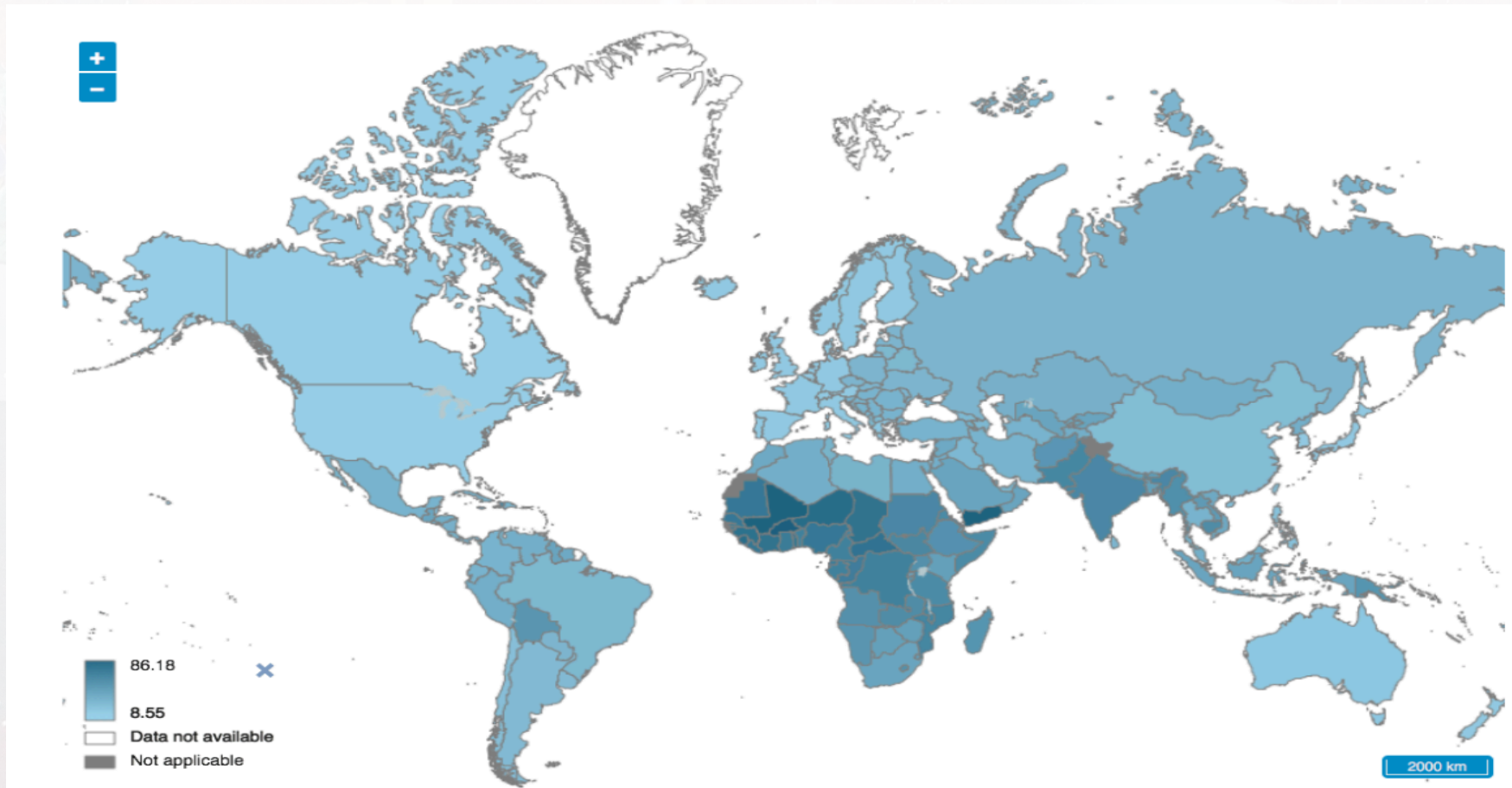




Adherence to a micronutrient home fortification program among diverse ethnic groups in remote rural China

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Anemia is one of the most prevalent nutritional disorders among preschool-aged children in low-and-middle-income countries (LMICs) .



