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The effects of organization and community embeddedness on public health professionals' intention to stay during the COVID-19 pandemic: a cross-sectional study

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Abstract

Background The recruitment and retention of public health professionals are critical to the effective functioning of public health systems and the promotion of population health, especially in the face of pandemic threats. This study aims to examine how job embeddedness, job satisfaction, work-related factors, and COVID-19-related factors affect the intention to stay of public health professionals, and explore the potential mediating roles of job embeddedness in explaining these effects.

Methods A cross-sectional survey was conducted among 912 public health professionals from January to March, 2022. Hierarchical multiple regressions were performed to explore the relationships between factors and intention to stay. We used path analysis to examine how job embeddedness affected these relationships.

Results Public health professionals with high job embeddedness had high levels of intention to stay in their jobs. Job satisfaction, perceptions of Centers for Disease Control and Prevention (CDC) work, and COVID-19 influence were directly related to intention to stay. In addition, job satisfaction, perceptions of CDC work, family factors, and COVID-19 influence indirectly affected intention to stay via organization-embeddedness; job satisfaction and family factors indirectly affected intention to stay via community-embeddedness.

Conclusions Highly embedded public health professionals who are satisfied with their current jobs and have gained family support have high levels of intention to stay. Highly job embeddedness and a sound work–life balance can inspire staff to stay in their current jobs and actively engage in public health tasks in the face of high turnover rates and pressure.

Keywords Public health professionals, Job embeddedness, Intention to stay, COVID-19, Retention

Introduction

The global spread of the COVID-19 pandemic underscores the heightened relevance and critical nature of public health, exposing vulnerabilities and fragmentation within health systems characterized by limited public health capacities and governance[1]. Effective delivery of public health services, enhancement of both population and individual health, and reduction of disease burden require performing essential public health functions (EPHFs)[1], as well as the availability and

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adequate distribution of a highly skilled and competent public health workforce[2]. Applying EPHFs ensures public health services and complements both health care and emergency response, facilitating the recovery and strengthening of health systems in the post-COVID-19 period era [1]. An adequate quantity and quality of the public health workforce is recognized as an essential component of EPHFs and a key enabler of its functioning [1, 3]. Developing a competent and fit-for-purpose public health workforce is essential to attain the goals of universal health coverage, global health security, and improved health and well-being [3]. Public health systems worldwide have been underfunded and understaffed for at least a decade, exacerbating numerous public health workforce challenges, and affecting the ability to retain the skilled workforce [4, 5], even in developed countries like the United States [6], Canada [7], and Australia [8], and even more in developing countries like China [9]. Due to comparatively low salaries and social benefits, China's public health workforce has seen substantial turnover [9]. Given the size of the country's population and the zero-COVID policy (The zero-COVID policy, more specifically the dynamic zero-COVID policy, is a measure against COVID-19 in China [10]. It highlights proactive and timely measures to contain domestic virus outbreaks before they reach uncontrollable levels, rather than indicating absolute "zero infection".). Public health workers are facing unprecedented stress and hardship, especially after the outbreak of COVID-19. Large populations are exposed to increasing infection risks following China's pandemic-optimized policy revisions since December 2022 (implementation of loosened anti-COVID-19 measures) [11]. Public health experts are under increasing pressure to safeguard public health and mitigate the pandemic's negative effects on societal development. The public health workforce is understaffed and encounters a dilemma of staff shortages and heavy workloads. Leider et al. found that nearly half of all employees in state and local public health agencies left between 2017 and 2021 (started before and continued throughout COVID-19) in the United States [12]. It also suggested that this trend was anticipated to continue in recent years, characterized by a rapid and ongoing occurrence of employee separations. High turnover among well-skilled public health professionals has led to a loss of institutional capacity, a decline in the quality of public health services, and an increased disease burden, hindering the development of Centers for Disease Control and Prevention (CDC) and public health [13]. Retaining qualified public health professionals and placing enough of them in the workforce are priorities.

Recent studies on human resources have tended to explore the experience of retaining employees in a more positive light [14]. Exploring employees' intention to stay can inspire them to become more integrated into the organization and positively impact their work performance [15]. Studies in China [16, 17] have mainly examined the intention of doctors and nurses to quit or stay in their current jobs, with little attention to public health professionals. Enhancing the intention to stay of public health professionals can help to create a stable public health workforce. Therefore, we considered it extremely important to examine the intention to stay of public health professionals, and planned to answer these calls by examining the effects of job embeddedness on the intention to stay.

