

BMJ Open Trends in disability of instrumental activities of daily living among older Chinese adults, 1997-2006: population based study

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ABSTRACT

Background Data on trends for disability in instrumental activity of daily living (IADL) are sparse in older Chinese adults.

Objectives To assess trends in prevalence and incidence of IADL disability among older Chinese adults and to explore contributing factors.

Design Population based study.

Setting 15 provinces and municipalities in China.

Subjects Participants (age ≥ 60) were from four waves of the China Health and Nutrition Survey, conducted in 1997 (n=1533), 2000 (n=1581), 2004 (n=2028) and 2006 (n=2256), and from two cohorts constructed within the national survey: cohort 1997–2004 (n=712) and cohort 2000–2006 (n=823).

Measurements IADL disability was defined as inability to perform one or more of the following: shopping, cooking, using transportation, financing and telephoning. Data were analysed with logistic regression and generalised estimating equation models.

Results The prevalence of IADL disability significantly decreased from 1997 to 2006 in the total sample and in all of the subgroups by age, sex, living region and IADL items (all $p_{\text{trend}} < 0.05$). The incidence of IADL disability remained stable from cohort 1997-2004 to cohort 2000-2006 in the total sample and in all of the subgroups (all $p > 0.10$). The recovery rate from IADL disability significantly increased over time in those aged 60–69 years ($p = 0.03$). Living in a rural area or access to local clinics for healthcare was less disabling over time ($p_{\text{trend}} < 0.02$).

Conclusions The prevalence of IADL disability decreased among older Chinese adults during 1997–2006, whereas the incidence remained stable. The declining prevalence of IADL disability might be partly due to the decreased duration of IADL disability, and to improvements in living conditions and healthcare facilities over time.

INTRODUCTION

Functional ability deteriorates progressively as people age. Given the significant impact of functional dependence on quality of life and the social care system,¹ clarifying time trends in physical disability as well as exploring modifiable risk factors for disability will have important implications for public health and

Strengths and limitations of this study

- The study had a nationwide sample with high participation rates, and the data were collected using a consistent design and approach over time.
- Certain items in instrumental activity of daily living (IADL) (eg, housekeeping and handling medications) were not available in the dataset, which might slightly affect the estimates of the prevalence and incidence of IADL disability.
- We were not able to explore the effects of other sociocultural and environmental factors and additional chronic diseases due to lack of specific data.
- The use of self-reported information on lifestyle factors and chronic diseases might lead to underestimation of their prevalence and potentially biased associations with disability.
- For the trends in incidence and recovery rates of IADL disability, participants in the two cohorts differed from those who were lost to follow-up with regard to age, education and marital status, which might affect the internal validity of the findings.
- Finally, because our study participants were relatively young (mean age 69.4 years), caution is needed when the trend in IADL disability from our study is generalised to older people.

policy development. To date, most studies on disability trends have focused mainly on basic activities of daily living (ADLs),^{2–6} which measured self-care tasks of everyday life, including feeding, dressing, bathing, toileting, transferring and continence.⁷ However, as disability in basic ADL function represents a more severe stage of physical dysfunction, it is crucial to investigate trends in functional loss from an early stage. Instrumental ADLs (IADLs), which include higher level tasks, such as using the telephone, preparing meals, shopping, housekeeping, using transportation and managing finances,⁸ usually decline prior to impairment in basic ADLs. Thus assessment of IADLs may identify

Table 1 Characteristics of participants in the surveys in 1997, 2000, 2004 and 2006