The average prevalence of anemia among children in 131 LMICs was **43%**.

The prevalence of anemia among children under five years old in 2016

- To reduce the prevalence of anemia in LMICs, the WHO recommends the daily use of micronutrient powders (MNP) in at-risk populations.
- Over the last decade, MNP treatments containing iron have been shown to effectively reduce anemia in young children when caregivers adhere to regular feeding practices.

- Anemia is also the main malnutrition problem of preschool children in China.
- National target is that malnutrition in children less than 5-years-old will be lower than 10% in 2030.

- China implemented a free MNP distribution program in 2012, called Ying Yang Bao (YYB).
- The YYB program was initially implemented in 100 nationally designated poverty counties and has steadily grown to distribute YYB in 715 counties in 21 provinces.
- Our previous study has found that regular caregiver adherence to YYB feeding guidelines results in reduced rates of anemia in rural China (Zhou et al., 2016)

The adherence rate of MNP was different in different areas

- Rate of MNP/YYB adherence : 40%-70%
- Consistently low adherence to intervention practices dilutes the would-be program benefits and limits program effectiveness.

To address these low rates of YYB adherence in western China, it is necessary to understand the factors that are limiting adherence to the program.

Significant relationships between YYB adherence and caregiver & infant characteristics :

- **Caregiver's** ethnicity, education, knowledge and attitudes towards YYB
- **Infant's** age and infant response to being fed YYB

Previous studies

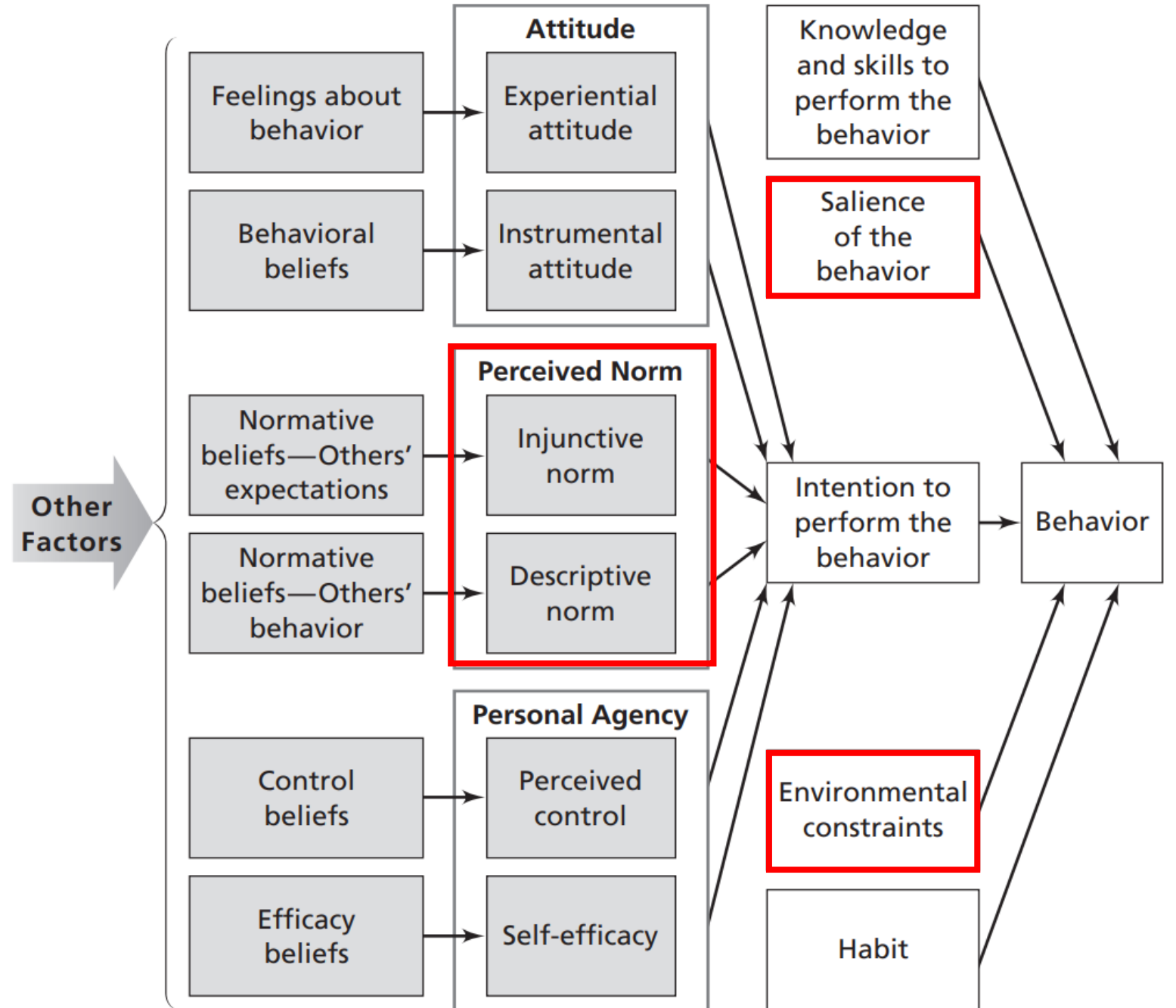
Certain methodological limitations:

- Environment factors
- Adherence evaluation indicator
- No theoretical guidance

Introduction

Integrated Behavioral Model, IBM

It is an extension of the prominent behavioral theories --the theory of reasoned action (TRA) and the theory of planned behavior (TPB) with further components incorporation from other influential behavioral theories, and has been proven effective to identify the determinants including personal and environmental inputs that may influence health-related behaviors.



Objectives

To assess the status of adherence of YYB in western rural areas of China



To explore the determinants on adherence of YYB on the basis of IBM model



To analyze the determinants on adherence of caregivers in different ethnics

1. Study design and participants

- The data were collected from 6 low-income counties in China's western **Sichuan Province**.
- A relatively rural province, with 48% of residents living in rural areas. The per capita income of rural residents is 13,331 RMB (USD 2,000).
- Ethnically diverse, with a large minority population , including Tibetan and Yi minority.
- In 2015, 32 YYB program counties have been established in Sichuan in an effort to mitigate nutritional deficiencies which are prevalent in rural, low-income communities.
- **Our samples are from areas with rural, low-income, and ethnically diverse.**

1. Study design and participants

32 YYB program counties



2 Han-ethnic counties
2 Tibetan-ethnic counties
2 Yi-ethnic counties



6 townships for each

36 sample townships



7 villages for each

252 villages



all caregivers with infants in 6–24 months

958 infants and their caregivers

A multistage
random sampling

2. Data collection

Quantitative data were collected through survey interviews using a tablet-based structured questionnaire by trained enumerators.

Questionnaire, including YYB adherence, behavioral influencing factors (IBM theory), and demographic information.



pre-test and improve the questionnaire



face-to-face interview

3. YYB adherence measurements

Three self-reported indicators were measured YYB adherence.

- Asked caregivers to report the number of YYB sachets they fed to their infants **in the past seven days** to assess current caregiver adherence.
- Asked caregivers to report the average number of YYB sachets they typically fed their infants **per week** to assess average levels of adherence during feeding YYB.
- Collected information about **sustainability** of caregiver YYB feeding behaviors from the beginning of YYB feeding to the time of the survey in order to assess overall long-term caregiver adherence.