Introduced by Mitchell et al. [18], job embeddedness refers to the net of influences affecting employee retention. The drivers and forces, affecting the intention of employees to stay with an organization, contain organization and community forces. Job embeddedness theory posits that the greater the forces that bind employees to organizations and communities, the less likely they are to leave their employer voluntarily [18–20]. Higher attachment to the organization and a lower likelihood of leaving are related to organization-embeddedness [18, 20]. Community-embeddedness represents the force to stay with an organization that is associated with non-work elements [18], in the form of social ties in the community and family factors. Studies have found that employees with highly community-embeddedness are more involved in activities to suit their lifestyle, and are less inclined to change and relinquish their work [21]. Drawing from the Job Embeddedness Model, we developed a conceptual model that focuses on public health professionals who are currently working at CDC. Our model combined with the literature [16] on job satisfaction to explicate how intention to stay is influenced by job satisfaction. We predicted that higher job satisfaction, more satisfying family factors and perceptions of CDC work would be associated with higher levels of organization and community embeddedness. Moreover, these factors, either directly or indirectly, were anticipated to be linked to increased intention to stay, as mediated by job embeddedness. Our research was conducted within the context of the zero-COVID policy and the normalized control of the pandemic, exerting enduring influences on the CDC and the work of public health professionals, persisting even after the optimal adjustment of the policy. Consequently, we included COVID-19 as an associated variable in the model. We hypothesized that the variables related to COVID-19 would be associated with job embeddedness, potentially influencing the intention to stay, either directly or indirectly through the mediation of job embeddedness.

Overall, we initially hypothesized that job embeddedness directly affects the intention to stay (Hypothesis 1). Specifically, we proposed that both organization and community embeddedness have direct effects on the intention to stay, which we further detailed as H1a and H1b. We hypothesized that job satisfaction, work-related factors, and COVID-19-related factors may be related to organization-embeddedness (Hypothesis 3, further divided into H3a, H3b, H3c, H3d, and H3e) and community-embeddedness (Hypothesis 4, further divided into H4a, H4b, H4c, H4d, and H4e), as well as directly related to intention to stay (Hypothesis 2, further divided into Hypothesis H2a, H2b, H2c, H2d, and H2e). We also proposed a mediation hypothesis that job embeddedness may mediate the relationship between job satisfaction, work-related factors, and COVID-19-related factors and intention to stay (Fig. 1).

Combining the tangible individual factors, the context of the COVID-19 pandemic and related policies, this study is the first to examine factors affecting the formation of a stable public health workforce from multiple dimensions. This study examined how job embeddedness, job satisfaction, work-related factors, and COVID-19-related factors affect the intention to stay of public health professionals in the real world, and tested the potential mediating roles of organization and community embeddedness in explaining these effects.

Methods

Participants and procedure

The cross-sectional survey was conducted from January 15th to March 10th, 2022, in Zhejiang, an eastern province of China with a population of over 65 million and the fourth-highest GDP among Chinese provinces. A multistage stratified sampling method was utilized to choose the Centers for Disease Control and Prevention (CDC), where the survey would be administered, and a cluster sampling method was utilized to select