Characteristic*	1997 (n=1533)	2000 (n=1581)	2004 (n=2028)	2006 (n=2256)	P _{trend} †
Age (years)	69.0 (7.0)	69.2 (6.7)	69.5 (6.8)	69.6 (7.0)	0.007
Women	820 (53.5)	853 (54.0)	1067 (52.6)	1189 (52.7)	0.410
Education					
No formal school	993 (70.0)	892 (61.1)	1004 (49.7)	1204 (53.5)	
Primary school	218 (15.4)	275 (18.8)	501 (24.8)	429 (19.1)	
Middle school or above	207 (14.6)	294 (20.1)	515 (25.5)	616 (27.4)	<0.001
Living region					
Urban	640 (41.7)	637 (40.3)	795 (39.2)	848 (37.6)	
Rural	893 (58.3)	944 (59.7)	1233 (60.8)	1408 (62.4)	0.002
Race					
Han majority	1357 (91.0)	1404 (89.4)	1801 (88.8)	1979 (87.7)	
Minority	134 (9.0)	167 (10.6)	227 (11.2)	277 (12.3)	<0.001
Married	1027 (67.7)	1046 (69.3)	1425 (70.8)	1647 (73.2)	<0.001
Access to healthcare facility					
Hospitals	363 (35.1)	346 (32.2)	367 (27.8)	396 (28.4)	
Local clinics	671 (64.9)	729 (67.8)	952 (72.2)	997 (71.6)	<0.001
Ever smoking	444 (29.1)	450 (28.6)	686 (33.9)	743 (33.0)	<0.001
Alcohol intake	242 (16.1)	282 (18.4)	335 (16.5)	363 (16.1)	0.796
Physical inactivity	1365 (89.0)	1469 (92.9)	1903 (93.8)	2151 (95.3)	<0.001
Unfavourable diet	1038 (69.2)	1102 (70.4)	1352 (67.2)	1555 (70.0)	0.529
Chronic multimorbidity					
No	1326 (86.5)	1300 (82.2)	1493 (73.6)	1702 (75.4)	
Yes	207 (13.5)	281 (17.8)	535 (26.4)	554 (24.6)	<0.001

Values are mean (SD) for age and n (%) for other variables.

*The number of subjects with missing values was 250 for education, 52 for race, 110 for marital status, 2577 for healthcare facility, 19 for smoking, 84 for alcohol intake and 99 for diet. When these factors were considered as covariates in subsequent analyses, a dummy variable for each of these factors was created to represent those with the missing value.

†The linear trend was tested using separate generalised estimation equation regression models if applicable, controlling for age, sex, education, living region, race and marital status.

incipient decline in self-care ADLs among older adults who might otherwise appear capable and healthy.⁹ Furthermore, IADLs require higher neuropsychological functioning, which can be severely affected in people with mild cognitive impairment.^{10 11} This further supports the importance of studies on time trend in IADL dysfunction.

However, time trends for IADL disability in older adults have not been well studied. In the USA, the prevalence of IADL disability was stable among older adults during the period 1998–2008.¹² In Europe, the prevalence of IADL disability either decreased (eg, among men in Italy and The Netherlands, and among women in Denmark, France and Sweden) or remained stable among older adults aged ≥65 years in other European countries for the period 2004–2013.¹³ We have previously reported that both prevalence and incidence of ADL disability had declined during the period 1993–2006 among older Chinese adults.^{4 5} Because ADLs and IADLs measure different aspects of functional capacity, trends for IADL disability might differ from those of self-care ADL disability. However, reports from nationwide surveys on

trends in IADL disability among older Chinese adults are lacking.

Late life functional disability has been associated with demographic factors (eg, being unmarried, illiterate and not living in an urban area),¹⁴ unhealthy lifestyle (eg, smoking),¹⁵ vascular risk factors (eg, obesity, hypertension and diabetes),^{16 17} chronic diseases (eg, stroke, dementia and arthritis)¹⁸ and geriatric syndromes (eg, depressive symptoms, dizziness, falls, hearing or visual impairment, osteoporosis and sleep disturbance).¹⁹ Therefore, the time trends observed for disability might be attributable to the variations in these influential factors. For example, data from The Netherlands indicate an increase in prevalence of chronic diseases but a relatively stable prevalence of functional disability, suggesting that chronic diseases might have become less disabling.²⁰ Similarly, stroke and multiple cardiometabolic diseases were found to be less disabling in ADLs over time in China.⁴ However, the impact of these factors on IADL disability has not yet been investigated among older Chinese adults. Further