**For the YYB sachets fed in one week, a cut-off value of 4 sachets was used for classification. (WHO, 2011; Chinese YYB program office, 2014).*

4. Data analysis

- A structural equation model (SEM) with maximum likelihood estimation (MLE) to examine personal and environmental inputs that may influence YYB feeding behavior, demographic characteristics were included as covariates.
- To analyze the impact factors on adherence in different ethnics, multiple-group SEM analyses were performed on the benchmark model to examine whether the inputs differed among different subgroups.

AMOS 22.0 (IBM) was used to fit the SEM and calculate model fit, using RGui 3.2.2 to apply the root-mean-square error of approximation (RMSEA) to calculate the model's test performance.

Results

Table 1 Basic characteristics of the research subjects (N=958)

Characteristics	n	%	Characteristics	n /mean	%/SD
Infant Gender			Caregiver generation		
Girls	451	47.08	Parent	675	70.46
Boys	507	52.92	Grandparent	283	29.54
Infant month age			Caregiver age	36.13	13.09
6-12	243	25.37	Caregiver occupation		
13-18	337	35.18	Unemployed	415	43.32
19-24	378	39.46	Farmer	440	45.93
Ethnicity			Others	103	10.75
Han	318	33.19	Caregiver education		
Tibetan	309	32.26	No formal education	437	45.62
Yi	331	34.55	Primary school	235	24.53
Family economic			Middle school	172	17.95
Quantile 1	272	28.39	High school and above	114	11.90
Quantile 2	208	21.71			
Quantile 3	259	27.04			
Quantile 4	219	22.86			

YYB feeding adherence behavior

Adherence indicator 1: Number of YYB sachets fed in the past 7 days

- 53% had fed infants four or more YYB sachets in the past seven days, with significant ethnic group differences, Han group is significantly higher than other 2 minority groups.

Adherence indicator 2: Average number of YYB sachets fed per week

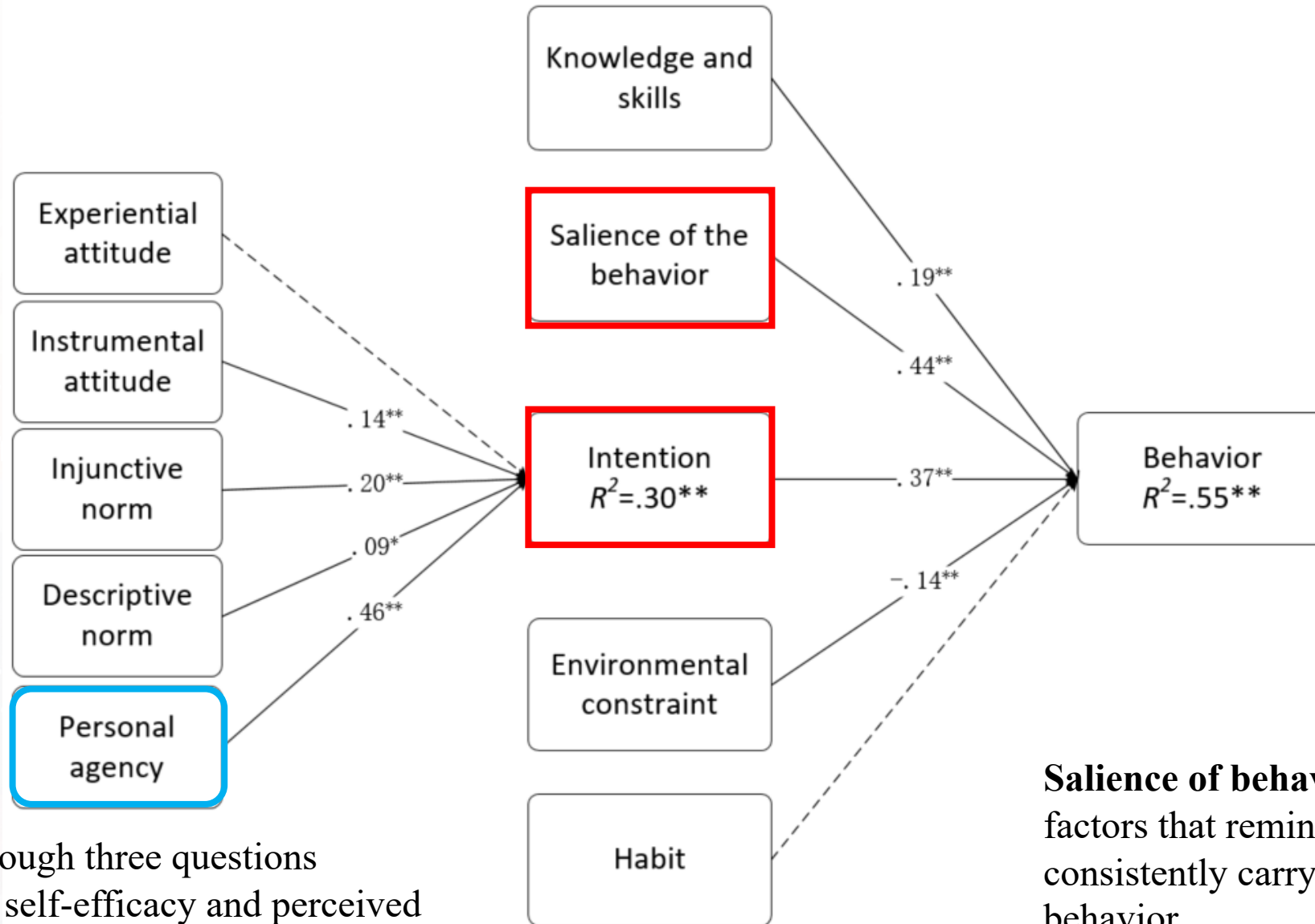
- 64% had fed infants four or more YYB sachets per week, with significant ethnic group differences, Han group is significantly higher than other 2 minority groups.