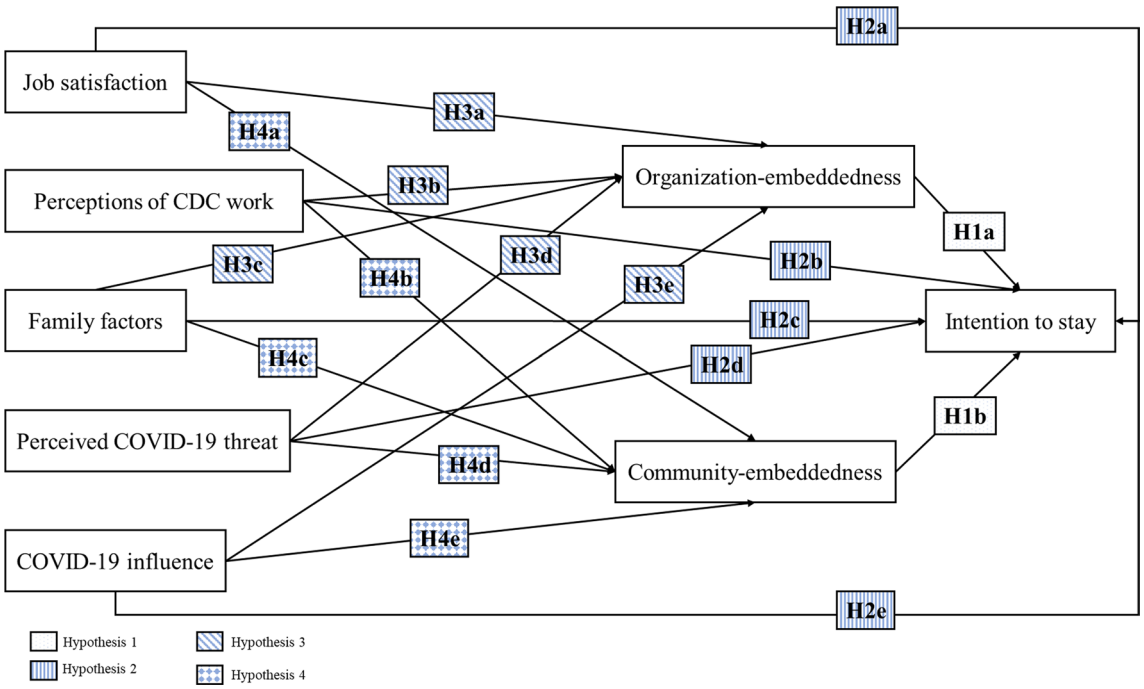

Fig. 1 Conceptual model. ***H1a*:** the direct effect of organization-embeddedness on intention to stay; ***H1b*:** the direct effect of community-embeddedness on intention to stay. ***H2a*:** the direct effect of job satisfaction on intention to stay; ***H2b*:** the direct effect of perceptions of CDC work on intention to stay; ***H2c*:** the direct effect of family factors on intention to stay; ***H2d*:** the direct effect of perceived COVID-19 threat on intention to stay; ***H2e*:** the direct effect of COVID-19 influence on intention to stay. ***H3a*:** the indirect influence of job satisfaction via organization-embeddedness on intention to stay; ***H3b*:** the indirect influence of perceptions of CDC work via organization-embeddedness on intention to stay; ***H3c*:** the indirect influence of family factors via organization-embeddedness on intention to stay; ***H3d*:** the indirect influence of perceived COVID-19 threat via organization-embeddedness on intention to stay; ***H3e*:** the indirect influence of COVID-19 influence via organization-embeddedness on intention to stay. ***H4a*:** the indirect influence of job satisfaction via community-embeddedness on intention to stay; ***H4b*:** the indirect influence of perceptions of CDC work via community-embeddedness on intention to stay; ***H4c*:** the indirect influence of family factors via community-embeddedness on intention to stay; ***H4d*:** the indirect influence of perceived COVID-19 threat via community-embeddedness on intention to stay; ***H4e*:** the indirect influence of COVID-19 influence via community-embeddedness on intention to stay

participants. Four cities in Zhejiang representing developed (i.e., Hangzhou and Shaoxing) and less-developed (i.e., Quzhou and Lishui) levels of economic development were randomly selected. One municipal CDC was selected from each city, and five districts and county CDCs in each city were randomly selected. A questionnaire survey of all the CDCs' public health professionals was conducted at a total of 24 CDCs. Potential participants later received a text message containing a link to an online survey through the organization's internal network. The text message explained that their decision to participate would not be shared with their institution, and all responses would be confidential and used for research purposes only. Personnel working in logistics and off-duty were excluded. A total of 940 public health professionals were contacted, with 915 completed surveys (response rate 97.34%), among which 3 (0.3%) were excluded for inconsistency in logic questions. The final analytic sample was 912. The questionnaire was validated through a pilot with 35 public health professionals through face-to-face interviews in Hangzhou and Quzhou city.

Measures

Sociodemographic characteristics

Sociodemographic characteristics included in the analysis were participants' age, gender (1—male; 2—female), marital status (1—unmarried; 2—married; 3—divorced/widowed), education level (1—junior college and below; 2—undergraduate; 3—graduate and above), city (1—Hangzhou; 2—Shaoxing; 3—Quzhou; 4—Lishui), level of CDC (1—city; 2—county/district), and monthly average income [≤3000 ($436); 3001–5000 ($437–729); 5001–7000 ($730–1020); 7001–9000 ($1021–1312); 9001–11000 ($1313–1604); 11 001–13 000 ($1605–1896); 13 001–15 000 ($1897–2187); >15000 ($2188)]. These variables, except for age, were defined as categorical variables. We did not differentiate between master's or doctoral degrees in this study, and all staff were specializing in public health. Based on qualitative interviews, all staff during the pandemic need to engage in certain epidemic-related tasks. Consequently, the categorization of respondents' departments refrained from further subdivision, merely distinguishing between operational departments (e.g., infectious disease prevention and control, prevention and control of chronic non-communicable diseases, nutrition and food safety, etc.) and administrative departments (e.g., general office, personnel department, etc.).

Job satisfaction

Job satisfaction was measured by the Minnesota Satisfaction Questionnaire-Short form (MSQ-short) [22], which has been widely used in the Chinese population [23, 24]. The 20-item short form MSQ used a 5-point Likert-type scale, ranging from 1 (very dissatisfied) to 5 (very satisfied). Scores are created by summing items to show each participant's satisfaction level ranging from 20 (low level of job satisfaction) to 100 (high level of job satisfaction). The Cronbach's alpha was 0.96 in this study.

Work-related items

Work-related items included two components of perceptions of CDC work and family factors. These two parts were based on previous studies [25–27] and qualitative interviews with 30 public health professionals before the survey. Six items were used to measure participants' feelings toward CDC work, focusing primarily on how public health professionals viewed the agency, its management style, occupational security, and career promotion opportunities. These items were designed based on existing literature [2, 13], and sample items included "The CDC's performance evaluation comprehensively reflects your contributions". Participants rated their agreement with each item on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). All responses to six questions were summed. Higher scores of perceptions of CDC work mean stronger recognition of the organization's management, occupation, and development opportunities.

