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Reserves and their role in protecting against anxiety and depressive symptoms among undocumented migrants undergoing regularization

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Resources help individual to function in everyday life, while reserves, a specific type of resources, help them to overcome shock and stress. Evidence is scarce about whether reserves (be they cognitive, economic or relational) protect people's mental health in situations of temporary stress. Based on a cohort study following undocumented migrants undergoing a stressful life course transition (regularisation with local authorities), we identified which resources and reserves, and which types, better protect mental health. To examine whether reserves, and which types, are prospectively associated with anxiety and depressive symptoms, whether this association is independent of resources, and whether reserves modify the effect of regularisation on anxiety and depressive symptoms. A two-wave cohort study followed 456 undocumented migrants (mean age 44 years) from 2017 to 2020, half (48%) of whom were involved in a pilot regularisation policy implemented by the local authorities of Geneva, Switzerland. Anxiety was measured with the Generalised Anxiety Disorder Questionnaire-7 and depressive symptoms with the Patient Health Questionnaire-9. Economic, cognitive and relational reserves were measured at baseline, as well as economic and relational resources. Generalised Estimating Equations tested the associations of reserves and resources with anxiety and depressive symptoms, and the interaction between reserves/resources and regularisation status. Economic and relational reserves were associated with lower anxiety and depressive symptoms, independent of economic and relational resources. Cognitive reserves were not associated with lower anxiety and depressive symptoms. Regularised participants reported lower anxiety and depressive symptoms compared to non-regularised undocumented participants. Reserves did not modify the effect of regularisation on anxiety and depressive symptoms. The provision of reserves for undocumented migrants may protect mental health but may not alter the impact of regularisation on mental health. Further research is needed among vulnerable groups experiencing psychologically distressing events to test the reserve hypothesis.

Keywords Mental health, Anxiety, Depressive symptoms, Resources, Reserves, Life course, Undocumented migrants, Regularisation

Health, and mental health in particular, is the capacity to grow up in healthy conditions and to adapt and cope with adversity and ageing[1]. This adaptive capacity has been found to be unequally distributed among people, resulting in social inequalities in mental health that are remarkably durable over time[2–4], across countries and cultures[5], and across stages of the life course[6,7]. One of the mechanisms for the lack of adaptation is the lack of resources[8–10]. Resources can be defined as "means" of different kinds (economic, relational, cognitive) whose

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purpose is immediate or direct[11], such as income, intimate partners of daily life and level of cognitive function. The function of resources in the everyday life is to adapt and cope with stress and adversity. Over the life course, resources can play an important role in maintaining good mental health[12–16].

The reserve perspective seeks to better understand the influence of resources on mental health by distinguishing between reserves and resources[11]. The reserve hypothesis suggests that when people experience temporary stressful or undesirable events, they are at an advantage if they have reserves and are able to draw on these reserves to cope with the temporary stressful event[11]. Reserves can be divided into several types: economic, relational and cognitive. Economic reserves represent all forms of economic resources (e.g., income, wealth, assets) that can be saved and held for future use (e.g., savings, life insurance)[17] and could be used in the event of an adverse event with financial consequences. Relational reserves are the possession of an enduring network of acquaintances that can be relied upon in times of need, without jeopardising relationships because of a temporary lack of reciprocity. Cognitive reserve, the most studied[18–22], is the ability of the brain to optimise performance through differential recruitment of brain networks. The concept was originally developed to explain the discrepancy between the extent of biological damage in the brain or brain pathology and the good clinical performance of the patient[23], and more recently its relevance has been extended beyond the onset of dementia to characterise normal cognitive ageing[24]. Building of cognitive reserve is based on the use of cognitive strategies and on the experiences of cognitive stimulation – such as education, cognitively stimulating work and leisure activities – that individuals have throughout their lives[23]. Similarly, the presence of economic or relational reserves has been associated with better health outcomes[25–30]. Recently, the cognitive reserve has been extended to the reserve hypothesis as a mechanism of vulnerability development[11].

Undocumented migrants living in high-income countries, and particularly in European societies such as Switzerland, are in a difficult situation: the lack of a valid residence permit exposes them to "bullshit jobs"[31] and "3D jobs" (dirty, dangerous, and demanding)[32], as well as unemployment and low wages[33–35]. They also have limited access to the country's social security and health systems[36,37]. Living under the constant stress of detention and deportation, they have to keep a low profile and struggle to plan for their future. As a result of these conditions, the quality of life and mental health of undocumented migrants is poorer than that of the general population or legal residents[38,39]. In 2017, the Council of Geneva in Switzerland launched a pilot regularisation programme to grant a one-year residence permit to undocumented migrants[40], provided they could meet numerous criteria (e.g., 10 years' residence, basic knowledge of local language, sufficient economic resources). This regularisation policy was an opportunity for undocumented migrants to officially integrate into the society in which they had been living illegally for many years.

However, it also represented a risk for those who chose to take advantage of it, as their application exposed their illegal status and refusal to regularise their status would result in expulsion from Switzerland. Regularisation represents a significant life course transition, or "turning-point", in their lives, often marked by a profound change in circumstances and a decisive transition in a person's life[41]. Regularisation does not just affect administrative status but also different aspects of life, such as employment status, housing, social and family relationships, new mobility opportunities, and more, which can be new sources of stress. Dealing with multiple changes simultaneously can thus be overwhelming. These changes may strain relationships within their community, friends, and family, as the new social position resulting from regularization might evoke feelings of injustice and guilt[41]. Added stress may emerge from potential cross-border mobility[42]. The process of socio-economic integration becomes complex as individuals adjust to new civic duties involving financial contributions (taxes, mandatory insurances such as health insurance), as well as adapting to shifts in the job market. These shifts may involve working in the same field but being seen as "costlier" by certain employers due to required social security payments, with some employers preferring undocumented migrants[43]. Consequently, regularised migrants might end up in less skilled jobs compared to long-term legal immigrants[44], with limited wage growth[45]. While regularization might motivate them to seek career paths more aligned with their aspirations, the stigma linked to their background and the history of unauthorized work on their resume can pose significant barriers and be a source of stress. In this sense, the experience of regularisation may represent a pivotal and stress inducing transition for the undocumented migrants. This situation in Geneva provided an opportunity for a quasi-experimental study to test the hypothesis of reserves as protective factors in the case of psychologically stressful experiences.