Table 2 Trends for the prevalence of instrumental activity of daily living disability over time in 1997–2006 by age, gender, living region and specific instrumental activity of daily living items

IADL disability	1997 (n=1533)	2000 (n=1581)	2004 (n=2028)	2006 (n=2256)	p _{trend} *
Total sample	597 (38.9)	562 (35.5)	554 (27.3)	601 (26.6)	<0.001
Age (years)					
60–69	266 (27.5)	231 (24.3)	181 (15.3)	180 (13.8)	<0.001
70–79	209 (48.7)	233 (46.0)	255 (37.9)	282 (37.5)	<0.001
≥80	122 (88.4)	98 (79.0)	118 (69.0)	139 (68.5)	0.002
Gender					
Men	213 (29.9)	174 (23.9)	183 (19.0)	217 (20.3)	<0.001
Women	384 (46.8)	388 (45.5)	371 (34.8)	384 (32.3)	<0.001
Living region					
Urban	202 (31.6)	159 (25.0)	168 (21.1)	194 (22.9)	<0.001
Rural	395 (44.2)	403 (42.7)	386 (31.3)	407 (28.9)	<0.001
Specific IADL items					
Shopping	150 (9.8)	140 (8.9)	185 (9.2)	221 (9.8)	0.047
Cooking	157 (10.3)	119 (7.5)	173 (8.5)	178 (7.9)	<0.001
Transportation	421 (27.8)	391 (24.8)	410 (20.3)	479 (21.4)	<0.001
Managing money	167 (11.0)	136 (8.6)	160 (7.9)	200 (8.9)	<0.001
Using telephone	355 (24.2)	336 (21.8)	281 (14.1)	290 (13.0)	<0.001

*The generalised estimation equation model was performed after controlling for age, sex, education, living region, race, marital status, access to healthcare facility, ever smoking, alcohol intake, leisure activity and chronic multimorbidity. IADL, instrumental activity of daily living.

research on how chronic health conditions and physical disability are associated over time is needed.

We hypothesised that together with the decreasing prevalence and incidence of disability in ADLs, the incidence and prevalence of IADL disability might also have decreased during the same time period in older Chinese adults. In this study, we investigated the secular trends in both prevalence and incidence of IADL disability among older Chinese adults, and also explored factors that may potentially contribute to the trends in IADL disability.

METHODS

Study design and population

Study participants were derived from the China Health and Nutrition Survey (CHNS), which is an ongoing longitudinal survey on health risk factors, nutritional status and health outcomes in Chinese populations nationwide (age ≥2 years). The study sample for CHNS was drawn from 15 provinces and municipalities through a multi-stage, randomised, cluster sampling process, as described in detail elsewhere.²¹ Counties in these provinces were stratified by income (low, middle and high), and a weighted sampling scheme was used to randomly select four counties in each province. Surveys for CHNS were conducted in 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009 and 2011, covering household, community and health/family planning facility data. Follow-up levels were high, but families who migrated from one community to a new one were not followed. Since 1997, new households

in the original communities were added to replace households no longer participating in the study. In this study, variables for IADLs were assessed only in surveys in 1997, 2000, 2004 and 2006, and the trend in the prevalence of IADL disability was assessed based on these four waves of cross sectional surveys.

We included participants who were aged ≥60 years and who had been assessed with IADLs: 1533 (participation rate, 88.3%) in 1997, 1581 (85.9%) in 2000, 2028 (92.6%) in 2004 and 2256 (94.0%) in 2006. Among these participants, 37.1%, 31.4%, 19.1% and 12.3% participated in 1, 2, 3 and all 4 waves of the survey, respectively. Compared with people who participated in only one wave, those who participated in two or more waves of the survey were younger, were more likely to be married, had a lower level of education, were more likely to drink alcohol and participate in physical activity, and were less likely to have chronic diseases, but no significant difference was found in the distribution of gender, race, living region, access to health facility, smoking or diet.