Questions about family factors were summarized through qualitative interviews, and measured by four items: caring for family members, getting family support, working close to home, and living with family members. Ratings were completed on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree), then summing across all four items. A sample item was, "My work can receive understanding and support from my family". Higher scores for the family factors indicate that public health professionals receive more family support and greater agreement on work from their family members.

COVID-19-related items

COVID-19-related items included perceived COVID-19 threat and COVID-19 influence. Perceived COVID-19 threat was measured by a question, "How do you think about the threat of CDC work during the pandemic?" Participants can score within a range of 1–10 points, with smaller values indicating lower perceived threat and larger values indicating greater perceived threat. COVID-19 influence, a total of eight items, included the impact of COVID-19 on workload, wages, benefits, and the level of attention. Items were rated from 1 (Significantly increased) to 5 (significantly decreased). Regarding the impact of COVID-19 on workload, participants were asked questions like, "How has your workload

changed compared with that before COVID-19". In this context, higher scores indicated a decrease in workload, which was generally perceived as a beneficial outcome by employees. The impact of COVID-19 on wages, benefits, and the level of attention to public health professionals was reverse-scored, meaning that higher scores indicated an increase in these factors after the pandemic. This increase was also considered beneficial by employees. Overall, the higher the scores of COVID-19 influence, the more beneficial the influence of COVID-19 on workload, wages, benefits, and attention.

Job embeddedness

We measured job embeddedness using a modified version of the measure created by Lee et al. [27]. In the analysis, job embeddedness was divided into organization-embeddedness and community-embeddedness [18]. Organization-embeddedness was measured by a 33-item, 5-point Likert-type (1 strongly disagree, 5 strongly agree) global embeddedness measure. A sample item was "I feel like I am a good match for the agency". All items were revised to include the CDC name in place of "agency". Community-embeddedness was measured by a 14-item measure, using the same 5-point Likert-type. Sample items included "I really love the place where I live". Cronbach's alpha for the overall job embeddedness was 0.95.

Intention to stay

Intention to stay was assessed with seven items, of which three items were adapted from measures of turnover intention [27] and four items were adapted from Turnley and Feldman [28]. These items were anchored from 1 (strongly disagree) to 5 (strongly agree). The intention to stay score was the sum of seven items, with reverse scoring for turnover intention. Higher intention to stay scores indicate a greater willingness to stay at the current organization. In this study, Cronbach's alpha for the scale was 0.87.

Statistical analysis

Descriptive analyses, presented as frequencies and percentages, and mean and standard deviation, were performed. Pearson correlations were used to examine the bivariate associations for study variables. We also included the means and standard deviations for each variable. To mitigate potential misunderstandings and enhance clarity, the means and standard deviations in the tables refer to the sum scores, not the average scores. The use of sum score or average score does not affect the statistical conclusions of correlation, regression, and mean comparison, but only affects the specific mean and standard deviation [29, 30].

To investigate the hypothesized relationships between potential explanatory variables and public health professionals' intention to stay (dependent variable), hierarchical multiple regression analyses were employed. First, the effects of control variables such as sociodemographic characteristics variables on intention to stay were estimated. Second, the main effects of predictor variables, including job satisfaction, perceptions of CDC work, family factors, perceived COVID-19 threat, and COVID-19 influence, were added to the regression model. Third, the effects of public health professionals' organization-embeddedness and community-embeddedness were added. In addition, path analysis was used to test the hypothesized model and its paths between the related constructs. Finally, the SPSS macro PROCESS suggested by Hayes [31] was used to examine the hypothesized structural model and the mediating effects. A bootstrapping procedure with bias-corrected confidence estimates was also used to confirm the mediating effects and indirect relationships [32]. Path analysis was performed using Amos 21.0 (Arbuckle JL and 18 SPSS Inc., Chicago, USA), and any other analyses were conducted using the SPSS 21.0 for Windows. A p value of less than 0.05 was considered statistically significant.

Results

As shown in Table 1, many respondents were female (55.3%), married (71.8%), possessed an undergraduate education level (67.7%), and earned a monthly average income of 5001–7000 RMB (17.3%). The mean age of the respondents was 38.57 years old (SD 9.79). Most of them were from Shaoxing (35.3%) and worked in a county/district CDC (72.9%). The means and standard deviations of job satisfaction [68.34 (11.67)], perceptions of CDC work [19.53 (3.98)], family factors [14.81 (3.40)], perceived COVID-19 threat [8.20 (2.08)], COVID-19 influence [20.74 (3.27)], organization-embeddedness [106.26 (16.17)], community-embeddedness [48.16 (7.56)], and public health professionals' intention to stay [24.20 (4.99)] are reported in Table 2.