Previous studies have suggested that having reserves is beneficial for health[46], including mental health[47]. Von Arx's study suggested that having socioeconomic reserve in adulthood could fully mediate the negative association between growing up in poor socioeconomic circumstances in childhood and reporting depressive symptoms in later life in men, while this association was partially mediated in women[47]. A large body of literature has confirmed that cognitive reserve (approximated by cognitive stimulation) has a positive effect on cognitive functioning throughout the life course[20,48,49]. Relational reserve may also protect against cognitive decline in old age, and it is possible that this protection is driven by the ability to engage in leisure activities[28]. Cognitive and relational reserves may thus have combined effects that contribute to less cognitive decline in old age[26]. However, by definition, reserves are a type of resource that can help in times of stress or difficult life turning-point, i.e. smoothing the experience of psychologically stressful transitions, and this has not been investigated.

In this study, we examined[1] whether and which types of reserves are prospectively associated with anxiety and depressive symptoms[2], whether this association was independent of resources, and[3] whether reserves modify the effect of regularisation on mental health. First, we expected that reserves would be prospectively associated with lower anxiety and depressive symptoms, independent of resources. Second, we expected that reserves would buffer the stress of regularisation on anxiety and depressive symptoms. Third, we expected that undocumented migrants who initiated the regularisation and had reserves would have better mental health at follow-up than those without reserves.

Methods

Design and sample

This prospective study, embedded in the larger framework of the Parchemins study, is based on panel data from the first and second waves, collected between November 2017 and October 2018 and March 2019 and February 2020 respectively[50]. At each wave, participants' sociodemographic characteristics, living conditions, health and well-being, and social relationships were assessed using a specially designed questionnaire. The questionnaire was administered by trained investigators and was accessible in the languages most commonly spoken by undocumented migrants in Geneva, Switzerland: French, English, Spanish and Portuguese. The average interval between the first and second waves was 15 months.

The sample was selected between November 2017 and October 2018 using convenience sampling among undocumented migrants[1] aged 18 or older[2], nationals of non-European Union or European Free Trade Association countries[3], living in Geneva for 3 or more years and[4] who had never applied for asylum. 464 participants took part in the study. After removing participants who did not participate in wave 2 ($n = 85$), with missing data on outcomes ($n = 3$), economic resources ($n = 39$), covariates ($n = 14$), the analytical sample consisted of 362 participants (Fig. 1).

Regularisation process with local authorities

Undocumented migrants who were undergoing regularisation or who had been regularised for less than 3 months through the Operation Papyrus were eligible to participate. Launched in 2017 by the local authorities of the State of Geneva, the Operation was a two-year pilot regularisation programme aimed at granting one-year residence permits to undocumented migrants. To be eligible for the programme, undocumented migrants had to prove that they had lived in the State of Geneva for at least 10 years (5 years for families with school-age children), had a basic knowledge of French, had sufficient economic resources and had no criminal record[50]. Local trade unions and non-governmental organisations (NGOs) contributed to the development of these criteria, which guaranteed regularisation if they were met, and subsequently acted as gatekeepers for the programme under a mandate from the authorities. Gatekeeping tasks under this mandate included discouraging undocumented migrants who did not meet the eligibility criteria for regularisation, as their application would be rejected and would result in deportation[40].

Recruitment of undocumented migrants for the Parchemins study was carried out face-to-face, either in the offices of trade unions and NGOs active in the migrant community and involved in the Papyrus operation, or at public medical facilities for the undocumented population[51]. Snowball sampling and promotion through social networks were used as secondary strategies. Telephone calls and emails were used to keep participants involved in the follow-up process. All participants gave written consent to participate in the study and the study has been performed in accordance with the Declaration of Helsinki.
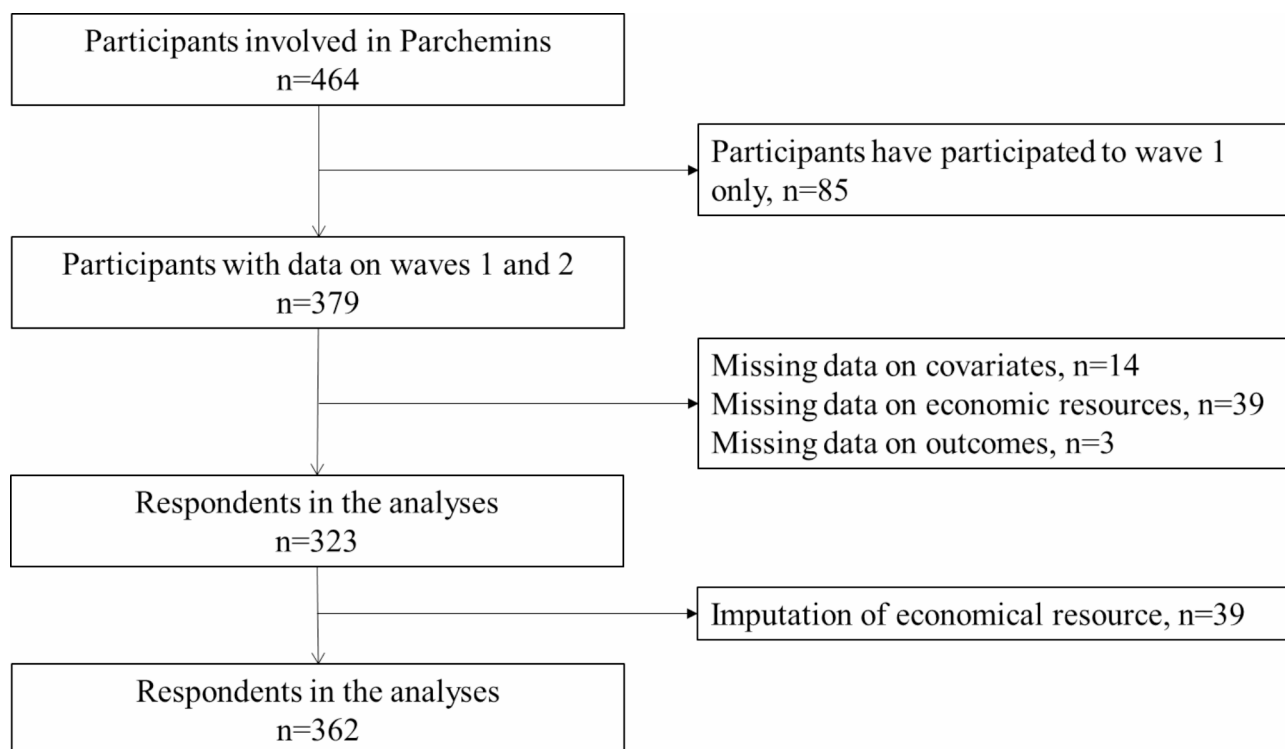

Fig. 1. Flow chart of respondents' inclusion in the analytical sample.