In addition, to explore changes over time in the incidence of IADL disability, we identified two consecutive cohorts within the four waves of the CHNS (cohort 1 (1997–2004) and cohort 2 (2000–2006)), as previously described.⁵ This was possible because some participants in CHNS were selected to participate in more than one wave of the survey. Specifically, cohort 1 (1997–2004) included participants who were free of IADL disability in 1997 and who were followed in 2000 or 2004 or both

Table 3 Incidence rate of instrumental activity of daily living disability by age, sex, living region and specific instrumental activity of daily living items in 1997–2004 and 2000–2006

IADL disability	Cohort 1997–2004 (n=712)				Cohort 2000–2006 (n=823)				p*
	No of subjects	No of cases	Person years	Incidence rate, per 1000 person years	No of subjects	No of cases	Person years	Incidence rate, per 1000 person years	
Total sample	712	231	3283	70.4	823	227	3818	59.5	0.110
Age (years)									
60–69	559	157	2672	58.8	612	139	2952	47.1	0.303
≥70	153	74	611	121.1	211	88	866	101.6	0.640
Gender									
Men	380	98	1887	51.9	446	112	2131	52.6	0.603
Women	332	133	1395	95.3	377	115	1687	68.2	0.124
Living region									
Urban	325	80	1639	48.8	381	95	1823	52.1	0.695
Rural	387	151	1644	91.8	442	132	1995	66.2	0.287
Specific IADLs									
Shopping	712	69	3283	21.0	823	86	3818	22.5	0.421
Cooking	712	63	3283	19.2	823	78	3818	20.4	0.707
Transportation	712	169	3283	51.5	823	182	3818	47.7	0.109
Managing money	712	60	3283	18.3	823	76	3818	19.9	0.252
Using telephone	712	104	3283	31.7	823	104	3818	27.2	0.873

*The generalised estimation equation model was performed to test the statistical difference in the incidence rates between cohort 1 (1997–2004) and cohort 2 (2000–2006) after controlling for age, sex, education, living region, race, marital status, access to healthcare facility, ever smoking, alcohol intake, leisure activity, chronic multimorbidity and follow-up time. IADL, instrumental activity of daily living.

(n=712). Similarly, cohort 2 (2000–2006) included participants who were free of IADL disability in 2000 and who were followed in 2004 or 2006 or both (n=823). In the two cohorts, compared with those who were lost to follow-ups (dropouts), persons who had at least one follow-up assessment were younger, had a lower level of education and were more likely to be married at baseline in cohort 1; baseline characteristics of participants were similar to those who were lost to follow-up except that participants were younger in cohort 2 (see online supplementary table 1).

Furthermore, we identified two cohorts of individuals with IADL disability within the CHNS to determine the recovery rate of IADL disability. The cohort 1997–2004 included individuals who were disabled in terms of IADLs in 1997 and who were followed in 2000 or 2004 or both (n=390), and the cohort 2000–2006 included those who had IADL disability in 2000 and who were followed in 2004 or 2006 or both (n=377).

Data collection and definitions

Data on demographic factors, healthcare, lifestyle and chronic diseases were collected by trained and certified health professionals through interviews and physical examinations.²¹ Education was divided into no formal

school (<1 year), primary school (1–6 years) and middle school or above (>6 years). Living region was divided into urban versus rural area (the area where most people work as farmers). Race was dichotomised into Han majority and non-Han minority.

