from a society perspective, therefore the costs included direct medical costs and indirect costs. However, the direct non-medical costs were not considered due to minor impact and measure difficulty.

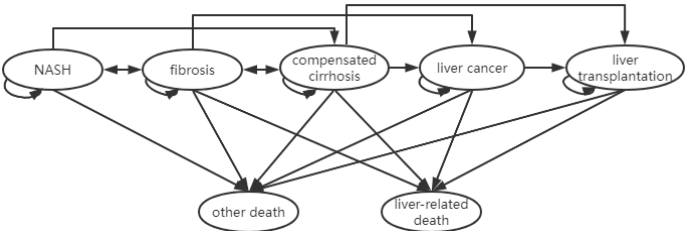


Fig.1 Model structure

Data Inputs

- Epidemiology data and disease progression rate for status transition were obtained from published literature<sup>[2-3]</sup> and National Bureau of Statistics.
- Diagnose rate, treatment rate, annual medical visits for each status and medical costs were collected from expert interviews.
- Direct medical costs were assessed by multiplying the annual medical visits by the medical costs per visit. Indirect costs were assessed by the labor loss through the human capital method. The conversion was calculated by multiplying the lost time of labor patients by the per capita daily wage. All future costs were discounted at an annual rate of 5%.

Sensitivity analysis

To quantify the impact of individual model parameter values on results, we used one-way sensitivity analysis to vary parameters inputs by ±20% of base case values.

RESULTS

Patient population

It is estimated that there are 37.5 million NASH patients in China in 2021. With the disease progression, in the next 5, 10, 20 and 50 years, there will be 13.6 million, 22.3 million, 30.2 million and 37.2 million advanced NASH patients, and 0.2 million, 0.9 million, 3.4 million and 9.0 million liver-related death (see Tab.1).

Tab.1 Populations of different status

| Patients            | 5 years    | 10 years   | 20 years   | 50 years   |
|---------------------|------------|------------|------------|------------|
| NASH                | 23,937,022 | 15,203,537 | 7,299,535  | 274,927    |
| Advanced NASH       | 12,994,201 | 20,276,759 | 23,069,787 | 1,520,768  |
| Liver-related death | 161,496    | 863,050    | 3,406,738  | 8,947,078  |
| Other death         | 419,808    | 1,169,181  | 3,736,467  | 26,769,754 |
| Total               | 37,512,527 | 37,512,527 | 37,512,527 | 37,512,527 |

Economic burden

In the next 5, 10, 20 and 50 years, the economic burden of all NASH patients will be 0.7 trillion, 3.2 trillion, 7.4 trillion and 13.1 trillion. The cost of advanced NASH accounted for 58.9%,85.1%, 88.9% and 89.1% of the total cost, respectively (see Tab.2).

Tab.2 The total economic burden

| Costs (yuan) |               | NASH      | Advanced NASH | Total      |
|--------------|---------------|-----------|---------------|------------|
| 5 years      | Direct cost   | 215,734   | 66,238        | 281,971    |
|              | Indirect cost | 51,387    | 317,204       | 368,591    |
|              | Subtotal      | 267,121   | 383,441       | 650,562    |
| 10 years     | Direct cost   | 386,905   | 271,580       | 658,485    |
|              | Indirect cost | 92,160    | 2,473,211     | 2,565,370  |
|              | Subtotal      | 479,065   | 2,744,791     | 3,223,856  |
| 20 years     | Direct cost   | 658,261   | 1,214,930     | 1,873,191  |
|              | Indirect cost | 156,796   | 5,339,426     | 5,496,222  |
|              | Subtotal      | 815,057   | 6,554,357     | 7,369,414  |
| 50 years     | Direct cost   | 1,150,583 | 5,503,729     | 6,654,312  |
|              | Indirect cost | 274,066   | 6,141,793     | 6,415,859  |
|              | Subtotal      | 1,424,629 | 11,645,523    | 13,070,171 |

Sensitivity Analysis

The key drivers of sensitivity analyses are annual costs of labor loss and probability of NASH to cirrhosis (see Fig.2).

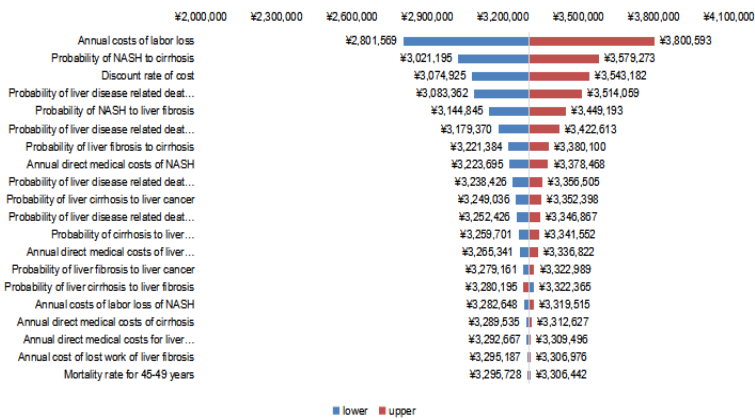


Fig.2 One-way sensitivity analysis

CONCLSIONS

In the next 50 years, the economic burden of NASH will increase rapidly, with a large percentage on the advanced NASH. Therefore, it is highly important to improve the rate of clinical screening and intervention as well as new drug development to prevent disease progression and reduce the economic burden.

LIMITATIONS

Some parameters came from expert interviews and thus may not be representative of whole China. The cost of job losing or changing due to disease was not considered in the model so the total economic burden is underestimated.

REFERENCES

[1] Zhou F, Zhou J, Wang W, Zhang XJ, Ji YX, Zhang P, She ZG, Zhu L, Cai J, Li H. Unexpected Rapid Increase in the Burden of NAFLD in China From 2008 to 2018: A Systematic Review and Meta-Analysis. Hepatology. 2019 Oct;70(4):1119-1133. doi: 10.1002/hep.30702. PMID: 31070259.

[2] Younossi Z, Tacke F, Arrese M, Chander Sharma B, Mostafa I, Bugianesi E, Wai-Sun Wong V, Yilmaz Y, George J, Fan J, Vos MB. Global Perspectives on Nonalcoholic Fatty Liver Disease and Nonalcoholic Steatohepatitis. Hepatology. 2019 Jun;69(6):2672-2682. doi: 10.1002/hep.30251. PMID: 30179269..

[3] Younossi ZM, Tampi R, Priyadarshini M, Nader F, Younossi IM, Racila A. Burden of Illness and Economic Model for Patients With Nonalcoholic Steatohepatitis in the United States. Hepatology. 2019 Feb;69(2):564-572. doi: 10.1002/hep.30254. Epub 2019 Jan 8. PMID: 30180285.