Outcomes

Depressive symptoms were measured using the Patient Health Questionnaire (PHQ-9). The PHQ-9 is a validated, self-administered, 9-items questionnaire that screens for symptoms of depression in the past 14 days and assesses their severity. Specifically, each item is scored from 0 ("never") to 3 ("almost every day") based on the frequency of the symptoms and summed to a score ranging from 0 to 27. A higher score indicates more severe symptoms of depression[52]. Anxiety was measured using the 7-item Generalized Anxiety Disorder (GAD-7) questionnaire, which reflects the severity of anxiety symptoms experienced over the previous 14 days[53,54]. As with the PHQ-9, each item on the GAD-7 is rated on a scale from 0 ("never") to 3 ("almost every day"), with a total score ranging from 0 (no anxiety) to 21 (severe anxiety). The PHQ-9 and GAD-7 were both measured at wave 1 and wave 2.

Predictors of interest—reserves

Following the reserve hypothesis on the development of vulnerability[11], we operationalised the concept of reserves through three types: economic, relational and cognitive. As the reserve hypothesis was not part of the main research question of the study, the operationalisation of the three types of reserves was limited to one or two items.

Economic reserve was measured by adapting the question used in the Swiss population survey on the ability to pay an unexpected bill of CHF 2,500 (€2,500) at a time[55]. Due to the lower median income of undocumented migrants compared to the general population, economic reserve was defined as the ability to pay an unexpected bill of CHF 1,500 (€1,500) at a time (No vs. Yes). Economic reserve was assessed in wave 1 and wave 2.

Relational reserve was assessed using two categorical variables. First, participants reported the number of close persons on which they could rely on in the event of serious personal problems. The median class was used to transform this variable into a binary measure ("Less than 3 persons" vs. "3 or more persons"). Second, participants were asked to indicate the number of persons among their loved ones to whom they could talk about very personal problems at any time. They could choose from three options: "No person", "One person" and "Several people". Both variables related to the relational reserve were only measured at wave 1.

Cognitive reserve was measured by educational attainment ("Primary education", "Secondary education (professional school, business school, apprenticeship, college, high school)", "Higher education (University or higher education)") and self-assessed oral French language skills ("Very poor or poor", "Fair", "Very good or good") and only in wave 1. Educational attainment levels corresponded to the International Standard Classification of Education[56]. According to a meta-analysis, education is a common measure of cognitive reserve[20].

Predictors of interest—conventional resources

With the exception of the cognitive reserve, we used a conventional resource indicator for each type of reserve. The economic resource were measured in terms of monthly equivalent disposable income (per CHF 100.- units ($90)) as defined by the Eurostat[57]. Partnership status (single, in a relationship, married), at both time points, was used as an indicator of relational resource.

Regularisation status

Based on previous studies[58–60], the regularisation status variable was dichotomised (yes, no). "Yes" represented participants who were regularised through the Papyrus operation and those who had applied for regularisation but were awaiting a decision from the local authorities (assuming that the decision of the authorities would be positive since they passed the gatekeeping to enter the programme). "No" represented participants who did not undergo the regularisation process. Regularisation status was assessed at both points in time.

Confounding variables

Confounding variables included gender (women, men), age (continuous) and the number of worked hours per week.

Statistical analysis

Descriptive statistics are presented as means and standard deviations (SD) for continuous variables and as absolute numbers and percentages (%) for categorical variables. Missing observations were excluded except for the equivalent disposable income, where the high rate of missing values required multiple imputation. The imputation model for the equivalent disposable income included the outcome variables (PHQ-9 and GAD-7 scores), all the predictors of interest and all the confounding variables. Five datasets were generated.

We used generalised estimating equations with exchangeable working correlation on each dataset to estimate population-averaged effects with 95% confidence intervals (95% CI) of the economic, relational and cognitive reserves as well as economic and relational resources on depressive symptoms and anxiety, accounting for the individual correlation over time. Estimates from each dataset were then pooled together. We first tested for associations between the outcomes and each predictor of interest, minimally adjusted for confounders (gender, age, the number of working hours) and regularisation status. In a second step, multivariable hierarchical regression analyses were performed. The first model included the economic, relational and cognitive reserves. In a second model, we added the equivalent economic (disposable income) and relational (partnership status) resources. In the third model, we tested for a moderating effect of regularisation status on the association between the reserves and depressive symptoms or anxiety. Finally, we examined the moderating role of regularisation status on the associations between the outcomes, partnership status and the equivalent disposable income. Statistical significance was set at 5%. All analyses were performed using R (4.0).