Smoking status was categorised into never and ever (former and current) smoking. Alcohol intake was categorised into no and regular drinking (ie, regularly drinking alcoholic beverage ≥3 times a week).⁴ Physically inactive was defined as weekly physical exercise less than the equivalent of 150 min of moderate intensity aerobic physical activity or 75 min vigorous intensity aerobic physical activity.²² According to the US recommendations on dietary reference intake for total energy, acceptable macronutrient distributions are 45–65% for carbohydrates, 20–35% for fat and 10–35% for protein.²³ In this study, on the basis of a 3 day record of household meals, unfavourable diet was defined as having ≥1 of three macronutrients out of the US dietary reference intake range.⁵

Chronic multimorbidity was defined as concurrently having ≥2 chronic health conditions that included obesity (ie, body mass index ≥28 kg/m²)²⁴ and hypertension (systolic/diastolic pressure ≥140/90 mm Hg or currently

Table 4 Recovery rate of instrumental activity of daily living disability by age, sex, living region and specific instrumental activity of daily living items in 1997–2004 and 2000–2006

Characteristic	Cohort 1, 1997–2004 (n=390)*				Cohort 2, 2000–2006 (n=377)*			
	No of disabled at baseline	No of recovered at follow-ups	Person years	Recovery rate, per 100 person years	No of disabled at baseline	No of recovered at follow-ups	Person years	Recovery rate, per 100 person years
Total sample	390	131	2090	62.7	377	149	2057	72.4
Age (years)								
60–69	203	91	1155	78.8	189	101	1052	96.0
≥70	187	40	936	42.8	188	48	1004	47.8
Gender								
Men	134	57	691	82.5	109	52	589	88.3
Women	256	74	1399	52.9	268	97	1468	66.1
Living region								
Urban	120	46	646	71.2	90	33	486	67.8
Rural	270	85	1445	58.8	287	116	1570	73.9
Specific IADLs								
Shopping	390	288	2090	137.8	377	282	2057	137.1
Cooking	390	301	2090	144.0	377	312	2057	151.7
Transportation	390	194	2090	92.8	377	194	2057	94.3
Managing money	390	295	2090	141.1	377	297	2057	144.4
Using telephone	390	202	2090	96.7	377	232	2057	112.8

*Among individuals with IADL disability at baseline, 390 out of 606 (64.4%) in cohort 1, and 377 out of 574 (65.7%) in cohort 2, undertook at least one follow-up assessment.

†Generalised estimating equation models were employed to test the statistical difference in the recovery rates between cohort 1 (1997–2004) and cohort 2 (2000–2006) after controlling for race, marital status, education, access to healthcare facility, smoking, alcohol intake, physical activity, diet, chronic multimorbidity, follow-up time and, if applicable, for age, sex and living region.

IADL, instrumental activity of daily living.

Table 5 Trends in cross sectional associations of various factors with instrumental activity of daily living disability, 1997–2006

Characteristic	Odds ratio (95% CI)*				p _{trend} †
	1997 (n=1533)	2000 (n=1581)	2004 (n=2028)	2006 (n=2256)	
Age (years)	1.12 (1.10 to 1.14)	1.11 (1.09 to 1.14)	1.13 (1.11 to 1.16)	1.14 (1.12 to 1.16)	0.071
Gender (women vs men)	1.45 (1.13 to 1.87)	2.23 (1.72 to 2.88)	1.63 (1.27 to 2.09)	1.39 (1.10 to 1.75)	0.026
Education					
No formal school	Ref	Ref	Ref	Ref	
Primary school	0.37 (0.25 to 0.55)	0.42 (0.30 to 0.60)	0.55 (0.41 to 0.74)	0.78 (0.59 to 1.05)	0.001
Middle school or above	0.26 (0.17 to 0.41)	0.28 (0.18 to 0.42)	0.39 (0.28 to 0.54)	0.40 (0.30 to 0.55)	0.002
Living region (rural vs urban)	1.88 (1.47 to 2.40)	2.31 (1.79 to 2.99)	1.91 (1.50 to 2.44)	1.43 (1.13 to 1.80)	0.016
Race (minority vs Han majority)	0.82 (0.55 to 1.24)	1.32 (0.91 to 1.90)	1.07 (0.76 to 1.51)	1.27 (0.93 to 1.73)	0.469
Marital status (married vs unmarried)	0.62 (0.48 to 0.81)	0.74 (0.56 to 0.96)	0.74 (0.58 to 0.95)	0.78 (0.61 to 0.99)	0.175
Access to healthcare facility (local or village clinics vs hospital)	1.72 (1.19 to 2.51)	1.36 (0.95 to 1.97)	1.16 (0.79 to 1.70)	1.15 (0.82 to 1.63)	0.007
Ever smoking	0.81 (0.60 to 1.10)	0.98 (0.72 to 1.33)	0.98 (0.74 to 1.30)	0.95 (0.72 to 1.25)	0.095
Alcohol intake	0.71 (0.50 to 1.02)	0.77 (0.54 to 1.09)	0.53 (0.37 to 0.77)	0.56 (0.40 to 0.79)	0.372
Physical activity (inactive vs active)	1.86 (1.21 to 2.86)	3.27 (1.69 to 6.32)	2.71 (1.40 to 5.26)	3.96 (1.75 to 8.96)	0.424
Unfavourable diet	1.50 (1.15 to 1.96)	1.17 (0.90 to 1.53)	1.41 (1.10 to 1.80)	1.18 (0.93 to 1.50)	0.171
Chronic multimorbidity	2.19 (1.56 to 3.07)	1.64 (1.20 to 2.23)	1.91 (1.50 to 2.44)	2.46 (1.94 to 3.12)	0.051