Table 2 presents the correlations for our study variables. Apart from the relationships between family factors and perceived COVID-19 threat, and between perceived COVID-19 threat and community-embeddedness, there were significant correlations between any two variables, of which the relationships between perceived COVID-19 threat and other variables were negatively correlated (all p values < 0.05).

Table 3 shows the results of the hierarchal multiple regression analysis. All variables used in the model were checked for multicollinearity by examining the variance inflation factors (VIF). No issue was detected, since all VIF values were lower than 5 and not beyond the

Table 1 Characteristics of the respondents ($N=912$)

Variables	*n* (%) / M (SD)[a]
Age M (SD)	38.57 (9.79)
Gender *n* (%)	
Male	408 (44.7)
Female	504 (55.3)
Marital status *n* (%)	
Unmarried	228 (25.0)
Married	655 (71.8)
Divorced / Widowed	29 (3.2)
Education level *n* (%)	
Junior college and below	128 (14.0)
Undergraduate	617 (67.7)
Graduate and above	167 (18.3)
City *n* (%)	
Hangzhou	223 (24.5)
Shaoxing	322 (35.3)
Quzhou	197 (21.6)
Lishui	170 (18.6)
Level of CDC *n* (%)	
City	247 (27.1)
County/district	665 (72.9)
Monthly average income (RMB) *n* (%)	
≤3000 ($436)	39 (4.3)
3001–5000 ($437–729)	153 (16.8)
5001–7000 ($730–1020)	158 (17.3)
7001–9000 ($1021–1312)	143 (15.7)
9001–11000 ($1313–1604)	152 (16.7)
11,001–13000 ($1605–1896)	108 (11.8)
13,001–15000 ($1897–2187)	76 (8.3)
>15,000 ($2188)	83 (9.1)

N number, *M* means, *SD* standard deviation

threshold of 10[33]. Job satisfaction (B = 0.13, SE = 0.02, $p<0.001$), perceptions of CDC work (B = 1.62, SE = 0.29, $p<0.001$), family factors (B = 0.80, SE = 0.17, $p<0.001$), and COVID-19 influence (B = 0.92, SE = 0.38, $p<0.05$) were positively associated with public health professionals' intention to stay, whereas no main effect was found for perceived COVID-19 threat (B = −0.08, SE = 0.07). Hence, H2a, H2b, H2c and H2e were supported, while H2d was not. Furthermore, we found that organization-embeddedness (B = 2.38, SE = 0.44, $p<0.001$) and community-embeddedness (B = 1.58, SE = 0.37, $p<0.001$) had positive effects on intention to stay, supporting H1a and H1b.

Figure 2 [standardized path analysis results from the total sample ($n=912$)] shows the standardized path model results, including the estimated standardized path loadings and interrelationships between the observational variables for the path analysis model. The results of the model fitting parameters showed that the p value of each path was < 0.05, which was reserved, and the model was modified using the correction index. Each fitness index had a good fit, see Fig. 2 for details. Consistent with H1a and H1b, organization-embeddedness (standardized $\beta=0.29$) and community-embeddedness (standardized $\beta=0.21$) were positively associated with intention to stay (all p values < 0.001). Furthermore, H2a, H2b, and H2e were supported by the significant effects of job satisfaction (standardized $\beta=0.13$), perceptions of CDC work (standardized $\beta=0.12$), and COVID-19 influence (standardized $\beta=0.08$) on intention to stay (all p values < 0.05). We did not find support for H2c and H2d. Using standardized path analysis, we tested the mediation hypothesis (H3 and H4). The indirect effects of job satisfaction (standardized $\beta=0.53$), perceptions of CDC work (standardized $\beta=0.15$), family factors (standardized $\beta=0.16$), and COVID-19 influence (standardized $\beta=0.09$) on intention to stay via organization-embeddedness were significant (all p values < 0.001), supporting H3a, H3b, H3c, and H3e. Similarly, the indirect effects of job satisfaction (standardized $\beta=0.24$) and family factors (standardized $\beta=0.62$) on intention to stay via community-embeddedness were significant (all p values < 0.001),

Table 2 Correlations among study variables

Variables	Mean	SD	1	2	3	4	5	6	7
1. Job satisfaction	68.34	11.67							
2. Perceptions of CDC work	19.53	3.98	0.676**						
3. Family factors	14.81	3.40	0.344**	0.253**					
4. Perceived COVID-19 threat	8.20	2.08	− 0.127**	− 0.187**	0.038				
5. COVID-19 influence	20.74	3.27	0.439**	0.518**	0.124**	− 0.279**			
6. Organization-embeddedness	106.26	16.17	0.728**	0.601**	0.395**	− 0.097**	0.429**		
7. Community-embeddedness	48.16	7.56	0.449**	0.338**	0.699**	− 0.009	0.206**	0.551**	
8. Intention to stay	24.20	4.99	0.546**	0.489**	0.348**	− 0.127**	0.366**	0.602**	0.479**