Our underlying causal model is shown in Fig. 2, using directed acyclic graphs (DAGs). For the second aim, testing the interaction between reserves and resources and regularisation status, we used Attia's suggestion for
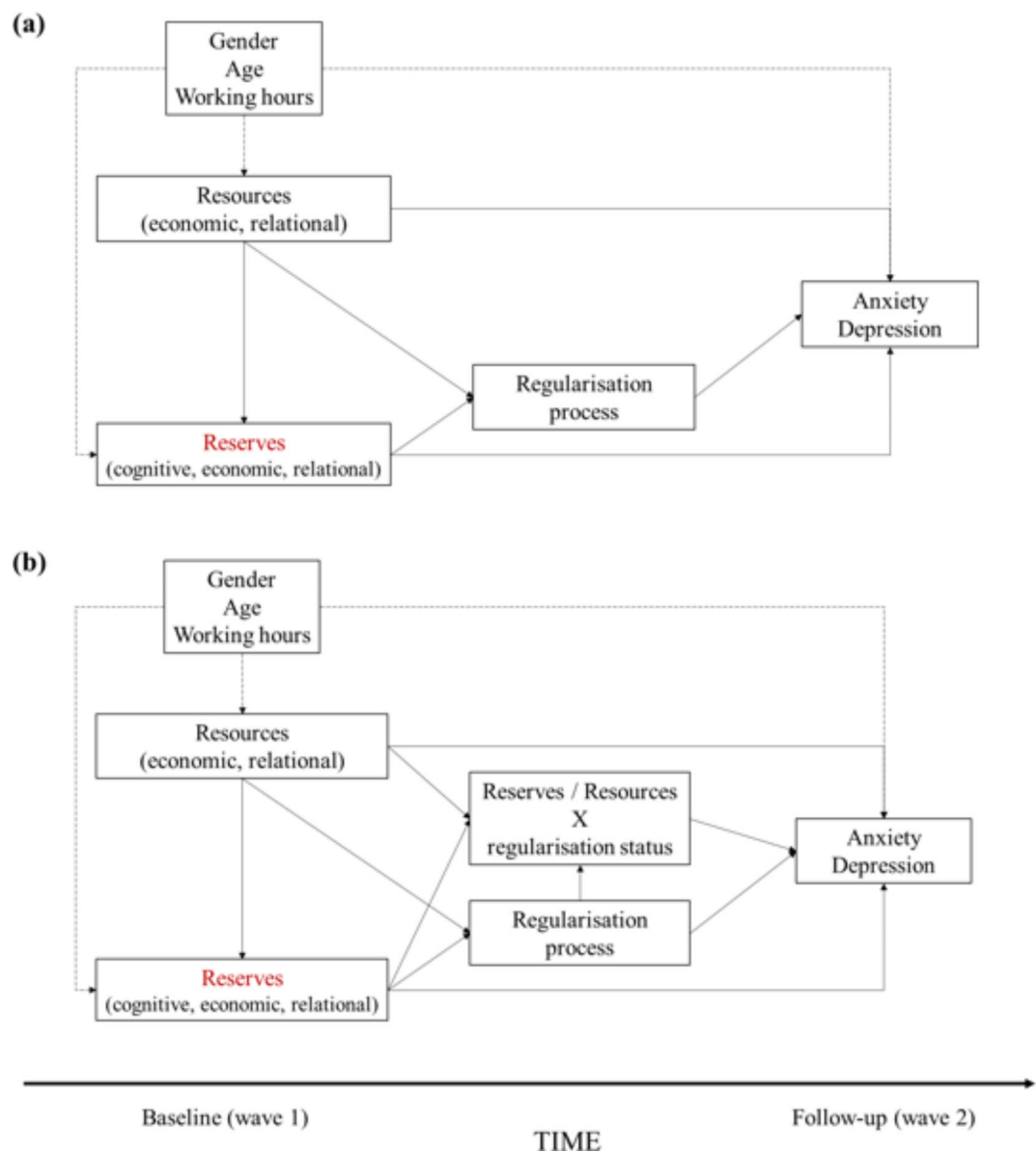
Fig. 2. Directed acyclic graphs (DAGs) depicting underlying causal models for two empirical scenarios. The first DAG (**a**) is a scenario testing the hypothesis one and two. Logically, normal narrows from node Z to node Y indicates that Z is a direct cause of Y, or Z influences Y not only through another node. DAG (**a**) is a scenario illustrating the first and second hypothesis, i.e. whether reserves are associated with anxiety and depression when exposed to the stress of regularisation; this scenario does not describe how the effect occurs, like whether nodes' effects interact together. DAG (**b**) is a scenario testing the third hypothesis, i.e. the interaction between the nodes reserve and resources and the regularisation status. Dashed narrows indicate effects of confounding factors. Working hours represents the number of working hours per week.

representing an effect modification[61]. The node "Reserves / Resources X regularisation status" represents an additional effect on the mental health outcomes.

Declaration of generative AI and AI-assisted technologies in the writing process
During the preparation of this work the authors used DeepL Write in order to check the English grammar and readability. After using this tool/service, the authors reviewed and edited the content as necessary and take full responsibility for the content of the publication.

Results
Participants' characteristics
At baseline, the mean age of participants was 44.1 years (SD 10.4). Most were women (73%), and participants worked an average of 30.7 h per week (SD 16.6). Almost half of the participants were in the process of being

regularised or had already been regularised (48%), i.e., were experiencing a major stressful life transition, and half were still in an undocumented status (52%). In terms of economic reserves and resources, 36% had the ability to pay an unexpected and significant bill, and the mean equivalent disposable income was 2,343 CHF (SD 1,193) – 2,343 €. In terms of relational reserve, half (50%) had three (or more) people close enough to rely on in the event of serious personal problems and fewer (47%) had only one person close enough to talk to in the event of serious problems. In terms of relational resource, half were single (51%), 23% were married and 26% were in a relationship. More than half (55%) had completed secondary education (or started without completing it) and less than half (43%) had good or very good self-assessed oral French language skills, two markers of cognitive reserve. Details are reported in Table 1 (first column). When comparing the baseline characteristics by regularisation status (Table 1, second and third columns), participants who were regularised or in the process of being regularised generally had more economic resources, more reserves (all types except educational achievement), and a higher number of working hours per week than those who remained in an undocumented status; however, both groups were similar in terms of age and sex.