*Odds ratio (95% CI) was derived from logistic regression after controlling for age, sex, education levels, living region, race and marital status.

†The trend was tested using generalised estimation equation regression models after controlling for age, sex, education levels, living region, race and marital status.

receiving antihypertensive medications)²⁵; self-reported physician diagnosis of diabetes, heart disease or myocardial infarction, and stroke; self-reported joint or muscle pain, eye/hearing problems, urinating or defecating problems, anxiety, exhaustion, unexplained weight loss, memory complaint and other chronic non-communicable conditions.

IADLs were measured according to self-reported responses to questions (ie, do you have any difficulty in doing this activity?), which involved five activities: shopping (buying food, clothes, etc), cooking, using public transportation, managing money (record income and expenses, etc) and using the telephone. Those who needed help or were unable to perform ≥ 1 of these activities were defined as having IADL disability. For some IADL items (eg, cooking), participants were coded as independent if they stated able to do even if they never did. Those having IADL disability but no disability for ADL items (eg, transferring, dressing, toileting, bathing and feeding) were defined as having only IADL disability.

Statistical analysis

Trends in baseline characteristics across the four waves of the survey were assessed using the generalised estimating equation (GEE) models to account for the correlation of repeated participation of the same individuals (eg, the same persons included in two or more surveys). The incidence of IADL disability was calculated according to person years of follow-up. For persons who did not develop IADL disability, the follow-up time was calculated from the date of the baseline survey to the date of the last contact. For those who developed IADL disability, the onset time of IADL disability was assumed to be in the midpoint between the dates of the two surveys.⁵ Furthermore, we also assessed the recovery rate in those who had IADL disability at baseline. The follow-up time for the recovery rate was calculated in the same way as that for the incidence of IADL disability. GEE models were employed to assess the trends in prevalence, incidence and recovery rates of IADL disability over time after controlling for possible covariates (eg, age, sex, education, living region, race, marital status, access to healthcare facility, ever smoking, alcohol intake, leisure activity and chronic multimorbidity).

Logistic regression models were used to examine the cross sectional associations between potential determinants and IADL disability within each survey. The GEE model was used to assess the trends in strength of associations between various factors and IADL disability across surveys, in which an interaction term between year of assessment and individual factors was included into the model together with covariates.

To assess the impact of dropouts (attrition rate) during follow-ups on the trends in incidence and recovery of IADL disability, multiple imputation analysis was performed using the Sequential Regression Imputation

Method. Five multiple imputation datasets were generated and the pooled dataset was used for estimation of trends.