Adherence indicator 3: Continuity of feeding behavior

- only 22% of all caregivers had consistently fed their infants YYB without interruption from the start to the time of the survey. We again found a significant inter-group difference in the consistency of YYB feeding among different ethnic groups, Han group is significantly higher than other 2 minority groups, respectively.

Results

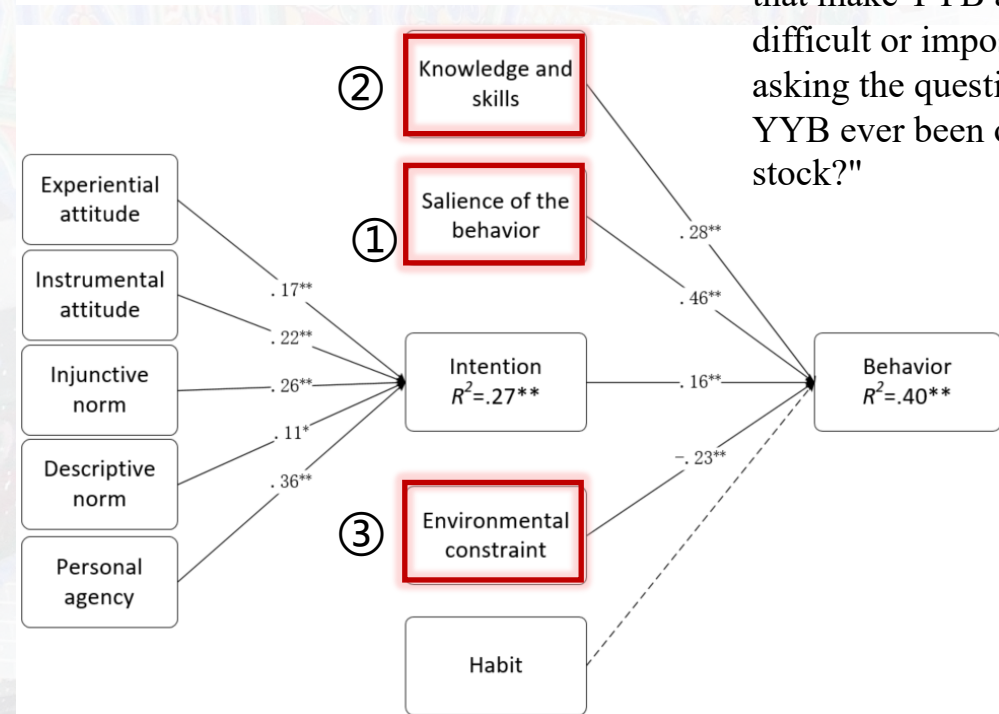
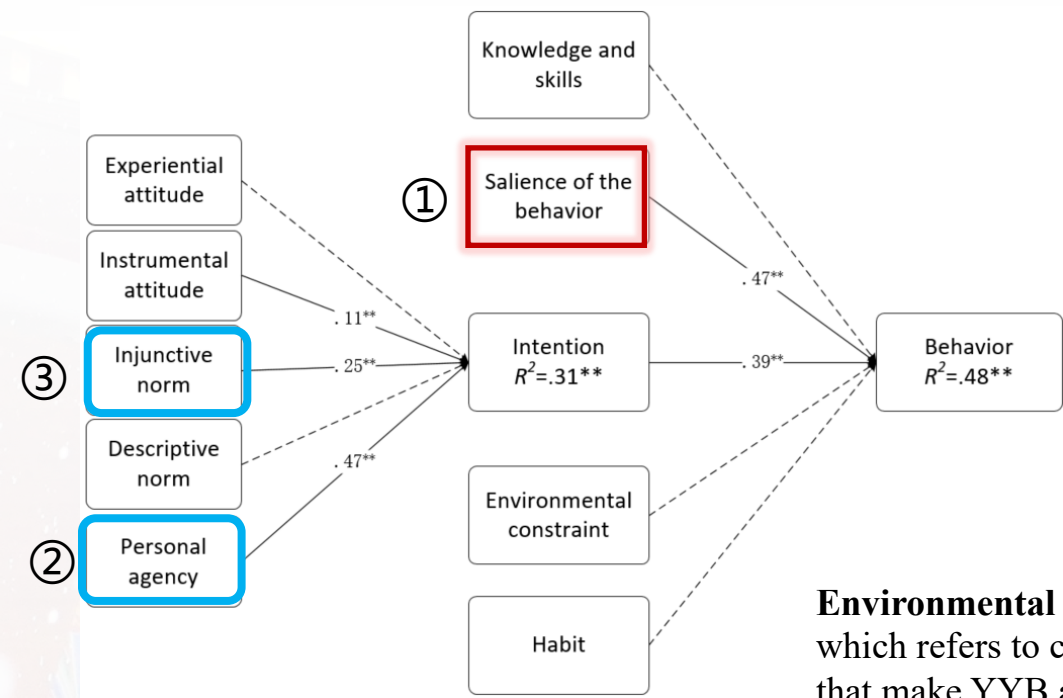
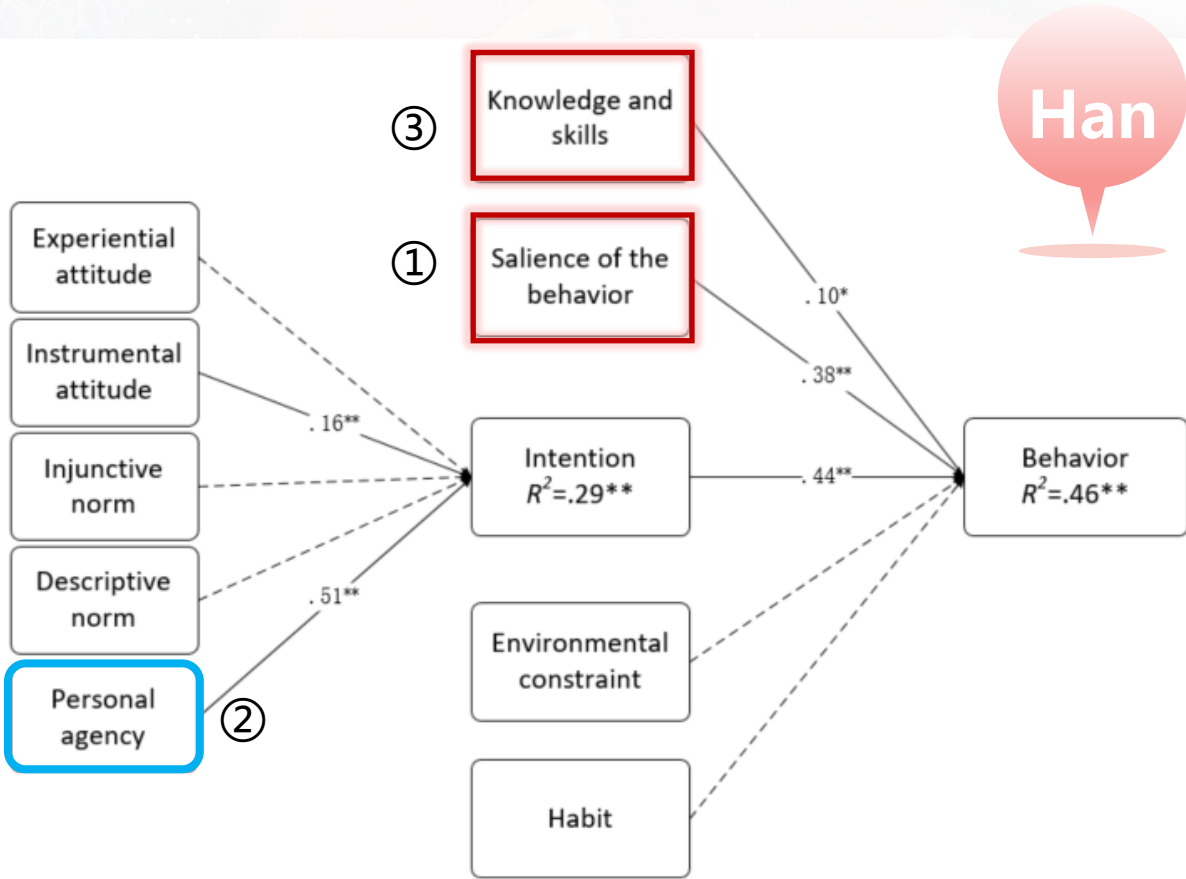
Result based on IBM for whole target population