	Total (n = 362)	Undocumented migrants who did not undergo the regularisation process (n = 190)	Undocumented migrants who were regularised or undergoing regularisation (n = 172)	
Reserves at baseline	**n (%)**	**n (%)**	**n (%)**	**p-value**
Economic reserve: ability to pay an unexpected bill of CHF 1,500 (€1,500) at a time				< 0.001
Yes	131 (36%)	48 (25%)	83 (48%)	
No	231 (64%)	142 (75%)	89 (52%)	
Relational reserve: Number of people close enough to rely on in case of personal serious problems				0.015
Less than three persons	180 (50%)	106 (56%)	74 (43%)	
Three persons or more	182 (50%)	84 (44%)	98 (57%)	
Relational reserve: Number of persons close enough to talk to in case of serious problems				0.004
More than one person	144 (40%)	64 (34%)	80 (47%)	
One person	169 (47%)	91 (48%)	78 (45%)	
Nobody	44 (12%)	35 (18%)	14 (8%)	
Cognitive reserve: Education				0.812
Compulsory and compulsory not finished	81 (22%)	41 (22%)	40 (23%)	
Secondary and secondary not finished	198 (55%)	103 (54%)	95 (55%)	
Higher education	83 (23%)	46 (24%)	37 (22%)	
Cognitive reserve: Oral proficiency in French				0.012
Very good or good	156 (43%)	74 (39%)	82 (48%)	
Fair	139 (38%)	70 (37%)	69 (40%)	
Poor or very poor	67 (19%)	46 (24%)	21 (12%)	
Resources at baseline				
Economic resource: Equivalent disposable income (CHF), mean (SD)	2343.4 (1193.1)	1953.0 (1204.5)	2774.6 (1022.4)	< 0.001
Relational resource: partnership status				0.230
Married	82 (23%)	42 (22%)	40 (23%)	
In a relationship	94 (26%)	43 (23%)	51 (30%)	
Single	186 (51%)	105 (55%)	81 (47%)	
Confounding characteristics at baseline				
Age, mean (SD)	44.1 (10.4)	43.6 (10.5)	44.7 (10.2)	0.294
Sex				0.894
Women	264 (73%)	138 (73%)	126 (73%)	
Men	98 (27%)	52 (27%)	46 (27%)	
Number of working hours per week, mean (SD)	30.7 (16.6)	27.0 (17.8)	34.7 (14.3)	< 0.001
Mental health at follow-up (Outcomes)				
Anxiety (GAD), mean (SD)	4.3 (4.7)	5.0 (5.3)	3.5 (3.7)	
Depressive symptoms (PHQ-9), mean (SD)	5.6 (5.2)	6.4 (6.0)	4.8 (4.1)	

Table 1. Participants characteristics at baseline and at follow-up. Parchemins Study[49], Geneva, Switzerland, 2017–2020. Baseline = October 2017 – December 2018; Follow-up = Mars 2019 – February 2020; SD = standard deviation; CHF = Swiss francs; PHQ-9 = Patient Health Questionnaire; GAD = Generalized Anxiety Disorder. P-values reflect chi-square test for categorical variables and t-test for continuous variables.

At follow-up, mean of anxiety and depressive symptoms were 4.3 (SD 4.7) and 5.6 (SD 5.2) respectively. Compared to baseline, mean of anxiety and depressive symptoms were stable (baseline GAD = 4.3 (SD 4.7) and PHQ = 5.5 (SD 5.2)). Compared to undocumented participants, regularised participants reported lower anxiety (-0.89 95%CI -1.50, -0.28 – Table 2, column univariable models) and depressive symptoms (-1.15 95%CI -1.89, -0.40 – Table 3, column univariable models) at follow-up.

Anxiety

In the univariable analysis (minimally adjusted for confounders), economic reserve (ability to pay bills) and relational reserve (≥3 persons close enough in case of serious problems; >1 close persons to talk to in case of personal problems) were associated with lower anxiety (Table 2, column univariable models). Indicators of cognitive reserve were not associated with anxiety. Among the resource indicators, economic resource (equivalent disposable income) and relational resource (being married) were also associated with lower anxiety.

In multivariable analyses, economic reserve and only one indicator of relational reserve (>1 close persons to talk to in case of personal problems) were associated with lower anxiety (Table 2, model 1). When resources indicators were added to the model (Model 2), the two reserve indicators (economic reserve and >1 close persons to talk to in case of personal problems) were attenuated but remained associated (test of hypothesis 1); note that the economic resource indicator was marginally associated with anxiety and the partnership resource indicator was not associated.

Regarding hypothesis 2, we found no moderating effect of reserves' indicators in the association between regularisation status and anxiety (no significant interactions, see Table S1, column Anxiety, model 3). However, one moderating effect of resources' indicators was observed in the association between regularisation status and anxiety: being in a relationship increased the positive effect of regularisation on anxiety while no differences were observed in other group combinations. (Table S1, column Anxiety, model 4)

In relation to hypothesis 3, a subgroup analysis of regularised participants and ongoing regularisation participants showed that economic reserve was associated with lower anxiety (Table 4, column anxiety, model 5) whereas relational and cognitive reserves were not associated with anxiety. This association was similar when adjusted for resources indicators (Table 4, column anxiety, model 6). We tested the inverse of hypothesis 3 by conducting the same analysis in the subgroup of undocumented migrants who had not initiated the regularisation process (Table 5). The findings were similar to those observed in the group of regularised and ongoing regularisation participants: economic reserve was associated with lower anxiety (Table 5, column Anxiety, model 7), whereas relational and cognitive reserves were not associated with anxiety. This association was attenuated but remained significant after adjusting for resources indicators (Table 5, column Anxiety, model 8). In addition, the economic resource indicator was marginally associated with anxiety. In summary, the protective role of

| | | Univariable model for reserve and resource factors[a] | Multivariable models | |
| | | | Reserves (Model 1) | Reserves + Resources (Model 2) |
		Coefficient (95%CI)	Coefficient (95%CI)	Coefficient (95%CI)
Reserves:	Economic reserve: ability to pay an unexpected bill (ref. No)	-1.45 (-2.00, -0.91)	-1.35 (-1.89, -0.80)	-1.16 (-1.72, -0.59)
	Relational reserves:			
	Three persons or more close enough in case of serious problems (ref. Less than three)	-0.88 (-1.64, -0.12)	-0.42 (-1.22, 0.39)	-0.31 (-1.11, 0.49)
	Among close enough people, number of people to talk to in case of personal problems (ref. No person):			
	One person	-1.20 (-2.60, 0.20)	-0.97 (-2.37, 0.43)	-0.82 (-2.19, 0.55)
	More than one person	-2.00 (-3.38, -0.61)	-1.58 (-3.05, -0.11)	-1.44 (-2.89, -0.00)
	Cognitive reserves:			
	Education (ref. Compulsory):			
	Higher education	-0.31 (-1.36, 0.74)	-0.49 (-1.52, 0.54)	-0.38 (-1.40, 0.64)
	Secondary education	0.01 (-0.97, 0.98)	-0.02 (-0.96, 0.93)	0.10 (-0.85, 1.04)
	Oral proficiency in French (ref. Poor/very poor):			
	Very good or good	-0.56 (-1.71, 0.59)	-0.49 (-1.61, 0.62)	-0.42 (-1.56, 0.71)
	Fair	-0.39 (-1.57, 0.79)	-0.33 (-1.48, 0.82)	-0.42 (-1.56. 0.73)
Resources:	Economic resource: Equivalent disposable income (cont.)	-0.060.10, -0.03)		-0.04 (-0.08, -0.00)
	Relational resource: Partnership status (ref. Single):			
	In a relationship	-0.21 (-0.98, 0.57)		0.08 (-0.86, 0.69)
	Married	-0.81 (-1.62, -0.01)		-0.67 (-1.46, 0.12)
Control:	Regularised status (ref. Undocumented)	-0.89 (-1.50, -0.28)	-0.58 (-1.18, 0.02)	-0.47 (-1.08, 0.13)