**$p<0.01$

*$p<0.05$

Table 3 Results of hierarchal multiple regression analysis for public health professionals' intention to stay

Variables	Model 1		Model 2		Model 3	
	B	SE	B	SE	B	SE
Age	0.08**	0.03	0.08***	0.02	0.06**	0.02
Gender	1.67***	0.33	0.65*	0.27	0.66*	0.26
Marital status—unmarried	0.155	0.48	−0.25	0.39	0.32	0.39
Marital status—divorced/widowed	0.10	1.03	1.11	0.83	0.65	0.81
Education—undergraduate	− 0.24	1.00	0.92	0.80	0.27	0.78
Education—graduate and above	− 1.423	1.09	0.83	0.89	0.13	0.86
Level of CDC	− 0.99*	0.39	0.26	0.32	0.29	0.31
Monthly average income	0.45***	0.09	0.26**	0.08	0.18*	0.07
Job satisfaction			0.13***	0.02	0.07***	0.02
Perceptions of CDC work			1.62***	0.29	1.12***	0.29
Family factors			0.80***	0.17	0.04	0.21
Perceived COVID-19 threat			− 0.08	0.07	− 0.09	0.06
COVID-19 influence			0.92*	0.38	0.72	0.37
Organization-embeddedness					2.38***	0.44
Community-embeddedness					1.58***	0.37
R^2	0.09		0.42		0.45	
F	11.33***		49.26***		49.72***	
ΔR2	0.09		0.33		0.04	
ΔF	11.33***		100.03***		31.17***	
VIFmax	3.12		3.17		3.19	

B the unstandardized coefficient

SE standard error

***$p < 0.001$

**$p < 0.01$

*$p < 0.05$

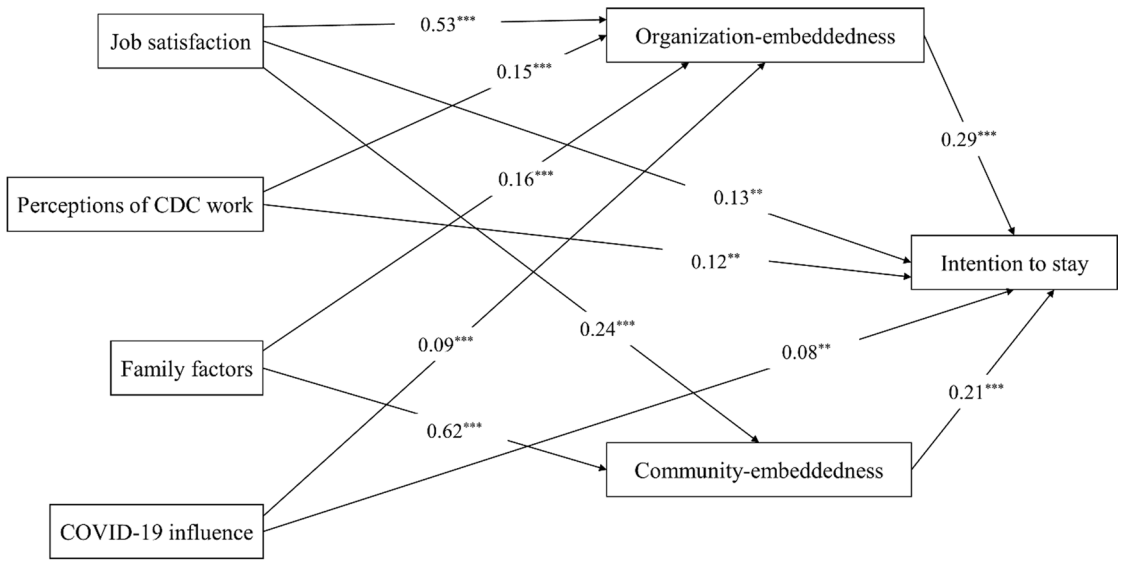

Fig. 2 Standardized path analysis results from the total sample ($n = 912$). Each fitness index had a good fit: $p = 0.454 > 0.05$; $X^2/df = 0.874 < 3$; GFI = 0.999 > 0.9; AGFI = 0.992 > 0.9; FI = 1.000 > 0.9; RMSEA = 0.000 < 0.05

supporting H4a and H4c. H3d, H4b, H4d and H4e were, therefore, not supported.

To confirm the mediating effects and direct and indirect relationships, Table 4 displays the bootstrapping procedure with bias-corrected confidence estimates. Job satisfaction had both direct and indirect effects on intention to stay; the direct and indirect effect values were 0.128 and 0.204, respectively. Perceptions of CDC work had both direct and indirect effects on intention to stay; the direct and indirect effect values were 0.115 and 0.042, respectively. COVID-19 influence had both direct and indirect effects on intention to stay; the direct and indirect effect values were 0.083 and 0.027, respectively. Moreover, family factors only had an indirect effect on the intention to stay; the indirect effect value was 0.175.