IBM SPSS Statistics 22 for Windows (IBM SPSS Inc, Chicago, Illinois, USA) was used for all analyses. A *p* for trend value was provided for assessing the trend in characteristics of the study participants and the prevalence of IADL disability. A *p* value for two group comparison was provided for the incidence and recovery rate of IADL disability. Statistical significance was set at $p \leq 0.05$.

RESULTS

Over time, from the survey in 1997 to 2006, participants were older and more likely to be educated, live in a rural region, have a minority race, be married, smoke and have chronic multimorbidity (all $p_{\text{trend}} < 0.01$) but less likely to go to hospital (vs local clinic) for healthcare and participate in physical activity (both $p_{\text{trend}} < 0.001$). The proportions of women, alcohol intake and unfavourable diet did not differ significantly across surveys ($p_{\text{trend}} > 0.40$) (table 1).

After controlling for covariates, the prevalence of IADL disability significantly decreased in the total sample and in all subgroups by age, sex and living regions (all $p_{\text{trend}} < 0.01$). The prevalence of disability in all IADL items decreased over time (all $p_{\text{trend}} < 0.05$) (table 2). In addition, the declining trend in the prevalence of IADL disability was unchanged after excluding persons with ADL disability, except for the prevalence of disability in shopping or cooking, which was relatively stable (both $p_{\text{trend}} > 0.10$) (see online supplementary table 2).

The incidence of IADL disability was stable between 1997–2004 and 2000–2006 in the total sample, in all subgroups by age, sex and living regions, and in all IADL items (all $p > 0.10$) (table 3). Furthermore, the multiple imputation analysis showed similar results in terms of the time trends in incidence of IADL disability (data not shown).

Among individuals who had IADL disability, the recovery rate from IADL disability marginally increased over time in the total sample ($p = 0.057$) and significantly increased among those aged 60–69 years ($p = 0.03$). For individual items of IADLs, the recovery rate significantly increased over time for disability in cooking ($p = 0.019$) and using the telephone ($p = 0.009$), whereas there was no change in the other three items (table 4). The multiple imputation analysis showed a similar trend in recovery rate of IADL disability (data not shown).

Logistic regression model showed that IADL disability was significantly associated with older age, female sex, low education, living in a rural area, being unmarried, being physically inactive and having multimorbidity at each survey, with local or village clinics (vs hospitals) in 1997, with regular alcohol intake in 2004 and 2006, and with unfavourable diet in 1997 and 2004. The GEE model showed that women were less likely to have IADL disability over time ($p_{\text{trend}} = 0.026$); the protective effects of

education on IADL disability decreased over time (both $p_{\text{trend}} < 0.01$); living in a rural area or having access to local or village clinics for healthcare services was less disabling over time ($p_{\text{trend}} < 0.02$); however, chronic multimorbidity tended to become more disabling in IADLs across the surveys ($p_{\text{trend}} = 0.051$) (table 5).

DISCUSSION

Findings from this nationwide study add to the current literature with regard to the time trends in occurrence of IADL disability (prevalence, incidence and recovery rates) as well as the potential contributing factors to trends among older Chinese adults. Specifically, the prevalence of IADL disability among people aged ≥ 60 years decreased from 1997 to 2006. The incidence of IADL disability was stable along with the improvement in recovery from IADL disability during the same period. The decreasing prevalence of IADL disability might be partly due to the less disabling effect of living in a rural area or having access to local clinics for healthcare services.

In line with the findings from the Shanghai region,²⁶ our nationwide data showed a decreasing trend in prevalence of IADL disability among older Chinese adults during 1997–2006. Of note, while the incidence of IADL disability remained stable from cohort 1997–2004 to cohort 2000–2006, the recovery rate of IADL disability was increased (or duration of disability was decreased) during the same period. Therefore, the declining prevalence of IADL disability was partly attributable to the increase in recovery from IADL disability over time. Functional disability is a complex and dynamic process that involves not only biological and chronic conditions but also a social and environmental context. Older people may experience frequent transition from being independent to dependent or vice versa. Our study emphasises that recovery needs to be considered when examining the time trends in the prevalence of functional disability.