Table 2. Generalised estimated equations of the associations between reserves and resources at baseline and anxiety (GAD) at follow-up, adjusted for confounding factors, Geneva, Switzerland, 2017–2020. [a] = minimally adjusted with age, gender and number of working hours. All multivariable models are adjusted for age, gender and number of working hours. GAD = Generalized Anxiety Disorder.

		Univariable model for reserve and resource factors[a]	Multivariable models	
			Reserves (Model 1)	Reserves + Resources (Model 2)
		Coefficient (95%CI)	Coefficient (95%CI)	Coefficient (95%CI)
Reserves:	Economic reserve: ability to pay an unexpected bill (ref. No)	-1.30 (-1.97, -0.63)	-1.18 (-1.84, -0.52)	-0.76 (-1.42, -0.10)
	Relational reserves:			
	Three persons or more close enough in case of serious problems (ref. Less than three)	-1.36 (-2.21, -0.51)	-0.78 (-1.71, 0.16)	-0.56 (-1.49, 0.37)
	Among close enough people, number of people to talk to in case of personal problems (ref. No person):			
	One person	-1.03 (-2.49, 0.43)	-0.60 (-2.07, 0.86)	-0.38 (-1.80, 1.04)
	More than one person	-2.41 (-3.84, -0.99)	-1.72 (-3.27, -0.17)	-1.49 (-2.99, -0.00)
	Cognitive reserves:			
	Education (ref. Compulsory):			
	Higher education	0.91 (-0.28, 2.10)	0.78 (-0.37, 1.92)	1.01 (-0.12, 2.14)
	Secondary education	0.65 (-0.42, 1.73)	0.65 (-0.38, 1.67)	0.86 (-0.18, 1.89)
	Oral proficiency in French (ref. Poor/very poor):			
	Very good or good	-0.54 (-1.79, 0.72)	-0.38 (-1.58, 0.82)	-0.20 (-1.43,1.04)
	Fair	-0.38 (-1.62, 0.87)	-0.24 (-1.43, 0.96)	-0.37 (-1.58, 0.84)
Resources:	Economic resource: Equivalent disposable income (cont.)	-0.10 (-0.14, -0.06)		-0.08 (-0.13, -0.04)
	Relational resource: Partnership status (ref. Single):			
	In a relationship	-0.79 (-1.66, 0.08)		-0.57 (-1.44, 0.30)
	Married	-0.97 (-1.90, -0.04)		-0.74 (-1.64 ,0.15)
Control:	Regularised status (ref. Undocumented)	-1.15 (-1.89, -0.40)	-0.80 (-1.54, -0.06)	-0.54 (-1.27, 0.19)

Table 3. Generalised estimated equations of the associations between reserves and resources at baseline and depressive symptoms (PHQ-9) at follow-up, adjusted for confounding factors, Geneva, Switzerland, 2017–2020. [a] = minimally adjusted with age, gender and number of working hours. All multivariable models are adjusted for age, gender and number of working hours. PHQ-9 = Patient Health Questionnaire.

		Anxiety (GAD)		Depressive symptoms (PHQ-9)	
		Reserves (Model 5)	Reserves + resources (Model 6)	Reserves (Model 5)	Reserves + resources (Model 6)
		Coefficient (95%CI)	Coefficient (95%CI)	Coefficient (95%CI)	Coefficient (95%CI)
Reserves:	Economic reserve: ability to pay an unexpected bill (ref. No)	-0.90 (-1.56, -0.24)	-0.91 (-1.62, -0.20)	-0.83 (-1.50, -0.15)	-0.56 (-1.26, 0.15)
	Relational reserves:				
	Three persons or more close enough in case of serious problems (ref. Less than three)	0.32 (-0.55, 1.19)	0.27 (-0.62, 1.16)	-0.38 (-1.39, 0.63)	-0.33 (-1.37, 0.71)
	Among close enough people, number of people to talk to in case of personal problems (ref. No person):				
	One person	-0.53 (-2.37, 1.32)	-0.55 (-2.38, 1.28)	0.24 (-1.53. 2.00)	0.22 (-1.52, 1.95)
	More than one person	-1.60 (-3.46, 0.27)	-1.60 (-3.45, 0.26)	-1.15 (-2.91, 0.62)	-1.12 (-2.85, 0.60)
	Cognitive reserves:				
	Education (ref. Compulsory):				
	Higher education	-0.23 (-1.34, 0.87)	-0.26 (-1.39, 0.86)	0.87 (-0.47, 2.21)	1.04 (-0.27, 2.35)
	Secondary education	-0.02 (-1.03, 0.98)	-0.02 (-1.04, 0.99)	0.26 (-0.91, 1.43)	0.33 (-0.85, 1.51)
	Oral proficiency in French (ref. Poor/very poor):				
	Very good or good	-0.49 (-1.95, 0.97)	-0.46 (-1.94, 1.02)	-0.38 (-1.87, 1.10)	-0.14 (-1.66, 1.38)
	Fair	-1.09 (-2.55, 0.37)	-1.08 (-2.54, 0.38)	-0.95 (-2.45, 0.55)	-0.89 (-2.43, 0.65)
Resources:	Economic resource: Equivalent disposable income (cont.)		0.00 (-0.04, 0.05)		-0.05 (-0.11, 0.00)
	Relational resource: Partnership status (ref. Single):				
	In a relationship		0.19 (-0.75, 1.13)		-0.09 (-1.15, 0.97)
	Married		-0.28 (-1.14, 0.59)		-0.47 (-1.50, 0.56)

Table 4. Subgroup of undocumented migrants who were regularised or undergoing regularisation (*n* = 172): generalised estimated equations of the associations between reserves and resources at baseline and anxiety (GAD) and depressive symptoms (PHQ-9) at follow-up, Geneva, Switzerland, 2017–2020. All models are adjusted for age, sex and number of working hours. GAD = Generalized Anxiety Disorder; PHQ-9 = Patient Health Questionnaire.