Discussion

For public health professionals in China, this study is the first to address the intention to stay articulated from a positive perspective utilizing Job Embeddedness Theory. The study found that public health professionals with higher organization and community embeddedness had a stronger intention to stay. Reasonable job satisfaction, positive perceptions of CDC work, and strong family support contribute to the intention to stay; COVID-19's unexpected influence serves as a disincentive. Perceptions of CDC work, family factors, and COVID-19 influence had indirect effects on intention to stay via organization-embeddedness; job satisfaction and family factors were also indirectly associated with intention to stay via organization and community embeddedness.

We draw from the Job Embeddedness Model to advance and test a conceptual model of public health professionals' intention to stay in the COVID-19 context. Specifically, our model extends relevant studies by investigating public health professionals' job embeddedness and the relationships to intention to stay, whereas previous researches had mainly focused on job embeddedness and turnover intention of healthcare workers [16, 17, 34, 35]. This study shows that job embeddedness is an important factor in predicting the intention to stay of public health professionals. Those who were better integrated into their organizations and communities were more likely to express a strong desire to stay. Based on the Conservation of Resources theory, more embedded employees in the organization may have more resources to meet their requirements [36, 37]. Consequently, embedded individuals can better catch their goals and are more likely to favor their current job over the alternative [36, 38, 39]. As Sender et al. [40] argued that due to cultural differences, Chinese employees would attach more importance to job embeddedness-related resources. Consistent with Decha's [41], the high job embeddedness of public health professionals is likely to strengthen the connection between individuals and organizations, helping build deeper perceptual forces that enmesh employees in their jobs.

This study showed that organizational factors (job satisfaction and perceptions of CDC work), family support (family factors), and social context (COVID-19 influence) played critical roles in the intention to stay. Job satisfaction and perceptions of CDC work of public health professionals were associated with intention to stay. The more satisfied they were with their jobs, the more they appreciated their jobs, and the more they intended to stay. Previous studies [42–44] have found that job satisfaction, work experience, and job characteristics, such as perceptions toward the organization, pay satisfaction, promotion chances, and fairness of organizational rules demonstrated strong associations with employee

Table 4 Bootstrap test regarding mediating effect for intention to stay

Variables	Effect type	Effect	95% Bootstrap SE	BootLLCI	BootULCI
Job satisfaction → Intention to stay	Total effect	0.332	0.041	0.250	0.409
	Direct effect	0.128	0.046	0.032	0.212
	Indirect effect	0.204	0.024	0.159	0.253
Perceptions of CDC work → Intention to stay	Total effect	0.158	0.039	0.080	0.233
	Direct effect	0.115	0.038	0.040	0.190
	Indirect effect	0.042	0.011	0.023	0.067
Family factors → Intention to stay	Total effect	0.175	0.021	0.135	0.218
	Indirect effect	0.175	0.021	0.135	0.218
COVID-19 influence → Intention to stay	Total effect	0.110	0.032	0.048	0.172
	Direct effect	0.083	0.030	0.023	0.141
	Indirect effect	0.027	0.010	0.010	0.048

LLCI lower limit confidence interval

ULCI upper limit confidence interval

losses. Positive beliefs about work and attitudes toward the organization may counter the influence of turnover intention [45]. Family factors, such as family support and child care, had significant effects on strengthening the intention to stay. The literature about work–family conflict revealed that increasing work–family conflict was linked to turnover intention, and a better work–family balance can lower turnover [46, 47]. The persistent pandemic may make the high stress and increased workload of public health professionals become the new normal in the future [48]. This study observed a significant positive association between the COVID-19 influence and public health professionals' intention to stay. Intention to stay scores demonstrated an increase when the impact of COVID-19 aligned with beneficial outcomes. For instance, if the welfare, wages, or attention increased due to COVID-19, the intention to stay correspondingly increased. Conversely, the intention to stay decreased when the impact of COVID-19 on workload, pressure, and wages was perceived as unfavorable. Healthcare workers reported higher levels of fear and perceived risk as a result of COVID-19, leading to a rise in turnover intention [34, 49], which was similar to the results reported by public health professionals in this study.

It is also notable that past work about healthcare workers' intention to stay has focused heavily on job satisfaction and job embeddedness, emphasizing the roles of job satisfaction and job embeddedness on intention to stay. Our work extends to public health professionals, explores the mediating effect of job embeddedness, and adds new variables such as perceptions of CDC work, and COVID-19 influence. We found that organization and community embeddedness mediated the relationships between job satisfaction, perceptions of CDC work, family factors, COVID-19 influence, and intention to stay. Furthermore, our focus on the specific effects of the mediating role of job embeddedness showed that job satisfaction and family factors were indirectly related to intention to stay via organization and community embeddedness, and perceptions of CDC work, family factors, and COVID-19 influence had indirect effects on intention to stay via organization-embeddedness. Perceived COVID-19 threat was supported by our findings, which may be due to the new normal of the pandemic and the effect of the COVID-19 vaccine[48]. In our qualitative interview, public health professionals reported that there wasn't much concern regarding the potential danger of COVID-19, because daily protection was in place.