To the best of our knowledge, the secular trends in disability for specific IADL items have not been reported previously in older Chinese adults. We found a declining prevalence of disability in all specific IADL items, which was different from the previous findings from other countries.^{27 28} The US Health and Retirement Study showed that the prevalence of disability decreased for shopping but did not change for other items (eg, managing money, preparing meals, using the phone and taking medication) during the period 1995–2004.²⁷ A Swedish study of 75-year-olds showed a decrease in the prevalence of disability for cleaning and using transportation but not for shopping and cooking during the period 1976–2006.²⁸ The inconsistent findings could be partly due to differences in the characteristics of the study populations (eg, age, education and ethnicity) and study settings.²⁹

The trends in IADL disability are likely to be determined by multiple influential factors for IADL disability. Participants had higher levels of education over time, which might contribute to the declining prevalence of

IADL disability, although the effect of education tended to decrease over time.⁵ Furthermore, living in rural areas was associated with an increased risk of IADL disability, but its disabling effect decreased over time. Indeed, socioeconomic environment and living conditions in rural China have improved greatly during the study period,³⁰ which might contribute to both the declining prevalence and increasing recovery of IADL disability.³¹ In addition, the less disabling effect of access to local clinics (vs hospitals) for healthcare might reflect the gradual improvement in healthcare service and basic infrastructure in rural China over time.^{30 32}

Of note, chronic multimorbidity was found to be less disabling in basic self-care ADLs over time in earlier studies.^{4 20} There may be different explanations for this: first, improvement in living environment as well as an increase in the use of aids and devices to facilitate greater independence of older adults with chronic diseases; and second, advancements in medical and health services lead to early diagnosis and better treatment of chronic diseases (eg, stroke).^{33 34} However, our data showed that chronic multimorbidity appeared to have a more disabling impact on IADLs over time. As dependence in IADLs may indicate an early sign of functional decline in old age, intervention programmes targeting major modifiable risk factors for chronic diseases might help to reduce the risk of IADL disability and its progression to disability in self-care ADLs.

The major strength of this study was the nationwide sample derived from the large and diverse population in China. Moreover, data were collected using consistent approaches over time. In addition, the participation rates across the four waves of the survey were high (86–94%). However, this study also had limitations. First, certain items in the IADL (eg, housekeeping and handling medications) were not available in the CHNS dataset, which might affect estimates of the prevalence and incidence of IADL disability.³⁵ Second, we were not able to explore the effects of other sociocultural and environmental factors (eg, improved medical techniques, social and family support, improvements in housing and public transport) and additional chronic diseases (eg, chronic obstructive pulmonary disease and dementia) due to lack of specific data. Third, the use of self-reported information on lifestyle factors and chronic diseases might lead to underestimation of their prevalence and potentially biased associations with IADL disability. Fourth, participants in the two cohorts did differ from those who were lost to follow-up with regard to demographic features (eg, age, education and marital status), which might affect the internal validity of the findings. Finally, because our study participants were relatively young (mean age 69.4 years), caution is needed when the trend in IADL disability from our study is generalised to older people.

In summary, the prevalence of IADL disability among older Chinese adults decreased during the period 1997–2006, along with a stable incidence and an increased recovery rate from IADL disability. The favourable trend in prevalence of IADL disability might be partly

attributable to the improved living environment, and to better healthcare services and facilities in local areas.

Contributors YL and CQ conceived the study idea, analysed and interpreted the data, and prepared the manuscript. YL, A-KW, JM and CQ revised the manuscript, read the final version of the manuscript and approved the submission.

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Competing interests None declared.

Patient consent Obtained.

Ethics approval The China Health and Nutrition Survey (CHNS) was approved by the Review Committees of the University of North Carolina at Chapel Hill, North Carolina, USA, and the Chinese Centre for Disease Control and Prevention, Beijing, China. All participants provided written informed consent prior to the surveys.

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