		Anxiety (GAD)		Depressive symptoms (PHQ-9)	
		Reserves (Model 7)	Reserves + resources (Model 8)	Reserves (Model 7)	Reserves + resources (Model 8)
		Coefficient (95%CI)	Coefficient (95%CI)	Coefficient (95%CI)	Coefficient (95%CI)
Reserves:	Economic reserve: ability to pay an unexpected bill (ref. No)	-1.67 (-2.53, -0.80)	-1.39 (-2.27, -0.50)	-1.47 (-2.71, -0.23)	-0.96 (-2.17, 0.26)
	Relational reserves:				
	Three persons or more close enough in case of serious problems (ref. Less than three)	-0.97 (-2.29, 0.35)	-0.72 (-2.02, 0.58)	-0.96 (-2.48, 0.56)	-0.67 (-2.20, 0.86)
	Among close enough people, number of people to talk to in case of personal problems (ref. No person):				
	One person	-0.91 (-2.81, 0.98)	-0.65 (-2.50, 1.20)	-0.81 (-2.82. 1.19)	-0.55 (-2.51, 1.41)
	More than one person	-1.26 (-3.36, 0.84)	-1.06 (-3.12, 1.00)	-1.82 (-4.05, 0.41)	-1.53 (-3.71, 0.65)
	Cognitive reserves:				
	Education (ref. Compulsory):				
	Higher education	-0.78 (-2.45, 0.90)	-0.61 (-2.22, 1.00)	0.62 (-1.23, 2.46)	0.82 (-0.99, 2.62)
	Secondary education	-0.12 (-1.70, 1.45)	0.13 (-1.40, 1.67)	0.94 (-0.72, 2.61)	1.32 (-0.38, 3.02)
	Oral proficiency in French (ref. Poor/very poor):				
	Very good or good	-0.62 (-2.20, 0.96)	-0.64 (-2.25, 0.98)	-0.37 (-2.31, 1.39)	-0.28 (-2.09, 1.53)
	Fair	0.26 (-1.34, 1.87)	0.00 (-1.61, 1.61)	0.41 (-1.26, 2.09)	0.06 (-1.65, 1.77)
Resources:	Economic resource: Equivalent disposable income (cont.)		-0.07 (-0.12, -0.01)		-0.10 (-0.17, -0.04)
	Relational resource: Partnership status (ref. Single):				
	In a relationship		-0.21 (-1.41, 0.99)		-1.03 (-2.37, 0.31)
	Married		-0.87 (-2.19, 0.44)		-0.86 (-2.33, 0.61)

Table 5. Subgroup of undocumented migrants who did not undergo the regularisation process ($n = 190$): generalised estimated equations of the associations between reserves and resources at baseline and anxiety (GAD) and depressive symptoms (PHQ-9) at follow-up, Geneva, Switzerland, 2017–2020. All models are adjusted for age, sex and number of working hours. GAD = Generalized Anxiety Disorder; PHQ-9 = Patient Health Questionnaire.

reserve on anxiety was not limited to undocumented migrants who had initiated the regularisation, but also extended to those who had not.

Depressive symptoms

In the univariable analysis (minimally adjusted for confounders), economic reserve (ability to pay an unexpected bill) and relational reserve (≥ 3 persons close enough in case of serious problems; >1 close persons to talk to in case of personal problems) were associated with lower depressive symptoms (Table 3, column univariable models). Cognitive reserve indicators were not associated with depressive symptoms. Among the indicators of resources, economic (equivalent disposable income) and relational (being married) resources were associated with lower depressive symptoms.

In multivariable analyses, economic reserve and only one indicator of relational reserve (>1 close persons to talk to in case of personal problems) were associated with lower depressive symptoms (Table 3, model 1). When resource indicators were added to the model (Model 2), the two reserve indicators (economic reserve and >1 close persons to talk to in case of personal problems) were attenuated but remained associated (test of hypothesis 1). Economic resource was marginally associated with depressive symptoms but the partnership resource indicator was no longer associated.

In relation to hypothesis 2, we found no significant interactions between regularisation status and the indicators of economic and relational reserves (Table S1, column Depressive symptoms, model 3).

The subgroup analysis among regularised participants and those with ongoing regularisation (test of hypothesis 3) showed that economic reserve was associated with lower depressive symptoms (Table 4, column depressive symptoms, model A); whereas relational and cognitive reserves were not associated with anxiety. This association was attenuated and became non-significant when adjusting for indicators of resources (Table 4, depressive symptoms, model B). Both types of resources - economic (disposable income) and relational (being married) - were marginally associated with lower depressive symptoms. We tested the inverse of hypothesis 3 by applying the same analysis in the subgroup of undocumented migrants who had not initiated regularisation. The results mirrored those for anxiety: economic reserves were associated with lower depressive symptoms, while relational and cognitive reserves were not. This association remained significant, though attenuated, after adjusting for resource indicators. Thus, the protective effect of economic reserves on depressive symptoms extended to those who had not started the regularisation process.

Discussion
Main findings

In this cohort study of undocumented migrants, we first found that the regularisation was associated with better mental health. This finding is consistent with other evidence suggesting that obtaining a legal status is associated with better access to health care[62]. In another study using the same cohort, we also showed that regularisation was associated with higher life satisfaction[58]. Second, we have shown that reserves play a more protective role than resources, supporting the reserve hypothesis[11]. Undocumented migrants with economic and relational reserves reported lower anxiety and depressive symptoms, a finding that supports previous studies in other populations[25–30]. Our study went a step further by showing that economic and relational reserves were predictors independent of economic and social resources, a finding that supports the distinction between resources and reserves[11]. In addition, our study showed that the protective role of reserves on mental health was not limited to the subgroup of the undocumented migrants who had initiated the regularisation process but was also observed for the mental health of migrants who remained in an undocumented status.