In addition to offering insights for future work on intention to stay and job embeddedness, this study also provides novel managerial strategies for enhancing public health professionals' intention to stay in CDC. With the ease of China's anti-COVID-19 restriction, public health professionals need to allocate pandemic prevention resources more precisely and intensify social public health interventions and health education. The additional workload and pressure brought by the pandemic can be counterbalanced by more care and welfare of the organization as well as increased attention from the public and the government. CDCs can supply their workforce appropriately by attracting high-quality talent with better treatment. Public health professionals' views of their current jobs could be greatly enhanced by effective management practices, promising promotion opportunities, and wages commensurate with their workload. Desired job characteristics and experiences, such as harmony with colleagues and managers, and a strong sense of job identification and accomplishment, can increase job satisfaction[44]. A good work–family balance is essential for most married public health professionals, which also suggests that additional support from organizations, employee-friendly schedules, and discretionary time can ensure that all public health professionals benefit from being highly embedded in their jobs[21, 46]. To retain the public health workforce, CDCs should pay great attention to public health professionals' perceptions of the shared identity and sentiments of attachment and strive to maintain them at a high level. This may lead employees to believe that they will sacrifice valued things if they quit, thus encouraging them to stick with their current organization.

This study contributes to the research on factors associated with intention to stay and the effects of organization and community embeddedness on intention to stay, and enriches the application of Job Embeddedness Theory in public health professionals. Another strength is that this study draws organization and community embeddedness from job embeddedness, and further explores potential factors affecting intention to stay from job and family aspects.

There are some limitations. First, our cross-sectional data limited the opportunity to draw causal conclusions. Longitudinal designs are needed in future studies to identify more about the causal patterns of relationships and the mechanisms behind the variables. We call for more studies using multi-wave designs to capture changes in the intention of public health professionals to stay in their organization with the local COVID-19 waves. Second, self-reported questionnaires may induce recall bias and social desirability, even though we asked participants to recall their experiences in daily life and answer all questions anonymously and truthfully. Furthermore, given the shortage of the public health workforce in several countries across the world, public health professionals shoulder a daunting task, with the emergence of new challenges such as long COVID. Thus, the topic we

discussed is quite important, while the findings regarding associated factors should be interpreted with caution. Despite these limitations, this study helps deepen the understanding of intention to stay and job embeddedness. We hope our findings encourage scholars to explore the positive effects of job embeddedness, and focus on the impact of COVID-19-related factors on the intention to stay. We also hope our work encourages scholars to devote more attention to public health professionals as an important but understaffed population.

Future investigation of public health professionals' intention to stay amid COVID-19 is needed. We advocate for focus on both the organization and community embeddedness of public health professionals to prevent losses, as these two constructs could buffer the impact of negative work-related influences on public health professionals' turnover. Future public health workforce development strategies are recommended to strike a balance between work and family, and encourage wage increases and promotions, which can foster a more profound embedding of employees within the organization. Concurrently, strategies should actively improve opportunities for mentorship in the public health sector, and enhance career attractiveness and development opportunities for public health professionals. Furthermore, the cultivation of emergency and disaster response capacity, with a specific emphasis on stress management in unique circumstances, is deemed essential. Therefore, we advocate that the management of public health workforce should facilitate public health professionals to maintain a sound work–life balance enabling them to persue their passions by actively participating in roles both inside and outside the workplace.

Conclusion

This study investigated the intention to stay of Chinese public health professionals in the context of COVID-19. We found that public health professionals with high job embeddedness had high levels of intention to stay. The results revealed a direct relationship between job satisfaction, perceptions of CDC work, and COVID-19 influence and intention to stay. Job embeddedness played a mediation role in the relationship between job satisfaction, perceptions of CDC work, family factors, and COVID-19 influence and intention to stay. Taking a more integral approach—combining individual, family, and job-related factors—adds to our understanding of the complex issue of public health professionals' losses.

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Author contributions
HW and LL made substantial contributions to the study design and supervised the data collection. HW, XX, YY, and LL contributed to the data collection and interpretation. HW wrote the substantial parts of manuscript. LL, XX, and YY commented on manuscript. All authors critically revised, reviewed, and approved the final version the manuscript.

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Availability of data and materials
The data used are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The study was reviewed and approved by the Ethics Committee of the School of Public Health at Zhejiang University (ZGL202109-4). All participants were informed of the background, aims, anonymous nature and length of the survey.

Consent for publication
Not applicable.

Competing interests
The authors declare there is no conflict of interest.

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