Personal agency through three questions examining caregiver self-efficacy and perceived control in feeding the infant YYB.

Saliency of behavior, which refers to factors that remind people to consistently carry out a certain behavior.

Comparisons based on IBM among different ethnic subgroups



Environmental constraints, which refers to conditions that make YYB adherence difficult or impossible, by asking the question, "Has YYB ever been out of stock?"

Note. Path estimates with solid lines were hypothesized to be significant, broken lines were hypothesized to be non-significant. The measurement components of the latent constructs and effects of control variables was statistically significant (infants and toddlers age, ethnicity, and family economic status) have been omitted for clarity.

Conclusion

- All three measures of YYB adherence in this study showed less optimistic compliance for MNP programs in remote rural China.
- Social cognition constructs, particularly salience of behavior, knowledge and skills, and personal agency may offer some potential in promoting participation in YYB adherence behaviors.
- There are different YYB adherence among different ethnic population, with different behavior determinants.

Suggestion

The study provided the necessary information to design and implement strategies that might be helpful for improvement of such programs for caregivers in different ethnic population for rural China.

- Adherence behavioral interventions targeting changes in social cognition constructs, particularly **salience of behavior** (reminding people to consistently feed YYB), **knowledge and skills towards YYB** , and **personal agency** (self-efficacy and perceived control in feeding the infant YYB).
- Caregivers in ethnic minority areas should take more attention for intervention.



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Thanks

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