However, the test of the reserve hypothesis was finally inadequate because the experience of regularisation, which we had originally expected to be a psychologically stressful life course transition, was associated with better mental health. Thus, the experience of regularisation – at least in our data – did not represent a negative event for participants' mental health. Two possible reasons could explain why the experience of regularisation was prospectively positively associated with better mental health. First, it could be a methodological artefact relying on the timing of the second wave during the regularisation process. Many regularised participants could have joined the second wave after receiving the good news of their regularisation (a period of relief and satisfaction), but too soon to be confronted with the negative consequences of their new situation. Second, the regularisation through the Operation Papyrus policy measure was singular and differed from standard regularisation in the sense that it was already the result of a selection mechanism: only applicants who have previously been able to accumulate resources in the host country generally came forward for regularisation, reducing the risk of refusal and deportation. Regularisation requires resources accumulated during the period of undocumented residence[63].

Limitations

This study has several limitations. First, it is possible that the undocumented population who was not exposed to the stressful life course transition (i.e., did not enter the regularisation programme) was otherwise exposed to stressful life events or non-normative transitions at the individual level. If this was the case, this contamination of the control group may have violated the criteria of non-interference and could explain the null result of the modification effect of reserves. Second, our measurement of economic and relational reserves was ad hoc and without validated scales. We may have missed indicator reserves that could have affected mental health and perhaps mitigated the impact of regularisation. Third, our sample was collected using convenience sampling, a non-probabilistic strategy that may affect the representativeness of the sample. In addition, we sampled a specific group of undocumented migrants, namely long-term undocumented workers, whose level of reserves and resources may differ from that of other undocumented sub-populations, such as rejected asylum seekers or short-term undocumented workers. Generalising our findings should therefore be done with caution. Fourth, the relatively small sample size ($n = 456$) may limit the power of our moderation analyses, potentially reducing the ability to detect significant interactions.

The strength of our study lies in its longitudinal design, which made it possible to measure reserves and resources before the start of regularisation, and to assess mental health after the regularisation process. In this sense, the main exposure was temporally prior to the regularisation and the outcome (mental health), a feature that supports a causal perspective. Another strength was the ability to graft a scientific project (the Parchemins study[50]) onto a political measure of public authorities (the Geneva State's "Operation Papyrus"[40]), and to organise the collection of data during the regularisation process by the public authorities. This "Operation Papyrus" policy provided access to a population that is generally difficult to survey.

Comparison with other studies

To our knowledge, this is the first study to examine the relationship between reserves, resources and mental health during the regularisation process. Most studies on the mental health of undocumented migrants are cross-sectional and focus on the prevalence of different mental health conditions, but little attention has been paid to resources and reserves as social determinants of health. Comparisons with other studies are therefore limited to a discussion of predictor by predictor.

The lack of an association between cognitive reserves and mental health (PHQ-9 or GAD-7) is generally in contrast to findings from other contexts. In Norway, an association was found between higher levels of education and lower psychological distress in a sample of 90 undocumented migrants[64]. Consistent results were found in Canada and French Guiana in two samples of undocumented migrants where higher levels of education and knowledge of the local language were significant predictors of better self-rated health and somatic health[65,66]. However, in a sample of 159 undocumented migrants in the Czech Republic, there was no evidence of an association between poorer health, lower levels of education or limited knowledge of the Czech language.

On the other hand, our findings on the relationships between economic resources and reserves and mental health are generally consistent with those observed in other contexts. For example, in French Guiana, migrants who had "enough to live on" were less likely to report poor self-rated and somatic health[66]. In Canada, migrants who reported a lower family income were at increased risk of reporting poorer health[65]. Our findings that social support is associated with fewer depressive and anxiety symptoms are also consistent with previous research. For example, in the USA, social support appeared to be an important protective factor against mental health problems

among undocumented migrants[67]. In Kazakhstan, based on a sample of 213 documented and undocumented women migrant workers, those with greater family support were less likely to report poor self-rated health[68].

Contextual implications

Our findings highlight the critical role of policy in supporting migrants with different legal statuses to protect their rights and to improve their health outcomes. In particular, it is imperative that policies ensure that migrants, regardless of their legal status, have access to effective financial, material and food support without jeopardising their current or future residence applications. Regularisation policies can alleviate the psychological stress associated with economic insecurity and fear of deportation, potentially improving their mental health. Ensuring access to support systems can provide a sense of stability and reduce anxiety, contributing positively to overall well-being.

In addition, our findings suggest that reserves—such as economic and relational ones—play a more protective role in mental health than resources. Policy makers could thus consider integrating support for reserves into their strategies for undocumented migrants. Policies focusing on developing relational reserves could be a novel and effective approach. This could include initiatives that foster community ties and support family reunification, which strengthen social support networks and provide critical emotional and practical support. While resources (economic, relational) are undeniably important, our findings suggest that the impact of reserves on mental health is more substantial. Therefore, interventions that strengthen both reserves and resources should be prioritised. Emphasising relational reserves may lead to more pronounced improvements, complementing existing resource-based policies and more effectively addressing the complex needs of undocumented migrants.

Conclusions

The provision of economic and relational reserves to undocumented migrants could be beneficial for their mental health. However, contrary to the reserve hypothesis, the presence of economic, relational or cognitive reserves did not alter the mental health of undocumented migrants when they were exposed to a potentially stressful regularisation programme. Further research with a finer granularity of measurement of mental health over the course of the regularisation process, as well as among vulnerable groups experiencing psychologically distressing events, is needed to confirm or refute the lack of a positive effect of reserves on mental health.

Data availability

The dataset supporting the conclusions of this article is available in the Swiss National Research Data Service "SwissUBase" (project ID 20126): https://www.swissubase.ch/en/.

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Author contributions

Conceptualization of the research question: SC & CBJ; Data collection: JF, JER & LC; Data analysis: JF; Funding acquisition: YJ & CBJ; Project administration: YJ & CBJ; Writing the original draft: SC; Review the draft of the manuscript: all authors. Approval of the final manuscript: all authors.

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Declarations

Competing interests

The authors declare no competing interests.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Geneva, Switzerland (CCER 2017–00897). All participants provided written informed consent.

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